HOME REMODELING

GREEN BUILDING GUIDELINES

The Alameda County Waste Management Authority & Source Reduction and Recycling Board

The Alameda County Waste Management Authority is a public joint-powers agency comprised of the County of Alameda, each of the fourteen cities within the county, and two sanitary districts that also provide refuse collection services. The Authority is governed by a Board of Directors made up of elected officials, primarily mayors and city council members, appointed by each member agency. Funding is derived solely from waste disposal and waste import mitigation fees collected at the Altamont, Tri-Cities, and Vasco Road landfill sites. The agency receives no general tax funds.

Together with its specialized arm – the Alameda County Source Reduction and Recycling Board – the Authority offers a wide range of programs in the areas of public education, green building, recycled product procurement, waste reduction, market development and technical assistance.

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Disclaimer

The information provided in these Guidelines should be considered by contractors, architects and other professionals, as well as owners, in the course of designing and constructing new or modified structures. They are provided as a public service by the Alameda County Waste Management Authority and Recycling Board in an attempt to provide environmental benefits and reduce costs. The Guidelines are not a substitute for the exercise of sound judgement in particular circumstances and are not intended as recommendations for particular products or processes.

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These 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 Alameda County communities; including solid waste management, water conservation, energy efficiency and resource conservation.

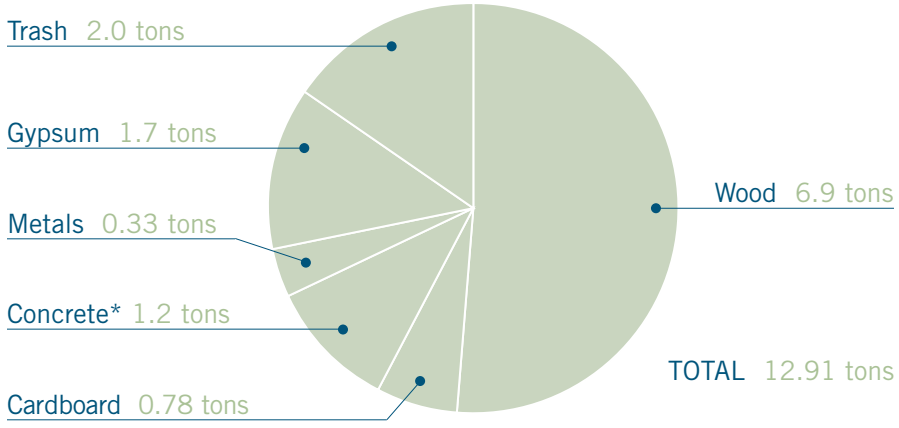
The practices contained in these Guidelines were selected for their viability in today's market and their ability to promote sustainable building. Builders using this booklet will differentiate themselves in the marketplace while protecting our environment.

The 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.

Agency Involvement

Construction and demolition debris comprise up to 30% of materials disposed in California landfills. The Alameda County Waste Management Authority and Recycling Board is working in partnership with the construction and building industry on ways to reduce this waste stream. 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 that ends up in landfills.

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



Source: Alameda County Waste Management Authority Case Study of Citation Homes (1999)
** Concrete figure includes waste generated by sidewalk pour.*

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Chapter One:
Overview of Green Building

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.

GREEN BUILDING TIP | **CERTIFIED GREEN BUILDING PROFESSIONALS**

The San Francisco Bay Area chapter of the National Association of the Remodeling Industry (SFBA NARI), in coordination with the Alameda County Waste Management Authority, offers a comprehensive certification class for California licensed building professionals. The class consists of a four session course on how to apply green building methods and materials in remodeling. Consumers can locate a Certified Green Building Professional at www.sfbanari.com. Building professionals interested in becoming certified can contact NARI at 415-982-9200 or visit their website at www.sfbanari.com.

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.

GREEN BUILDING TIP | **GREEN REMODELERS GUILD**

Graduates of the NARI Certified Green Building Professional class have formed a new trade group called the Green Remodelers Guild. Their mission is to provide continuing education in green building practices as well as a forum for discussion of green building materials and methodologies. For more information, visit www.build-green.org.

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.

The following is a list of green building features that convey the benefits of building green:

Higher Quality, Environmentally Sound Products:

Most green building products and materials were developed to do something better than their conventional counterpart. These products usually perform better and are manufactured in an environmentally sound manner, thus protecting and restoring our natural resources. Consider using the following:

- Recycled-content decking
- FSC Certified wood
- Engineered lumber
- Interior steel studs
- Solvent-free adhesives
- Natural linoleum flooring
- Recycled-content ceramic tile
- Flyash in concrete
- Bamboo flooring

More Durable/Lower Maintenance Products:

Next to quality, durability and reduced maintenance are very important. There is never enough time to do what needs to be done and home maintenance is never high on the list of how to spend time away from work. Consider using the following:

- Fiber-cement siding
- Recycled-content decking
- Exposed concrete flooring
- Natural linoleum flooring
- Recycled-content ceramic tile
- Resource-efficient landscapes and gardens
- 40 year roofing

Products and Practices that Provide Greater Comfort and Lower Utility Bills:

Comfort is what drives high energy use. When it gets hot, we turn on the air conditioning. By increasing the insulation and providing for natural cooling, the electricity demand can be reduced with no compromise in occupant comfort. Consider incorporating the following:

- Foundation/slab insulation
- Increased wall and ceiling insulation
- Spray cellulose insulation
- Advanced infiltration reduction practices
- Low-e windows
- Hydronic heating
- All ducts located in conditioned spaces
- Ceiling fans
- Whole house fans
- Passive solar heating
- Natural cooling
- ENERGY STAR® appliances
- Attic ventilation systems

Healthier Products and Practices For Families

What is more important than the health of our children? The public health community has identified homes as one of the most significant threats to children's health. It is only common sense to reduce the use of products that are known to have health impacts. Consider offering the following:

- Low/No-VOC paints
- Natural linoleum in place of vinyl flooring
- Formaldehyde-free medium density fiberboard (MDF)
- Solvent-free adhesives
- Water-borne wood finishes
- Clean ducts before occupancy
- Exhaust fan in attached garages
- Recycled-content fiberglass insulation with no added formaldehyde
- Seal all particleboard and MDF

Chapter Two:
Green Points

When remodeling, it is important to look carefully at the type of project and incorporate as many green features as possible. The Green Points is a rating system that has been developed to offer building professionals and homeowners a tool to assess how environmentally friendly or "green" a home is. The items listed on the Green Points represent a variety of green building opportunities, however; not all of them may apply to your project. Each measure is assigned to a specific category – Resources, Energy and IAQ/Health – to give you an idea of the impact of each measure. Although some measures may fit into more than one category, they have been assigned to the category where they have the greatest impact.

Green Points

Due to the diversity of remodeling project types, assigning a "total points" value to a project to be considered environmentally friendly is not feasible. However, 25 measures have been highlighted to signify that every effort should be made to incorporate them into your projects. These items have been chosen based up on their impact on the environment and the health of the home in coordination with ease of implementation and relative low cost. These measures can be used as a starting point for "greening" your project. You can download an electronic version of the Green Points at www.stopwaste.org.

POINTS PER CATEGORY	Available Points	Resources	Energy	IAQ/Health
A. Site				
1. Recycle Job Site Construction and Demolition Waste 65% = 1 point; 75% = 2 points; 80% = 4 points	up to 4 Resource pts.			
2. Salvage Reusable Building Material	4 Resource pts.			
3. Remodel for Mixed Use, Adaptive Reuse, and Historic Preservation	4 Resource pts.			
4. Protect Native Soil	2 Resource pts.			
5. Minimize Disruption of Existing Plants and Trees	1 Resource pt.			
6. Implement Construction Site Stormwater Practices	2 Resource pts.			
7. Protect Water Quality with Landscape Design	2 Resource pts.			
8. Design Resource-Efficient Landscapes and Gardens	4 Resource pts.			
9. Reuse Materials/Use Recycled-Content Materials for Landscape Areas	2 Resource pts.			
10. Install High-Efficiency Irrigation Systems	2 Resource pts.			
11. Provide for On-Site Water Catchment / Retention	2 Resource pts.			
	Subtotal from this section			
B. Foundation				
1. Incorporate Recycled Flyash in Concrete 25% Recycled Flyash = 2 points; Add 1 point for every 10% increase of flyash, up to 5 points	up to 5 Resource pts.			
2. Use Recycled-Content Aggregate	2 Resource pts.			
3. Insulate Foundation Before Backfill	3 Energy pts.			
	Subtotal from this section			
C. Structural Frame				
1. Substitute Solid Sawn Lumber with Engineered Lumber	3 Resource pts.			
2. Use FSC Certified Wood for Framing (For every 10% of FSC lumber used = 2 points, up to 10)	up to 10 Resource pts.			
3. Use Wood I-Joists for Floors and Ceilings	2 Resource pts.			
4. Use Web Floor Trusses	2 Resource pts.			
5. Design Energy Heels on Roof Trusses 6" or More	2 Energy pts.			

POINTS PER CATEGORY	Available Points	Resources	Energy	IAQ/Health
C. Structural Frame (continued)				
6. Use Finger-Jointed Studs for Vertical Applications	2 Resource pts.			
7. Use Engineered Studs for Vertical Applications	2 Resource pts.			
8. Use Recycled-Content Steel Studs for Interior Framing	2 Resource pts.			
9. Use Structural Insulated Panels (SIPs)				
a. Floors	3 Energy pts.			
b. Walls	3 Energy pts.			
c. Roof	3 Energy pts.			
10. Apply Advanced Framing Techniques	4 Resource pts.			
11. Use Reclaimed Lumber for Non-Structural Applications	3 Resource pts.			
12. Use OSB for Subfloor and Sheathing				
a. Subfloors	1 Resource pt.			
b. Sheathing	1 Resource pt.			
	Subtotal from this section			
D. Exterior Finish				
1. Use Sustainable Decking Materials				
a. Recycled-Content	3 Resource pts.			
b. FSC Certified Wood	3 Resource pts.			
2. Use Treated Wood That Does Not Contain Chromium or Arsenic	1 IAQ/Health pt.			
3. Install House Wrap Under Siding	1 IAQ/Health pt.			
4. Use Fiber-Cement Siding Materials	1 Resource pt.			
	Subtotal from this section			
E. Plumbing				
1. Install Water Heater Jacket	1 Energy pt.			
2. Insulate Hot and Cold Water Pipes	2 Energy pts.			
3. Retrofit all Faucets and Showerheads with Flow Reducers				
a. Faucets (1 point each, up to 2 points)	up to 2 Resource pts.			
b. Showerheads (1 point each, up to 2 points)	up to 2 Resource pts.			
4. Replace Toilets with Ultra-Low-Flush Models (1 point each, up to 3 points)	up to 3 Resource pts.			
5. Install Chlorine Filter on Showerheads	1 IAQ/Health pt.			
6. Convert Storage to Tankless Water Heater	4 Energy pts.			
7. Install Water Filtration Units at Faucets (2 points each, up to 4 points)	up to 4 IAQ/Health pts.			
8. Install On-Demand Hot Water Circulation Pump	4 Resource pts.			
	Subtotal from this section			
F. Electrical				
1. Install Compact Fluorescent Light Bulbs (CFLs) (6 bulbs=2 points, 10 bulbs =3 points, 12 bulbs = 4 points)	up to 4 Energy pts.			
2. Install IC-AT Recessed Lighting Fixtures with CFLs (1 point each, up to 5 points)	up to 5 Energy pts.			
3. Install Lighting Controls (1 point per fixture, up to 4 points)	up to 4 Energy pts.			
4. Install High Efficiency Ceiling Fans with CFLs (1 point each, up to 4 points)	up to 4 Energy pts.			
	Subtotal from this section			

POINTS PER CATEGORY	Available Points	Resources	Energy	IAQ/Health
G. Appliances				
1. Install Energy Star® Dishwasher	1 Energy pt.			
2. Install Washing Machine with Water and Energy Conservation Features	1 Energy pt.			
3. Install Energy Star® Refrigerator	1 Energy pt.			
4. Install Built-In Recycling Center	3 Resource pts.			
	Subtotal from this section			
H. Insulation				
1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements				
a. Walls	2 Energy pts.			
b. Ceilings	2 Energy pts.			
2. Install Floor Insulation Over Crawl Space	4 Energy pts.			
3. Install Recycled-Content, Fiberglass Insulation with No Added Formaldehyde	3 IAQ/Health pts.			
4. Use Advanced Infiltration Reduction Practices	2 Energy pts.			
5. Use Cellulose Insulation				
a. Walls	4 Resource pts.			
b. Ceilings	4 Resource pts.			
6. Install Alternative Insulation Materials (Cotton, Spray-Foam)				
a. Walls	4 Resource pts.			
b. Ceilings	4 Resource pts.			
	Subtotal from this section			
I. Windows				
1. Install Energy-Efficient Windows				
a. Double-Paned	1 Energy pt.			
b. Low-Emissivity (Low-E)	2 Energy pts.			
c. Low Conductivity Frames	2 Energy pts.			
2. Install Low SHGC Window Film on Single-Glazing	1 Energy pt.			
	Subtotal from this section			
J. Heating, Ventilation and Air Conditioning				
1. Use Duct Mastic on all Duct Joints	2 Energy pts.			
2. Install New Ductwork within Conditioned Space	3 Energy pts.			
3. Vent Range Hood to the Outside	1 IAQ/Health pt.			
4. Clean all Ducts before Occupancy	2 IAQ/Health pts.			
5. Install Solar Attic Fan	2 Energy pts.			
6. Install Attic Ventilation Systems	1 Energy pt.			
7. Install Whole House Fan	4 Energy pts.			
8. Install Sealed Combustion Furnaces and Hot Water Heaters				
a. Furnaces	3 IAQ/Health pts.			
b. Water Heaters	3 IAQ/Health pts.			
9. Replace Wall-Mounted Electric and Gas Heaters with Through-the-Wall Heat Pumps	3 Energy pts.			
10. Install 13 SEER and 11 EER or Higher AC with TXV	3 Energy pts.			
11. Install AC with Non-HCFC Refrigerants	2 Resource pts.			
12. Install 90% Annual Fuel Utilization Efficiency (AFUE) Furnace	2 Energy pts.			
13. Retrofit Wood Burning Fireplaces				
a. Install EPA certified wood stoves/inserts	1 IAQ/Health pt.			
b. Install/Replace Dampers	1 Energy pt.			
c. Install Airtight Doors on Fireplaces	1 Energy pt.			

POINTS PER CATEGORY	Available Points	Resources	Energy	IAQ/Health
J. Heating, Ventilation and Air Conditioning (continued)				
14. Install Zoned, Hydronic Radiant Heating	3 Energy pts.			
15. Install High Efficiency Filter	4 IAQ/Health pts.			
16. Install Heat Recovery Ventilation Unit (HRV)	5 IAQ/Health pts.			
17. Install Separate Garage Exhaust Fan	3 IAQ/Health pts.			
	Subtotal from this section			
K. Renewable Energy and Roofing				
1. Pre-Plumb for Solar Water Heating	4 Energy pts.			
2. Install Solar Water Heating	10 Energy pts.			
3. Pre-Wire for Future Photovoltaic (PV) Installation	4 Energy pts.			
4. Install Photovoltaic (PV) System (1.2 kw = 6 points, 2.4 kw = 12 points, 3.6 kw = 18 points)	up to 18 Energy pts.			
5. Select Safe and Durable Roofing Materials	1 Resource pt.			
6. Install Radiant Barrier	3 Energy pts.			
	Subtotal from this section			
L. Natural Heating and Cooling				
1. Incorporate Passive Solar Heating	5 Energy pts.			
2. Install Overhangs or Awnings over South Facing Windows	3 Energy pts.			
3. Plant Deciduous Shade Trees on the West and South Sides	3 Energy pts.			
	Subtotal from this section			
M. Indoor Air Quality and Finishes				
1. Use Low/No-VOC Paint	1 IAQ/Health pt.			
2. Use Low VOC, Water-Based Wood Finishes	2 IAQ/Health pts.			
3. Use Low/No-VOC Adhesives	3 IAQ/Health pts.			
4. Use Salvaged Building Materials for Interior Finish	3 Resource pts.			
5. Use Engineered Sheet Goods with No Added Formaldehyde	6 IAQ/Health pts.			
6. Use Exterior Grade Plywood for Interior Uses	1 IAQ/Health pt.			
7. Seal all Exposed Particleboard or MDF	4 IAQ/Health pts.			
8. Use FSC Certified Materials for Interior Finish	4 Resource pts.			
9. Use Finger-Jointed or Recycled-Content Trim	1 Resource pt.			
10. Install Whole House Vacuum System	3 IAQ/Health pts.			
	Subtotal from this section			
N. Flooring				
1. Select FSC Certified Wood Flooring	8 Resource pts.			
2. Use Rapidly Renewable Flooring Materials	4 Resource pts.			
3. Use Recycled-Content Ceramic Tiles	4 Resource pts.			
4. Install Natural Linoleum in Place of Vinyl	5 IAQ/Health pts.			
5. Use Exposed Concrete as Finished Floor	4 Resource pts.			
6. Install Recycled-Content Carpet with Low VOCs	4 Resource pts.			
	Subtotal from this section			
	TOTAL	**Resources**	**Energy**	**IAQ/Health**
Total Available Points	**327**	**140**	**130**	**57**
Points Achieved				

Chapter Three:
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 over 300,000 tons of construction and demolition debris is disposed of at Alameda County landfills.

Application:

Identify the types and quantities of materials generated at the job site and recycle at least 50% of the construction/demolition debris. Contact local recycling facilities and haulers to identify terms and conditions required for recycling materials. Allocate space for recycling bins and containers. Call the Alameda County Recycling Hotline 1.877.STOPWASTE 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. Refer to the Green Building Materials Listing.

Benefit:

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

3. 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.

4. Protect Native Soil

Description:

Typically, a building site is cleared of vegetation and the topsoil is removed. After building, sod is laid on subsoil, beginning a cycle of high water and chemical dependency. Ideally, construction is coordinated with a landscape professional to protect the soil, which is a valuable, living resource.

Application:

Design for minimum building & hardscape footprints and little or no grading. Retain native vegetation. Delineate and limit the construction footprint; restrict heavy equipment that compacts soil, including cars, to areas that will be paved or built over. When grading is unavoidable, identify areas to be paved as a place to store native topsoil during construction. Amend soil with compost and re-spread topsoil after construction.

Benefit:

Preserving native soils, along with nurturing the health of disturbed soils, can significantly reduce storm runoff, reduce fertilizer and pesticide requirements, improve water quality and conserve irrigation water.

5. Minimize Disruption of Existing Plants and Trees

Description:

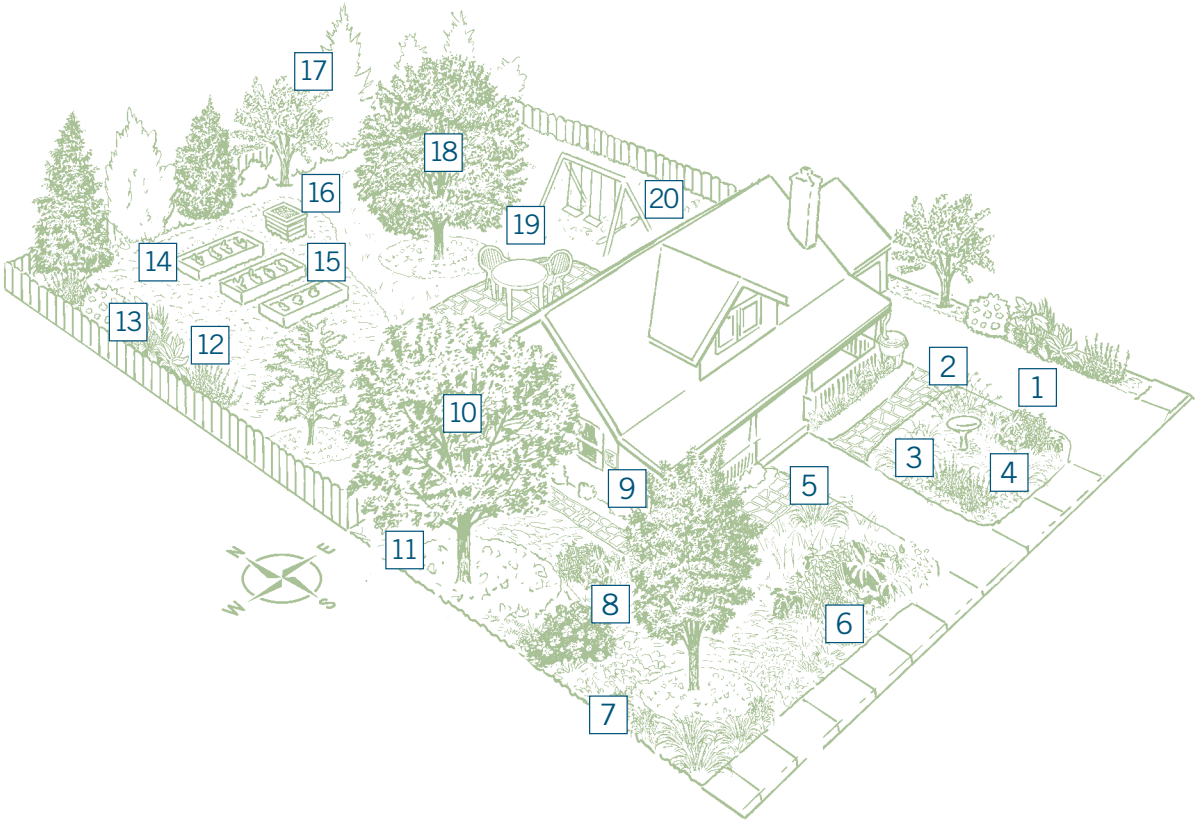
Through careful planning and construction practices, valuable trees and plants can be preserved in existing developments and neighborhoods.

Application:

Complete a landscape survey to determine the feasibility of preserving or relocating mature trees and shrubs. Fence trees and shrubs for protection from equipment.

Benefit:

Preserving existing, mature landscape features helps prevent soil erosion, maintains existing sources of natural cooling (e.g. shade from a mature tree), diverts waste from landfills, and keeps the unique character of the community.



1 Permeable paving on driveway and walkway to front door
2 Water from roof channeled to rainbarrel.
3 Water for wildlife habitat.
4 Lawn in front replaced with low water use native groundcovers.
5 Pavers with spaces and low water use plants between.
6 Diverse plantings with many California native groundcovers, shrubs and trees, but no invasive species
7 All plants given the space to grow to their natural size
8 Plants selected to match the microclimates
9 Irrigation controller waters hydrozones according to plant needs, soil moisture and weather
10 Deciduous trees placed to the west & southwest of the house & patio for summer cooling
11 Repository for leaves to collect under trees as mulch
12 Mulched paths keep soil covered
13 All plants grouped by water needs into hydrozones
14 Drip irrigation for vegetable beds, shrubs, trees and elsewhere where feasible.
15 Raised beds are constructed from plastic or composite lumber
16 Compost bin recycles plant and kitchen debris
17 Evergreen windbreak blocks north winter winds
18 Trees not topped but pruned properly
19 Small lawn in backyard where family will use it
20 Integrated pest management used for controlling weeds, insect and disease pests

6. Implement Construction Site Stormwater Practices

Description:

Stormwater runoff is part of a natural hydrologic process. However, land development and construction activities can significantly alter natural drainage patterns and pollute stormwater runoff.

Application:

Identify all storm drains, drainage swales and creeks located near the construction site, and make sure all subcontractors are aware of their locations to prevent pollutants from entering them. Train employees not to dump anything down storm drains. Protect all storm drain inlets using filter fabric cloth to prevent sediments from entering the storm drainage system during construction activities. Keep materials out of the rain, and prevent runoff pollution at the source. Store hazardous waste in drums and covered bins and contract a company to dispose of it properly.

Benefit:

Properly managing a gallon of water on site saves money in avoided engineering costs downstream. Keeping pollutants out of the storm drains minimizes erosion and water pollution and protects local creeks, reservoirs and the Bay. For more information, visit www.cleanwaterprogram.com or call 888/BAYWISE.

Permeable Pavers

7. Protect Water Quality with Landscape Design

Description:

Designing landscapes to allow irrigation and stormwater to soak into the soil recharges groundwater systems and filters out pollutants.

Application:

Use permeable paving, which allows water to percolate into the soil, for walkways, patios, and driveways. Install like conventional pavers. Design infiltration basins, swales and berms to keep water on site.

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, non-source pollution as well as lower risk of flooding.

8. 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 and fuel consumption, water pollution and waste generation.

Application:

Specify plants that are appropriate for the climate and soil; select slow-growing, drought tolerant, preferably California native plants. Design with perennials instead of annuals; choose and

GREEN BUILDING 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 the Alameda County Rotline 510.444.SOIL for more information and discounts on compost bins.

site trees to reduce building heating and cooling energy. Give plants plenty of room to mature, reducing the need for pruning. Avoid invasive species and hedges that require constant shearing. Limit turf to the smallest area that will meet recreational needs. Recycle yard trimmings by grass-cycling, 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.

9. Reuse Materials/Use Recycled-Content Materials for Landscape Areas

Description:

Plastic or composite lumber makes a very durable landscape edging, broken concrete can make a very attractive retaining wall or path, and ground glass cullet can be used for walkways.

Application:

Use salvaged or recycled-content materials for hardscapes (patios, decks, walkways and driveways) and other landscape structures.

Benefit:

The durability of plastic or composite lumber is greater than wood as they do not rot, crack or splinter. Salvaging or buying recycled-content landscaping products conserves natural resources and strengthens markets for recycled materials.

10. Install High-Efficiency Irrigation Systems

Description:

New irrigation technologies apply water to the soil at the plant root zones at the rate the soil can absorb it, significantly reducing water waste from overspray.

Application:

Install low-flow drip, sub-surface drip, or low-flow sprinklers in place of standard sprinkler systems for all landscape applications. Base watering levels on moisture sensors or weather based controllers. Use captured rainwater. Group plants by water requirements.

Benefit:

High-efficiency irrigation systems dramatically reduce landscape water use, and are critical to preventing disease & minimizing weed growth.

11. 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.

GREEN BUILDING TIP | **BAY-FRIENDLY GARDENING: FROM YOUR BACKYARD TO THE BAY**

Create Healthy Landscapes, Build Healthy Soil, and Reduce Waste.
In the Bay Area, how you care for your garden – from applying fertilizer to planting a lawn – affects the Bay. Bay-Friendly Gardening means simplifying garden care, preventing and reusing plant waste, and using as few resources as possible. Bay-Friendly Gardening builds healthy soils, reduces waste and protects local ecosystems by working with nature. Start with some simple steps such as leaving your clippings on the lawn, composting your plant trimmings and planting native species in your garden. For a copy of the Bay-Friendly Gardening how-to guide, call the compost information hotline – 510-444-SOIL or visit www.stopwaste.org.

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, installers should know that it has slightly different curing characteristics 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. Use Recycled-Content Aggregate

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.

3. 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.

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 gluelams, laminated veneer lumber, wood I-joists, oriented strand board, parallel strand lumber, and other manufactured wood fiber structural materials.

Application:

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 at many local suppliers. Refer to the Green Building Materials Listing.

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. Specify wood I joists with MDI resin whenever possible.

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. MDI resin reduces the amount of formaldehyde used in the adhesive and improves indoor air quality.

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.

I-Joists use 50% less wood fiber than solid sawn lumber.

4. Use Web Floor Trusses

Description:

Web floor trusses use solid wood or laminated veneer lumber top and bottom chords that are connected by wood or steel webbing for structural integrity.

Application:

Use primarily for long-span floor joists.

Benefit:

Web trusses eliminate waste since they are made to order. They reduce the pressure on old growth forests by replacing 2x10s and 2x12s traditionally used for floor joists.

5. Design Energy Heels on Roof Trusses 6" or More

Description:

Energy heels raise the height of the truss at exterior wall top plates to accommodate increased insulation at the perimeter of the house.

Application:

Install where conventional trusses are used for an addition. An energy heel needs to be specified when ordering roof trusses. The increased height may require modifications to exterior soffit and trim details.

Benefit:

The perimeter intersection between walls and roof framing is often an area of increased heat loss since conventional trusses reduce insulation to less than the required depth. Raising the heels allows for full insulation around the house, saving energy dollars.

6. Use Finger-Jointed Studs for Vertical Applications

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.

7. Use Engineered Studs for Vertical Applications

Description:

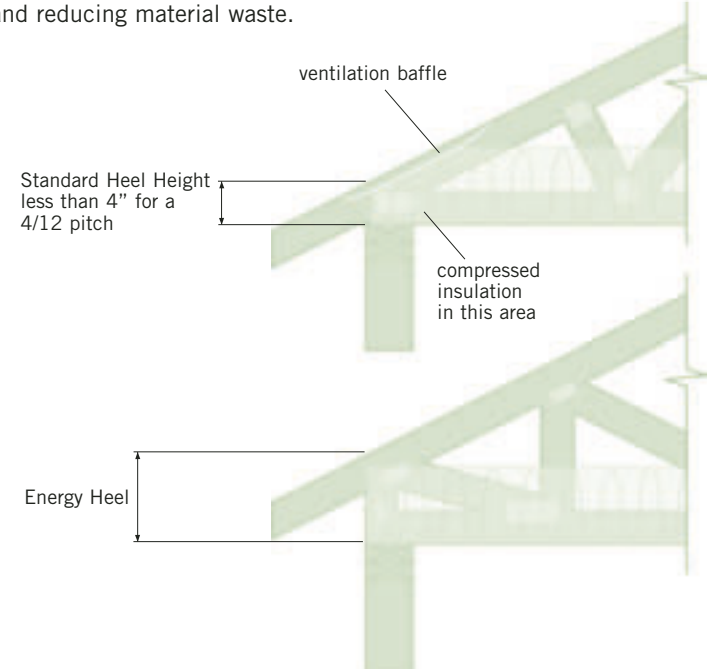
Engineered studs are laminates, like OSB and plywood, that are used in vertical structural applications.

Application:

Use for interior or exterior wall applications except where prohibited by seismic codes. They are particularly appropriate for tall cathedral wall applications.

Benefit:

Engineered studs are straighter than conventional studs and will not deform, twist, split or warp. They save wood by using small laminated pieces.



Energy Heels on Trusses Allow More Insulation

8. Use Recycled-Content Steel Studs for Interior Framing

Description:

Steel studs can be either stand-alone or provide a "c" channel over wood stud pieces. Steel contains up to 95% recycled-content. Steel contains high recycled-content, which typically increases in proportion to the steel's thickness.

Application:

For use in interior walls.

Benefit:

Steel reduces the need for wood and provides strong interior walls.

Steel Studs

9. Use Structural Insulated Panels (SIPs)

Description:

SIPs are high-performance, load-bearing panels that consist of a core of foam insulation with OSB on either side. SIPS can be used for floors, walls and roofs in residential buildings. They are generally 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. Note: It's important to seal the joints well, to avoid water penetration.

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.

Construction using SIPs

10. Apply Advanced Framing Techniques

Description:

Advanced framing involves using wood to its maximum structural potential. For a comprehensive overview, visit www.nrdc.org.

Application:

Advanced framing includes: framing exterior and interior walls 24" on center, 2 stud corners, ladder blocking at wall partitions, stacking trusses over studs and other wood saving strategies.

Benefit:

Advanced framing saves up to 20% on wood and framing labor costs and makes the home more energy efficient by allowing for a higher percentage of the wall to be insulated, reducing frame conduction heat loss.

11. Use Reclaimed Lumber for Non-Structural Applications

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.

12. 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 contribute to a healthier indoor air quality.

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.

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) (commonly sold as ACQ Preserve) and Copper Boron Azole (CBA) (commonly sold as Wolman Natural Select) are alternative treated woods that do not contain chromium – a heavy metal – and arsenic, which are detrimental to human health.

Application:

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

Benefit:

ACQ and CBA 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.

Recycled-Content Decking

3. Install House Wrap Under Siding

Description:

House wrap protects the sheathing from moisture and allows vapor from inside to escape and provides an effective air infiltration barrier.

Application:

Install house wrap according to manufacturer specifications over all sheathing before exterior finish is installed. To provide an effective drainage plane for water, it needs to be lapped and edges should be taped with manufacturer's tape, and all flashing elements deep to be properly installed in shingle fashion. Special products have been developed for wrapping window and door openings and for stucco applications.

Benefit:

House wrap provides a continuous drainage plane that diverts water away from the stud cavity and provides an effective air infiltration barrier. It can also help reduce moisture build up in stud cavities by allowing water vapor to migrate through the material.

4. Use Fiber-Cement Siding Materials

Description:

Fiber-cement siding is composed of cement, sand and cellulose fibers. It is currently available available in shingles, planks or 4x8, 4x9, or 4x10 sheets. It is usually 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, noncombustible 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 Water Heater Jacket

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. 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.

3. Retrofit all Faucets and Showerheads 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:

Specify low-flow water conservation devices according to East Bay Municipal Utility District's (EBMUD) recommendations:

- Kitchen faucets ≤ 2.0 gpm
- Bathroom faucets ≤ 1.5 gpm
- Showerheads ≤ 2.5 gpm

Limit showerheads to one fixture per shower

Benefit:

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

4. Replace Toilets with Ultra-Low-Flush Models

Description:

New high-efficiency toilets use 1.6 gpf (gallons per flush) or less. Some manufacturers offer dual flush toilets

Application:

Whenever possible, replace existing toilets with a new 1.6 gpf – or less – models. Select a toilet from EBMUD (www.ebmud.com) pre-tested list to ensure the model actually uses no more than 1.6 gpf and performs well.

Benefit:

Ultra-Low-Flush toilets reduce the amount of water usage.

5. Install Chlorine Filter on Showerheads

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.

6. Convert Storage 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 storage 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.

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7. Install Water Filtration Units at Faucets

Description:

Water filtration units can be installed under counter at individual fixtures 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.

8. 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.

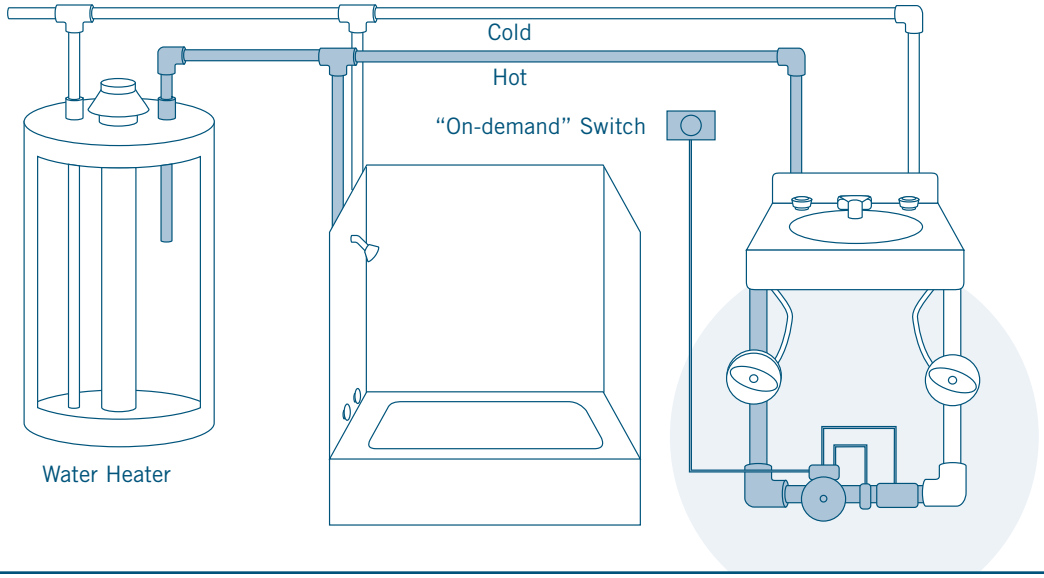
Application:

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)

Description:

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. 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 Insulation Compatible Air-Tight (IC-AT) Recessed Lighting Fixtures with Compact Fluorescent Lamps (CFLs)

Description:

Conventional IC recessed fixtures are not energy efficient because they use incandescent bulbs and they allow the "chimney effect" to occur, in which the heat of the bulb and fixture naturally draws the room's conditioned air up through the fixture's holes and exhausts it into the attic or ceiling/floor cavity. IC-AT fixtures are sealed, eliminating this effect and also allowing for insulation to be blown on top to keep the heat in.

Application:

Use IC-AT fixtures with CFLs wherever recessed cans are specified.

Benefit:

Typical recessed fixtures are not energy efficient because they use incandescent lamps, generate significant heat, and allow conditioned air to infiltrate out of the house. IC-AT fixtures eliminate the air leakage, while compact fluorescent lamps stay cool and use less energy.

3. Install Lighting Controls

Description:

Lighting controls use dimmers, 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. Dimmable CFLs are available at a premium.

Benefit:

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

4. Install High Efficiency Ceiling Fans with CFLs

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. Appliances

1. Install Energy Star® Dishwasher

Description:

ENERGY STAR® dishwashers use water and energy more efficiently.

Application:

Select ENERGY STAR® dishwashers. These dishwashers use an internal water heater to boost temperatures inside the dishwasher. For this reason, water heaters can be turned down to 120 degrees, saving water heating costs.

Benefit:

Water-efficient dishwashers are also energy-efficient because most energy consumed by dishwashers is used to heat water. ENERGY STAR® dishwashers use 25% less energy than comparable models.

2. Install Washing Machine with Water and Energy Conservation Features

Description:

Horizontal axis machines load from the front, spinning clothes in and out of the water to tumble them clean. Some newer model top loading washing machines offer water and energy conservation features.

Application:

Select ENERGY STAR® horizontal axis and conservation model washing machines.

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. Some of the newer model top loading washing machines offer water and energy savings as well.

Horizontal Axis Washing Machines

3. Install Energy Star® 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.

4. Install Built-In Recycling Center

Description:

Built-in recycling centers provide bins for separated recyclables and food waste.

Application:

To be most effective and make recycling easy, recycling bins should be built into kitchen cabinets, while stand alone units in the garage will also be helpful.

Benefit:

A built-in recycling center offers an easy and convenient choice between the trash bin and the recycling bins rather than having to move between two separately located bins.

Built-In Recycling Center

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.

H. 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 for your climate zone 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 for your climate zone by 20%, when 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, and re-roofing is being done at the same time, add additional rigid foam insulation on top of the existing roof sheathing. Special products are available that come pre-vented for new roofing.

Benefit:

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

2. Install Floor Insulation Over Crawl Space

Description:

Insulate and seal floors over unconditioned crawl spaces with R-19 or greater.

Application:

Seal all penetrations through the floor, including electrical, plumbing and ductwork, with expanding foam to prevent migration of air, moisture, and mold spores. Install insulation with vapor barrier towards the floor (warm side). Protect underside of fiberglass with inexpensive sheathing or wire mesh materials that act as a barrier to vermin.

Benefit:

Improves comfort by insulating the floor, protects indoor air quality from moisture that can grow in damp crawl spaces.

Recycled-Content Fiberglass Insulation with No Added Formaldehyde

3. Install Recycled-Content, Fiberglass Insulation with No Added Formaldehyde

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. This type of fiberglass insulation is installed exactly as traditional fiberglass.

Benefit:

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

4. Use Advanced Infiltration Reduction Practices

Description:

Expanding 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.

5. Use Cellulose Insulation

A. Walls

Description:

Cellulose is a highly effective insulation made out of recycled newspaper. Damp-spray cellulose wall insulation is mixed with low-toxic binders to adhere to itself and the 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. Avoid damp blown cellulose during wet months and install drywall only after testing for 25% (maximum) moisture content. Use boric acid treatment only; avoid ammonium sulfate treated cellulose insulation.

Benefit:

Spray insulation completely fills cavities and penetrations, thus reducing air infiltration. The binder in the insulation reduces the chance of settling. The cellulose is treated to retard insects and fire; use boric acid treatment only. Using cellulose insulation makes the home quieter, more comfortable and reduces energy use.

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. Avoid excessive blown-in cellulose behind netting as it may make it difficult to achieve flat walls and ceilings with drywall. Best to use 5/8" drywall only over dry-blown cellulose insulation. Use boric acid treatments only and avoid ammonium sulfate treated cellulose.

Benefit:

Cellulose insulation is fire-resistant, manufactured with recycled materials, and has no added formaldehyde. It also reduces air leakage and contributes to a more comfortable and energy-efficient home.

6. Install Alternative Insulation Materials

Description:

Advanced insulation materials such as spray foam, recycled cotton and others are alternatives to conventional products.

Application:

Varies per product type. Cotton comes in both batt and loose fill while spray foam is spray applied and expands in place.

Benefit:

Cotton uses recycled-content fabric (such as blue jeans trimmings) while spray foam provides superior air infiltration resistance. Both types have no added formaldehyde.

Loose-Fill Cellulose Insulation (Left), Damp-Spray Cellulose (Right).

I. 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 specifying wood windows as standard window packages.

Benefit:

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

When replacing windows, use the following as a guide to selecting the most energy efficient windows for your climate zone:

In hot climates (Zone 12) choose windows with SHGC and U-factor values of .45 or lower. In moderate climates (Zone 3) make sure that the U-factor value is also .45 or lower.

2. Install Low Solar Heat Gain Coefficient (SHGC) Window Film on Single-Glazing

Description:

Low solar heat gain coefficient window film reduces solar heat gain through glass (particularly during late afternoon and evening hours) while still transmitting light and visibility.

Application:

Reflective film should only be used on single-glazed windows. Look for a SHGC of less than the code requirement of 0.4. Consider using on all east or west facing windows.

Benefit:

Low SHGC window film reduces overheating, improves comfort and can significantly lower the need for additional cooling.

1. 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.

2. 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.

3. 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.

4. NFRC technical procedures by which the window was evaluated.

5. Name of the window manufacturer.

6. Manufacturer's description of the labeled product.

7. 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.

8. Solar Heat Gain Coefficient (SHGC) is a measure of the solar energy entering the building though the entire window. A lower SHGV will reduce air conditioning costs and provide more comfort on hot days.

9. Air Leakage (AL) is a measure of the amount of air that can pass through the cracks and joints in the window assembly. The lower the AL, the less air will pass through.

10. 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.

Source: www.NFRC.org

J. 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. Nationally, leaks at the joints between ductwork connections allow, on average, 25% of the 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. Professional testing for a duct leakage rate of under 10% can be helpful in determining success.

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. Ducts run through attic space can be buried under new loose fill insulation.

Benefit:

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

3. Vent Range Hood to the Outside

Description:

Steams, 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 most easily where stoves are adjacent to exterior walls.

Benefit:

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

GREEN BUILDING TIP | **INSPECT AIR DUCTS REGULARLY**

Ducts should be inspected, tested and sealed to ensure adequate airflow and eliminate loss of conditioned air. Ducts can leak as much as 20-30% of the air passing through them and can bring dust, unconditioned outdoor air and humidity into living spaces. To find out how leaky your ducts are have them professionally tested and seek to have them repaired so that you accomplish a leakage rate of under 10%. Thorough duct sealing can cut heating and cooling costs in many homes by 20%.

4. Clean all Ducts Before Occupancy

Description:

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

Application:

Cover or seal all ductwork in work space during construction. 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.

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 150ºF. That heat migrates into the home and increases the temperature inside. A solar attic fan removes much of this hot air and reduces the burden on the air conditioning system.

6. Install Attic Ventilation Systems

Description:

Soffit/eave ventilation and gable/continuous ridge ventilation exhaust excess heat and moisture from attic spaces by natural convection.

Application:

Install equal amounts of ventilation between the soffits/eaves and the gables/ridges. The code requirement of 1 square foot of net free area of venting for every 150 square feet of attic floor area should be doubled. Keep insulation from blocking the soffit/eave vents.

Benefit:

Attics can reach up to 150º F on a hot summer day. That heat migrates into the house, exchanging air with the living space. Eave and soffit venting and continuous ridge venting increases comfort, reduces air conditioning costs and reduces problems associated with excess attic moisture.

7. Install Whole House Fan

Description:

Whole house fans can cool a house without using an air conditioner by exhausting warm, indoor air and bringing in large volumes of fresh, cool, outdoor air at night.

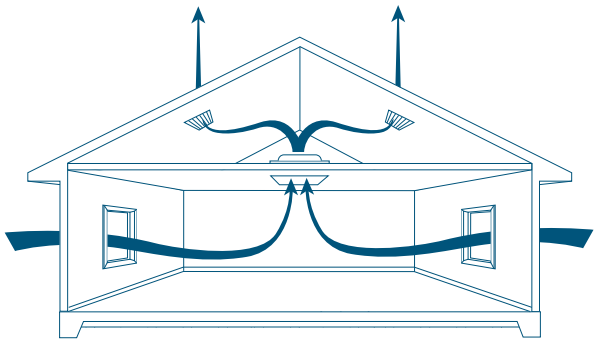
Application:

The fan must be mounted in a hallway ceiling on the top floor. An insulated, airtight seal is necessary to prevent air leakage through the fan in winter. Fans should be sized to produce between 4-5 air changes per hour and should have two speeds: low speed for continuous ventilation and high speed. PLEASE NOTE: Keep a window open when fan is running to avoid back drafting of carbon monoxide from gas appliance flues.

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.

Air Flow with Whole-House Fan



8. Install Sealed Combustion Furnaces and Hot Water Heaters

Description:

Sealed combustion furnaces and water heaters duct fresh, outdoor air directly into a sealed jacket around the combustion chamber eliminating the use of conditioned house air for combustion.

Application:

Install in place of conventional furnaces or hot water heaters.

Benefit:

Traditional natural gas furnaces and hot water heaters use conditioned, indoor air for combustion. When a negative pressure situation is created in the home by exhaust fans, dryers or leaky ducts, carbon monoxide can be pulled into the house from the combustion chamber and exhaust flue. Sealed furnaces and hot water heaters eliminate that condition, thereby improving indoor air quality and reducing the danger of carbon monoxide contamination. They also improve energy efficiency by not taking your home's conditioned air and sending it outdoors through the exhaust flues.

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

Description:

Wall-mounted electric and gas heating units are potential health and 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 fan coils in each room to distribute heat in the home.

Benefit:

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

10. Install 13 SEER and 11 EER or Higher Air Conditioning with a Thermostatic Expansion Valve (TXV)

Description:

Air conditioning equipment is one of the greatest loads on power grids. SEER (Seasonal Energy Efficiency Ratio) measures cooling system efficiency at low temperatures while EER (Energy Efficiency Ratio) is a high temperature performance rating. The higher the SEER/EER number the less power is required to provide comfort. This assures that the air conditioning system operates at high efficiency during the full range of summer temperatures. TXV is a refrigerant regulation device that can help ensure that the air conditioning system operates at maximum efficiency over a wide range of conditions.

Application:

Higher SEER (13 – 18 SEER) and EER (11 or greater) units are installed like any other AC equipment. Some AC equipment comes with a factory installed TXV and others accept a TXV that can be bolted on. Zoned AC systems allow 2 to 4 zones to be conditioned at different temperatures so only the spaces being used are cooled. These require thermostats in each zone.

Benefit:

High SEER units save money and energy and reduce peak load problems for utilities. High EER systems not only save money and energy but offer more cooling when you need it most, on very hot days. Installing air conditioning systems with a TXV lowers utility bills and saves energy.

11. Install Air Conditioning with Non-HCFC Refrigerants

Description:

R-22 is an HCFC refrigerant used in residential heating and cooling systems. R–22 contains chlorine which is an ozone-destroying chemical. In 2010, under the Clean Air Act, HVAC manufacturers can no longer produce new air conditioners using R-22.

Application:

Some new AC units already use alternatives to R-22 refrigerant such as R-410A, as well as the trade brand Puron and others. Additional care should be taken when handling refrigerants, always select a reputable dealer who employs service technicians that have achieved Environmental Protection Agency (EPA) certification to handle refrigerants.

Benefit:

Using alternatives to HCFC refrigerants reduces depletion of the ozone layer in case of leakage during replacement.

12. Install 90% Annual Fuel Utilization Efficiency (AFUE) 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.

13. 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. In addition, open fireplaces suck air out of the house and extract more heat than they provide. Retrofitting wood burning fireplaces with airtight doors and working dampers reduces down drafting, heat loss and the amount of oxygen drawn from the house for combustion purposes.

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. If total retrofit is not feasible, then replace old damper if it no longer seals the flue due to mechanical failure, rust or soot buildup in the chimney. Retrofit sealed doors onto 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:

EPA certified stoves or fireplace inserts reduce the amount of pollutant particulate matter by 75-90% compared to a standard fireplace. A properly operating damper reduces drafts throughout the house when the fireplace is not in use. Airtight doors, when shut, can reduce the heat taken from the house as well as reduce drafts when the fireplace is not in use.

14. 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.

15. Install High Efficiency Filter

Description:

High efficiency filters remove 70% or more of dust and particulates from the air.

Application:

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 filter makes the living space healthier.

Radiant Floor Heating

16. Install Heat Recovery Ventilation Unit (HRV)

Description:

An HRV is a mechanical ventilation system that recovers heat from the exhausting, stale, indoor air and transfers it to the incoming, fresh, outdoor air.

Application:

The unit should be designed into the HVAC system to distribute the fresh air more evenly throughout the home. Note: Use of this equipment is particularly appropriate with blower door test results of less than .35 Natural Air Changes per Hour (NACH).

Benefit:

Heat recovery ventilators provide fresh, outdoor air while exhausting stale indoor air. They also save energy by recovering the heat lost in the exhausting air and transfer it to the incoming air.

17. 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. Do not install fan if water heater or gas furnace are located in garage.

Benefit:

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

GREEN BUILDING TIP | CHANGE FURNACE FILTERS OFTEN

Furnace filters capture large particles of dust, pollen, and other indoor pollutants preventing them from build-up on the workings of the system and from distributing throughout your home. The best option is to purchase high efficiency disposable filters with a MERV rating of between 6 and 12; greater than 12 will restrict your system's air flow too much. Replace these filters as they become built-up with contaminants; generally every two months or as needed. If utilizing reusable, high efficiency electronic or electrostatic filters, remember to clean them often.

K. Renewable Energy and Roofing

1. 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.

2. Install Solar Water Heating

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.

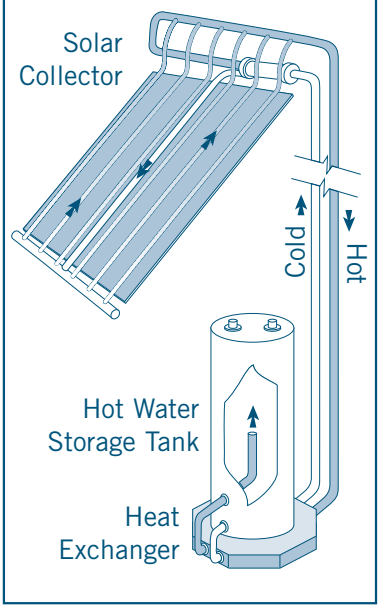
Application:

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.

Solar Water Heating



3. Pre-Wire for Future Photovoltaic (PV) Installation

Description:

Running wires from the roof to the electric service entrance/circuit breaker panel can save costly installation of photovoltaic panels at a future date.

Application:

Run two pair #10 THHN wire plus #8 ground in conduit from the south facing roof to a junction box near the panel (don't wire the panel). East and West facing roofs can work if the South is unavailable or shaded for panels.

Benefit:

Photovoltaic panels and systems will continue to drop in price over the next few years. Homebuyers may not be able to afford the system today but may be interested in the future when the price comes down. Visit www.consumerenergycenter.org for more information on rebates.

GREEN BUILDING 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.

4. Install Photovoltaic (PV) System

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:

Typical PV installations include flat roof, sloped roof, building integrated PV and ground mount. Items to consider when installing PV include: sunlight – minimum of 4 hours required during peak period (8 a.m. to 4 p.m.) with no shade; orientation – anything but North; angle – flat to 60 degrees; adequate roof area-depending on type of PV selected (monocrystal, polycrystal or amorphous).

Benefit:

PV panels can be used as a means to decrease reliance on conventional power plants that contribute to air pollution.

Installing Solar Water System

5. Select Safe and Durable Roofing Materials

Description:

40-50 year asphalt composition, tile, slate, fiber-cement and metal are examples of safe and durable roofing materials. Avoid cedar and wood shake shingles.

Application:

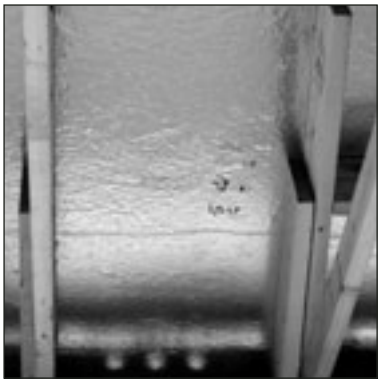
Applicable anytime roofing material is specified.

Benefit:

A durable and safe roof is cost effective and reduces landfill deposits. Some products may also reduce your homeowner insurance rates.

Photovoltaic Panel System

Radiant Barrier Sheathing



6. Install Radiant Barrier

Description:

When radiant energy from the sun strikes the roof surface, it is converted to heat energy which radiates downward into the attic and the adjoining rooms. A radiant barrier reflects or blocks radiant heat and does not emit it to the cooler surfaces around it. Radiant barrier sheathing is a roof sheathing material with a reflective layer (film or foil) applied to the underside of the OSB. Another radiant barrier application is reflective film or foil that attaches to the rafters, reflects radiant heat upwards and does not emit it downward towards the attic and the home's interior.

Application:

Radiant barrier sheathing can be used in place of conventional roof sheathing or apply reflective material (foil or paint) to the underside of rafters and decking.

Benefit:

Radiant barriers reduce heat build-up in attic spaces by not re-radiating heat from the roof to the attic and eventually to the interior rooms. They can prevent up to 97% of the sun's radiant heat from entering the home and can bring attic temperatures down as much as 30 degrees on hot days, keeping the whole home cooler and reducing energy consumption for air conditioning.

L. Natural Heating and Cooling

1. Incorporate Passive Solar Heating

Description:

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

2. Install Overhangs or Awnings over South Facing Windows

Description:

Properly sized overhangs or awnings on south facing windows are important components of passive solar heating and natural cooling. Overhangs and awnings help keep the heat of the sun from entering the home during summer, but allow heat to enter in the winter. These shade control devices can be oversized roof overhangs, wood trellises/arbors with deciduous plants, or adjustable or demountable awnings made of fabric or metal.

Application:

The overhang or awning design should keep out summer sun by shading the entire window during the hottest month(s) of the year. Size overhangs or awnings above south windows so that winter sunlight is allowed into the space, where it can be absorbed by thermal mass, and be re-radiated as heat. Also consider shading devices on the west and east facing windows to protect from morning and afternoon heat, especially in hotter climates.

Benefit:

Overhangs, awnings and trellises are an integral part of making passive solar heating and natural cooling work. Removable/retractable fabric awnings offer a low cost solution to reduce heat gain, lower energy bills, and make the home more comfortable in the summer.

3. Plant Deciduous Shade Trees on the West and South Sides

Description:

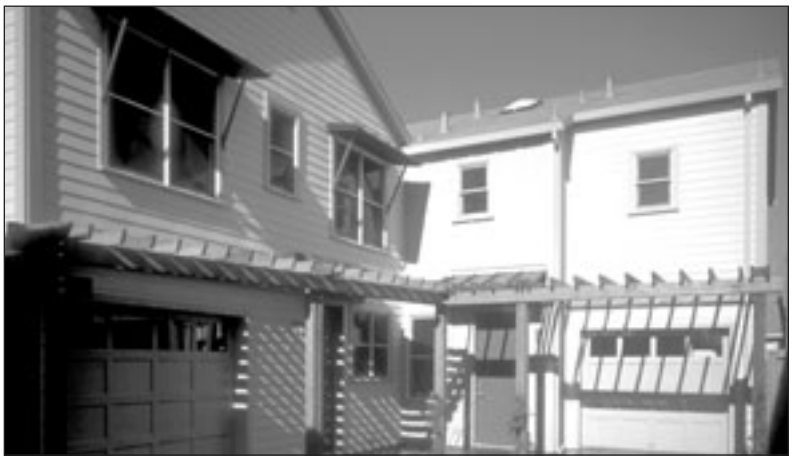
During summer months, the sun shines on the south and west sides of the home causing the home to heat up which in turn makes air conditioners work their hardest. Trees offer the best solution for keeping out low-angle sunlight from west and south windows in summer. The additional cooling demanded by low-angle sun penetration of west windows in late summer afternoons create the most significant summer peak utility costs.

Application:

Plant shade trees on the west and south sides of the home to provide shade and summer cooling. The most important areas to shade are windows and paved areas. Keep trees an appropriate distance from the home or utilities to avoid introduction of pests and root/branch intrusions as trees mature.

Benefit:

Planting shade trees can reduce summer air-conditioning costs by 25% to 40%. Trees provide numerous additional benefits to the environment including cleansing the air, creating habitats for birds and play places for children as well as adding aesthetic beauty to the neighborhood. Through shade and evapotranspiration, trees can create a microclimate that is up to 15 degrees cooler than the surrounding area.



Awning and Trellises to Reduce Heat Gain

M. Indoor Air Quality / Finishes

1. Use Low/No VOC 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.

3. Use Low/No-VOC Adhesives

Description:

Unlike solvent-based adhesives that off-gas toxic compounds for months, low/no-VOC adhesives reduce toxic gasses such as aromatic hydrocarbons or solvents that contribute to air pollution.

Application:

Use low/no-VOC products in place of standard adhesives for all interior applications such as installation of flooring, countertops, wall coverings, paneling and tub/shower enclosures.

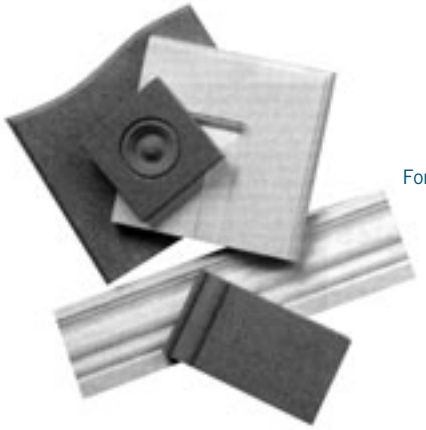
Benefit:

Low/No-VOC adhesives are often stronger, emit fewer pollutants, and reduce the potential harmful impacts on the health of the occupants and installers.

Low/No-VOC paint

GREEN BUILDING TIP | **CONTACT BAY AREA BUILD IT GREEN**

Build It Green is a program designed to provide Bay Area homeowners, homebuyers, remodelers, and builders a trusted resource for information on Green Building and its various applications. A local effort with far reaching effects, the program is dedicated to creating healthier, more durable, and energy and resource-efficient homes that will provide Bay Area residents years of higher quality living. Visit www.build-green.org for more information on events, products, presentations and more.



Formaldehyde-Free Medium Density Fiberboard (MDF)

4. Use Salvaged Building Materials for Interior Finish

Description:

Salvaged building materials are selectively and carefully removed from buildings for reuse. Many salvaged materials are superior to the products available today such as old-growth non-structural beams, flooring and interior trim.

Application:

Use salvaged building materials the same way conventional materials are used. Please note, salvaged painted wood items often contain lead based paint. Use lead safe painting and paint removal strategies identified by the Alameda County Lead Poisoning Prevention Program – www.aclppp.org/hazard.shtml.

Benefit:

Using salvaged building materials keeps valuable resources out of landfills, reduces pressures on the landfills as well as offering the homeowner inexpensive and unique materials for the home.

5. Use Engineered Sheet Goods with No Added Formaldehyde

Description:

Engineered sheet goods such as particleboard and medium density fiberboard (MDF) typically use adhesives that contain urea formaldehyde, a suspected human carcinogen. The formaldehyde is continuously released, referred to as "offgassing", for years after installation. Formaldehyde off-gassing contributes to poor indoor air quality. Better alternatives include MDF without formaldehyde binders as well as sheet goods made from agricultural waste, such as straw-based particleboard manufactured with non-formaldehyde binders.

Application:

Whenever possible, eliminate new particleboard and formaldehyde based MDF inside the home by using solid wood for stair treads, exterior grade plywood (which uses the less dangerous phenol formaldehyde), MDF with formaldehyde-free binders, or straw-based MDF for shelving, cabinets, trim and substrate for countertops.

Benefit:

Elimination of engineered sheet goods containing urea formaldehyde reduces exposure to residents, particularly children, who are most 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.

6. 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.

GREEN BUILDING TIP — SELECT LESS-TOXIC 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. For tips on how to make and use toxic-free household cleaners, call 1.877.STOPWASTE for a copy of *Easy Recipes for A Healthy House.*

7. 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 formaldehyde-based 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.

8. Use Forest Stewardship Council (FSC) Certified Material for Interior Finish

Description:

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

Application:

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

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.

9. Use Finger-Jointed or Recycled-Content Trim

Description:

Finger-jointed trim is manufactured from short pieces of clear wood glued together to create finished trim. recycled-content trim is made from recycled polystyrene/plastics.

Application:

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

Benefit:

Finger-jointed or recycled-content trim is straighter and more stable than conventional clear wood, and uses materials more efficiently.

10. Install Whole House Vacuum System

Description:

Whole house vacuums exhaust the dust to the outside rather than collecting it in a bag that may not filter the dust effectively.

Application:

Whole house vacuum systems must be vented outdoors, not into a garage, and not to any area where air may be taken back into the house.

Benefit:

Whole house vacuums expel the dust outside the house whereas most vacuum cleaners do not filter the dust effectively and merely redistribute the dust that is most harmful to the respiratory system. This can aggravate asthma and other respiratory problems.

GREEN BUILDING TIP | **PURCHASE VACUUM CLEANER WITH HEPA FILTER**

If installing a whole house vacuum system is not feasible, consider purchasing a high efficiency particulate air (HEPA) filters. It catches 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.

Bamboo Flooring

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. It is important to specify a durable finish.

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.

4. Install Natural Linoleum In Place of Vinyl

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.

GREEN BUILDING TIP | **PLACE 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.

Ingredients of Natural Linoleum

Used with permission from *This Old House*

5. Use Exposed Concrete as Finished 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. It is durable and easy to clean and can be used to hold piping for active radiant floor heating or as a thermal mass for passive solar heating.

6. Install Recycled-Content Carpet with Low-VOCs

Description:

Recycled-content carpet is made from recycled plastic bottles, recycled nylon/wool or recycled cotton. Recycled-content carpet does not differ in appearance or performance and the price is comparable to conventional carpet. Some recycled-content carpets include agricultural by-products such as corn silk. Carpet tiles as well as broadloom are available. The Carpet and Rug Institute (CRI) has a Green Label Indoor Air Quality Test Program which labels the VOC content of carpeting.

Application:

Use recycled-content carpet in all applications where conventional carpet is specified. Choose carpet that meets or exceeds the CRI Green Label requirements.

Resource: *www.carpet-rug.com*

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.

Look for carpets that meet or exceeds the CRI Green Label requirements.

GREEN BUILDING TIP | **MINIMIZING OFFGASSING FROM ADHESIVES**

Use low VOC, water-based sealants and low/no solvent adhesives when installing or refinishing flooring. When installing laminate flooring, use glueless installation to minimize offgassing from adhesives.

Chapter Four:

Summary of Green Building Benefits

A. Site	BENEFITS
1. Recycle Job Site Construction and Demolition Waste	Reduces pressure on landfills, saves money by reducing landfill fees, and provides raw materials for future building products.
2. Salvage Reusable Building Materials	Reduces landfill deposits, decreases disposal costs and saves natural resources.
3. Remodel for Mixed Use, Adaptive Reuse, and Historic Preservation	Diverts demolition waste, preserves neighborhood character and conserves resources.
4. Protect Native Soil	Reduces storm runoff, fertilizer and pesticide requirements, improves water quality and conserves irrigation water.
5. Minimize Disruption of Existing Plants and Trees	Helps prevent soil erosion, maintains existing sources of natural cooling, diverts waste from landfills, and adds a unique character to the community.
6. Implement Construction Site Stormwater Practices	Minimizes erosion and water pollution; and protects the Bay.
7. Protect Water Quality with Landscape Design	Reduces the volume of polluted water flowing into rivers or the Bay.
8. Design Resource-Efficient Landscapes and Gardens	Helps conserve water, reduces use of chemicals, and creates healthier soil and plants.
9. Reuse Materials/Use Recycled-Content Materials for Landscape Areas	Conserves natural resources and strengthens markets for recycled materials.
10. Install High Efficiency Irrigation Systems	Reduces landscape water use and lowers water costs.
11. Provide for On-Site Water Catchment/Retention	Reduces the need to use treated, potable water for lawns and gardens.

B. Foundation	
1. Incorporate Recycled Flyash in Concrete	Increases the strength and durability of the concrete and reduces the amount of cement needed.
2. Use Recycled-Content Aggregate	Saves money, natural resources and energy.
3. Insulate Foundation Before Backfill	Reduces utility bills by minimizing heat loss.

C. Structural Frame	
1. Substitute Solid Sawn Lumber with Engineered Lumber	Reduces demand for virgin lumber, is stronger, straighter, and more durable.
2. Use FSC Certified Wood for Framing	Ensures long-term availability of precious woods.
3. Use Wood I-Joists for Floors and Ceilings	Uses 50% less wood fiber, will not twist, warp or split, stronger and lighter than 2x10s or 2x12s and can span greater distances.
4. Use Web Floor Trusses	Eliminates waste. Reduces the pressure on old growth forests.
5. Design Energy Heels on Roof Trusses 6" or More	Allows for full insulation around the house, saving energy and money.
6. Use Finger-Jointed Studs for Vertical Applications	Uses recycled-content materials, is straighter and stronger than solid sawn studs, and eliminates crooked walls, thereby reducing material waste.
7. Use Engineered Studs for Vertical Applications	Engineered studs are straighter, and will not deform, twist, split or warp. They save wood by using small laminated pieces.
8. Use Recycled-Content Steel Studs for Interior Framing	Steel reduces the need for wood and provides strong interior walls.
9. Use Structural Insulated Panels (SIPs)	Reduces infiltration relative to frame construction, is energy-efficient, provides excellent soundproofing, is erected quickly, and saves wood by eliminating much of the conventional framing lumber.
10. Apply Advanced Framing Techniques	Makes the home more energy efficient, saves wood and construction costs. It also allows for a higher percentage of the wall to be insulated reducing frame conduction heat loss.
11. Use Reclaimed Lumber for Non-Structural Applications	Reduces resource consumption and landfill deposits, and is often of higher quality than new lumber.
12. Use OSB for Subfloor and Sheathing	Reduces the need for large diameter old-growth trees, is as strong as traditional plywood sheet material and is less expensive.

D. Exterior Finish	BENEFITS
1. Use Sustainable Decking Materials	Contains recycled-content materials, is more durable and reduces demand for old-growth timbers.
2. Use Treated Wood That Does Not Contain Chromium or Arsenic	Reduces exposure to chromium and arsenic, which are harmful, particularly to children who play on structures built with treated wood.
3. Install House Wrap Under Siding	Protects the home by diverting water away from the wall cavity.
4. Use Fiber-Cement Siding Materials	Lasts longer, is fire-resistant, and reduces maintenance costs.

E. Plumbing	
1. Install Water Heater Jacket	Reduces heat loss by 10% (on older heaters.)
2. Insulate Hot and Cold Water Pipes	Saves energy and water, and reduces water heating costs.
3. Retrofit all Faucets and Showerheads with Flow Reducers	Saves water and is a low cost option.
4. Replace Toilets with Ultra-Low-Flush Models	Saves water.
5. Install Chlorine Filter on Showerheads	Reduces chlorine absorbed by skin.
6. Convert Storage to Tankless Water Heater	Saves energy, is often quicker and more reliable.
7. Install Water Filtration Units at Faucets	Reduces contaminants in water.
8. Install On-Demand Hot Water Circulation Pump	Deliver hot water quicker to fixture, saving water and energy.

F. Electrical	
1. Install Compact Fluorescent Light Bulbs (CFLs)	Lowers energy bills and reduces need for energy production.
2. Install IC-AT Recessed Lighting Fixtures with CFLs	Saves energy and reduces the amount of heat loss/gain.
3. Install Lighting Controls	Reduces need for energy and lowers energy bills.
4. Install High Efficiency Ceiling Fans with CFLs	Reduces the need for air conditioning. Saves energy.

G. Appliances	
1. Install Energy Star® Dishwasher	Reduces water and energy use, and lowers utility bills.
2. Install Washing Machine with Water and Energy Conservation Features	Uses less water and energy than conventional top loading washers.
3. Install Energy Star® Refrigerator	Reduces energy and can save over 10% on utility bill.
4. Install Built-In Recycling Center	Makes it easy and convenient to recycle.

H. Insulation	
1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements	Lowers utility bills, improves comfort, decreases heating and cooling needs and makes home quieter.
2. Install Floor Insulation Over Crawl Space	Lowers utility bills, improves comfort.
3. Install Recycled-Content, Fiberglass Insulation with No Added Formaldehyde	Reduces indoor air quality problems due to formaldehyde binders, and can contain up to 30% recycled glass.
4. Use Advanced Infiltration Reduction Practices	Reduces drafts, and makes home more energy-efficient.
5. Use Cellulose Insulation	Increases energy-efficiency, uses recyclable materials, and contains no formaldehyde.
6. Install Alternative Insulation Materials	Uses recycled-content materials and provides superior air infiltration resistance.

I. Windows	BENEFITS
1. Install Energy-Efficient Windows	Increases energy-efficiency, and provides greater comfort.
2. Install Low SHGC Window Film on Single-Glazing	Reduces overheating, improves comforts and lowers the need for additional cooling.

J. Heating, Ventilation and Air Conditioning (HVAC)	
1. Use Duct Mastic on all Duct Joints	Improves indoor air quality, and keeps the homes more comfortable.
2. Install New Ductwork within Conditioned Space	Reduces energy loss and improves occupant comfort.
3. Vent Range Hood to the Outside	Improves indoor air quality.
4. Clean all Ducts Before Occupancy	Reduces dust around the house after occupancy.
5. Install Solar Attic Fan	Increases comfort and reduces air conditioning use.
6. Install Attic Ventilation Systems	Increases comfort and reduces air conditioning use.
7. Install Whole House Fan	Reduces electricity usage, and moves large volumes of air to achieve comfort at higher temperatures without air conditioning.
8. Install Sealed Combustion Furnaces and Hot Water Heaters	Improves indoor air quality, reduces the danger of carbon monoxide contamination.
9. Replace Wall-Mounted Electric and Gas Heaters	Reduces fire hazard, saves energy and improves indoor air quality.
10. Install 13 SEER and 11 EER or Higher Air Conditioning with a Thermostatic Expansion Valve (TXV)	Saves money and energy, and reduces peak load problems.
11. Install Air Conditioning with Non-HCFC Refrigerants	Reduces depletion of the ozone layer.
12. Install 90% Annual Fuel Utilization Efficiency (AFUE) Furnace	Reduces air emissions, costs less to operate, and saves natural resources.
13. Retrofit Wood Burning Fireplaces	Reduces drafts, pollutant particulate matter and the amount of heat taken from the home.
14. Install Zoned, Hydronic, Radiant Heating	Saves energy by only heating the zone that requires heat.
15. Install High Efficiency Filter	Makes living space healthier, and reduces microparticulates from the air.
16. Install Heat Recovery Ventilation Unit (HRV)	Improves indoor air quality and reduces energy.
17. Install Separate Garage Exhaust Fan	Creates healthier indoor environments.

K. Renewable Energy and Roofing	
1. Pre-Plumb for Solar Water Heating	Saves money should a solar system be installed in the future.
2. Install Solar Water Heating	Reduces the use of gas or electricity, and pay back in as little as seven years.
3. Pre-Wire for Future Photovoltaic (PV) Installation	Allows installation of PV system in the future.
4. Install Photovoltaic (PV) System	Decreases reliance on conventional power plants.
5. Select Safe and Durable Roofing Materials	Reduces landfill deposits and saves money on replacement costs.
6. Install Radiant Barrier	Keeps the whole home cooler by reducing heat build-up in attic spaces.

L. Natural Heating and Cooling	
1. Incorporate Passive Solar Heating	Reduces heating requirements by 30-50%, saves energy and money.
2. Install Overhangs or Awnings over South Facing Windows	Reduce heat gain, making the home more comfortable in summer.
3. Plant Deciduous Shade Trees on the West and South Sides	Reduce summer air-conditioning costs while providing numerous benefits to the environment.

M. Indoor Air Quality and Finishes	BENEFITS
1. Use Low/No-VOC Paint	Improves indoor air quality, reduces smog, and is healthier for installers and occupants.
2. Use Low VOC, Water-Based Wood Finishes	Reduces smog and is healthier for installers and occupants.
3. Use Low/No-VOC Adhesives	Improves indoor air quality, and are healthier for occupants and installers.
4. Use Salvaged Building Materials for Interior Finish	Keeps valuable resources out of landfill.
5. Use Engineered Sheet Goods with No Added Formaldehyde	Reduces exposure to formaldehyde, provides reuse of a former waste product.
6. Use Exterior Grade Plywood for Interior Uses	Reduces formaldehyde exposure to occupants.
7. Seal all Exposed Particleboard or MDF	Reduces exposure of harmful emissions to occupants.
8. Use FSC Certified Materials for Interior Finish	Assures the long-term availability of precious woods while protecting ancient, old-growth forests.
9. Use Finger-Jointed or Recycled-Content Trim	Uses material more efficiently, saves money and resources, and is straighter and more stable than conventional clear wood.
10. Install Whole House Vacuum System	Expels dust outside the house, improving indoor air quality.

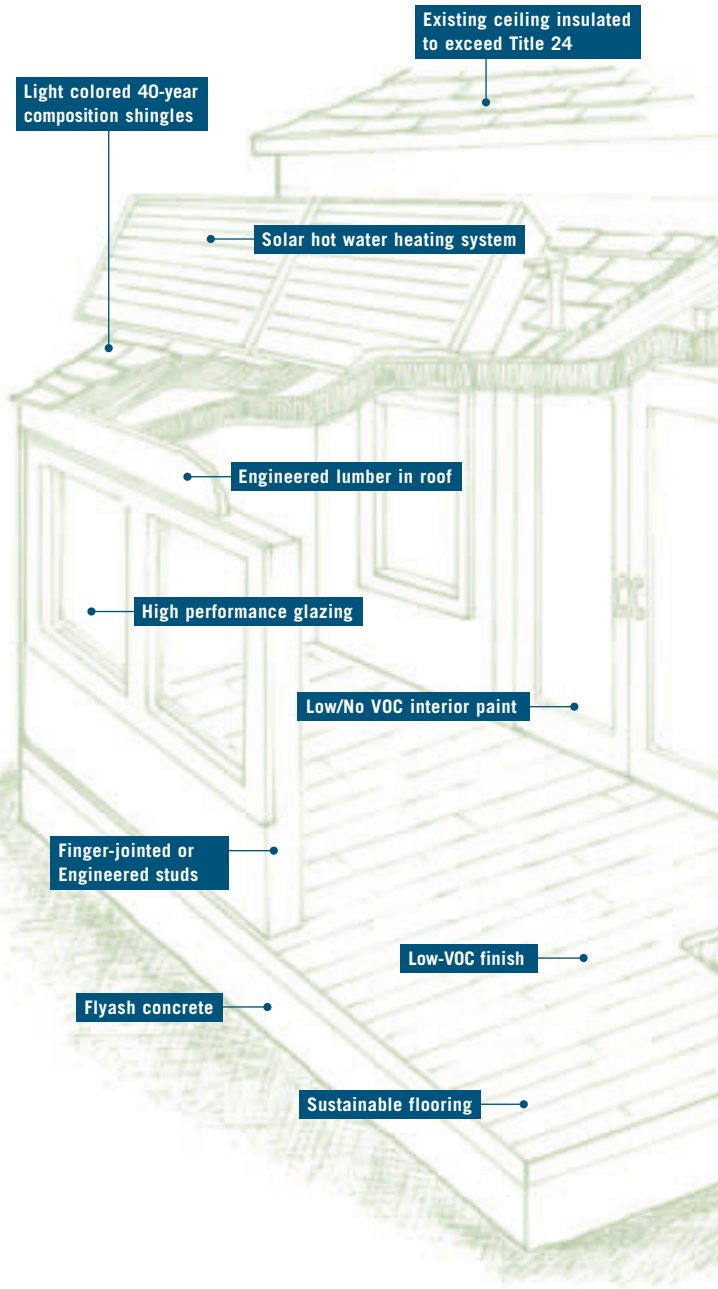
N. Flooring	
1. Select FSC Certified Wood Flooring	Assures the long-term availability of woods while protecting ancient, old-growth forests.
2. Use Rapidly Renewable Flooring Materials	Reduces demand for old-growth hardwood.
3. Use Recycled-Content Ceramic Tiles	Uses recycled-content materials and is easy to maintain.
4. Install Natural Linoleum in Place of Vinyl	Reduces exposure to toxins, is durable, and healthier for occupants and installers.
5. Use Exposed Concrete as Finished Floor	Eliminates the need for additional flooring materials, is easy to maintain, and very durable.
6. Install Recycled-Content Carpet with Low VOCs	Saves resources, diverts waste from landfills, is more resilient and colorfast than carpet made from virgin fibers.

Chapter Five:

Green Remodeling Illustrations

New Addition

Consider the following green remodeling options in a new addition.



Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Building Materials
- Design Resource-Efficient Landscapes and Gardens
- Provide for On-Site Water Catchment / Retention
- Remodel for Mixed Use, Adaptive Reuse, and Historic Preservation
- Install High Efficiency Irrigation Systems
- Reuse Materials or Use Recycled-Content Materials for Landscape Areas
- Protect Native Soil
- Minimize Disruption of Existing Plants and Trees
- Implement Construction Site Stormwater Practices

Foundation

- Incorporate Recycled Flyash in Concrete
- Use Recycled-Content Aggregate for Backfill Drainage
- Insulate Foundation Before Backfill

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, Engineered or Steel Studs for Vertical Applications
- Use Reclaimed Lumber
- Use Web Floor Trusses
- Design Energy Heels on Roof Trusses 6" or More
- Apply Advanced Framing Techniques

Exterior Finish

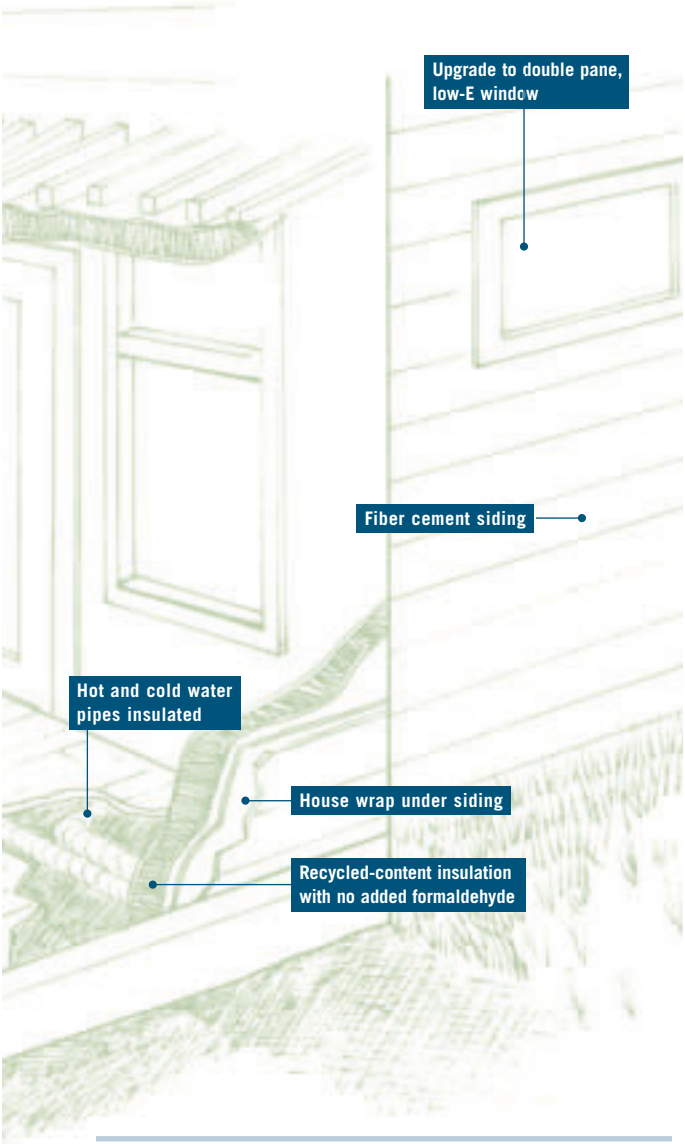
- Use Sustainable Decking Materials
- Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- Use Fiber-Cement Siding Materials
- Install House Wrap Under Siding

Plumbing

- Install Hot Water Jacket Insulation
- Convert Storage to Tankless Water Heaters
- Insulate Hot and Cold Water Pipes
- Retrofit all Faucets and Showerheads with Flow Reducers
- Replace Toilets with Ultra-Low-Flow Models
- Install Chlorine Filter on Showerhead
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

Electrical

- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install High Efficiency Ceiling Fans with CFLs
- Install Insulation-Compatible, Air-Tight Recessed Lighting Fixtures with CFLs



Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled-Content Fiberglass Insulation with No Added Formaldehyde
- Use Advanced Infiltration Reduction Practices
- Use Cellulose Insulation
- Install Floor Insulation Over Crawl Space

Windows

- Install Energy-Efficient Windows
- Install Low Solar Heat Gain Coefficient Window Film on Single-Glazing

Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Install New Ductwork within Conditioned Space
- Install 90% or Greater Efficiency Gas Forced Air Furnace
- Install Attic Ventilation Systems or Solar Attic Fan
- Clean all Ducts Before Occupancy
- Install Whole House Fan
- Replace Wall-Mounted Electric and Gas Heaters with Heat Pumps
- Install Zoned, Hydronic, Radiant Heating
- Retrofit Wood Burning Fireplaces
- Install Heat Recovery Ventilation Unit (HRV)
- Install High Efficiency Filter
- Install 13 SEER and 11 EER (or higher) Air Conditioning with Non HCFC Refrigerant with a TXV
- Install Sealed Combustion Units

Renewable and Solar Energy

- Pre-Plumb or Install Solar Water Heating System
- Pre-Wire or Install Photovoltaic (PV) System
- Install Radiant Barrier
- Select Safe and Durable Roofing Materials

Natural Heating and Cooling

- Incorporate Passive Solar Heating
- Install Overhangs or Awnings over South Facing Windows
- Plant Deciduous Shade Trees over the West and South Sides

Indoor Air Quality / Finishes

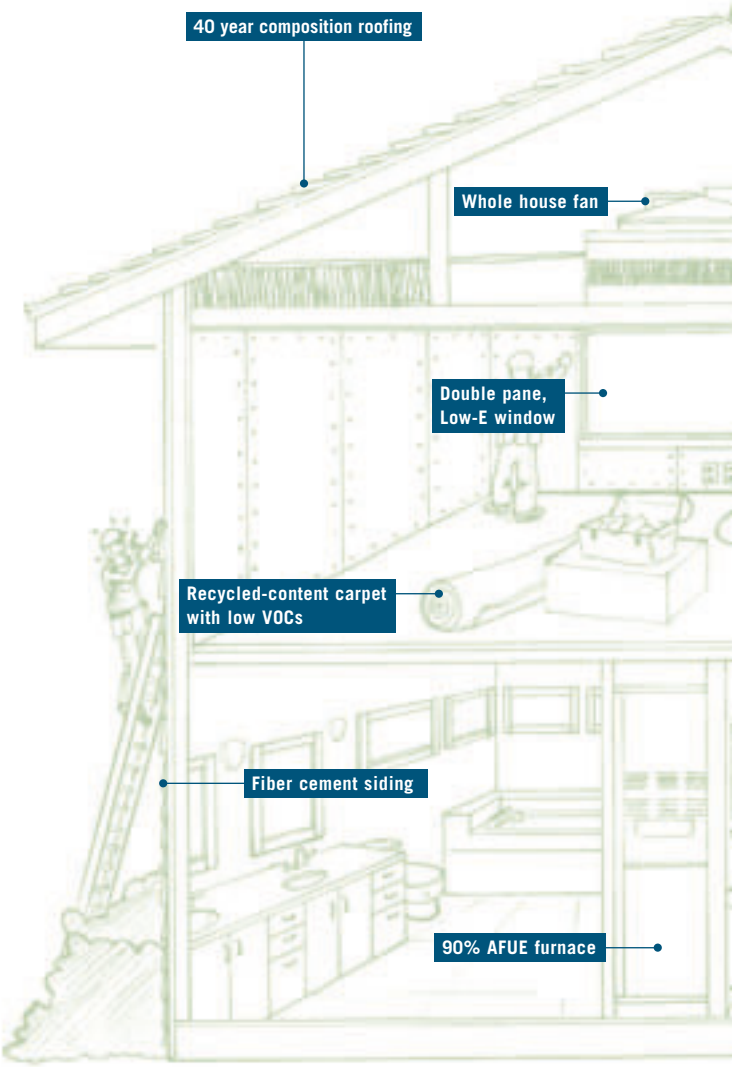
- Use Low/No-VOC Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Low/No VOC Adhesives
- Use Exterior Grade Plywood for Interior Uses
- Use FSC Certified Materials for Interior Finish
- Seal all Exposed Particleboard or MDF
- Use Finger Jointed or Recycled-Content Trim
- Use Salvaged Building Materials for Interior Finish
- Use Engineered Sheet Goods with No Added Formaldehyde
- Install Whole House Vacuum System

Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled-Content Ceramic Tile
- Install Natural Linoleum in Place of Vinyl
- Use Exposed Concrete as Finished Floor
- Install Recycled-Content Carpet with low VOCs

Second Floor

Consider the following green remodeling options in a second floor.



Site

- Recycle Job Site Construction and Demolition Waste
- Salvage Reusable Building Materials
- Implement Construction Site Stormwater Practices

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, Engineered or Steel Studs for Vertical Applications
- Use Web Floor Trusses
- Design Energy Heels on Roof Trusses 6" or More
- Apply Advanced Framing Techniques

Exterior Finish

- Use Treated Wood that Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- Use Fiber-Cement Siding Materials
- Install House Wrap Under Siding

Plumbing

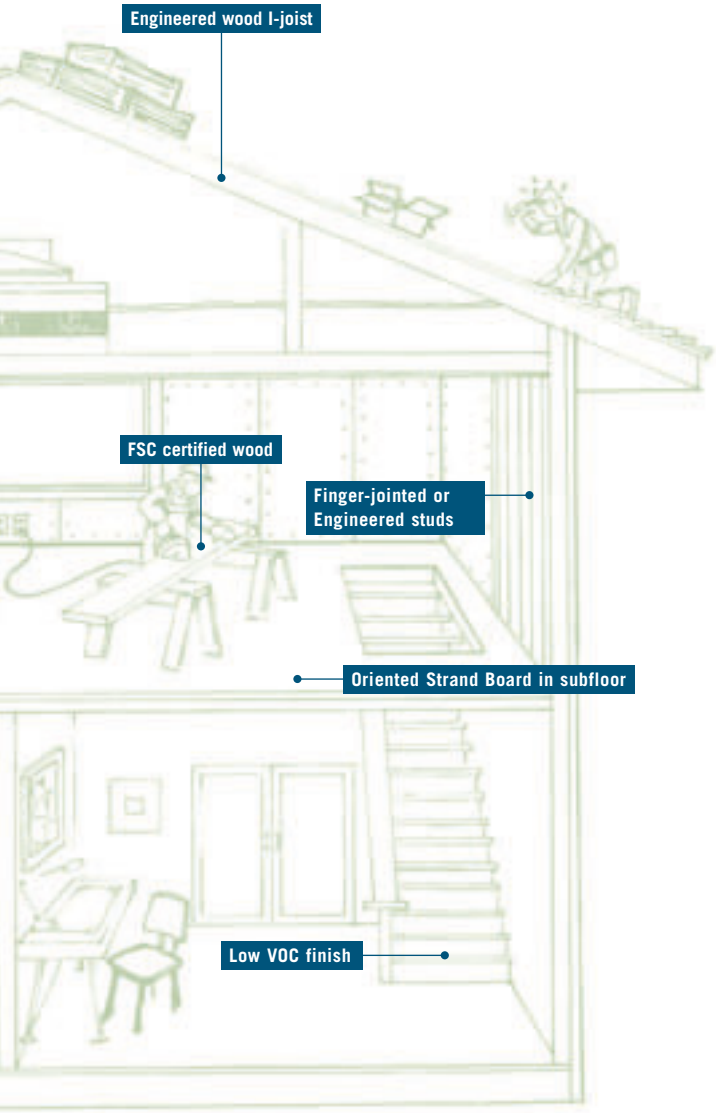
- Insulate Hot and Cold Water Pipes
- Install Chlorine Filter on Showerhead
- Install Water Filtration Units at Faucets
- Install On-Demand Hot Water Circulation Pump

Electrical

- Install Compact Fluorescent Light Bulbs (CFLs)
- Install Lighting Controls
- Install High Efficiency Ceiling Fans with CFLs
- Install Insulation-Compatible, Air-Tight Recessed Lighting Fixtures with CFLs

Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled-Content Fiberglass Insulation with No Added Formaldehyde
- Use Cellulose and Other Alternative Insulation
- Install Floor Insulation Over Crawl Space



Heating, Ventilation and Air Conditioning (HVAC)

- Use Duct Mastic on all Duct Joints
- Install New Ductwork within Conditioned Space
- 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 Filter
- Install 13 SEER and 11 EER (or higher) Air Conditioning with Non HCFC Refrigerant with a TXV
- Install Sealed Combustion Units
- Install Attic Ventilation Systems or Solar Attic Fan

Renewable Energy and Roofing

- Install Radiant Barrier
- Pre-Wire or Install Photovoltaic (PV) System
- Select Safe and Durable Roofing Materials

Natural Heating and Cooling

- Incorporate Passive Solar Heating
- Install Overhangs or Awnings over South Facing Windows

Indoor Air Quality / Finishes

- Use Low/No-VOC Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Low/No VOC Adhesives
- Use Exterior Grade Plywood for Interior Uses
- Use FSC Certified Materials for Interior Finish
- Seal all Exposed Particleboard or MDF
- Using Finger Jointed or Recycled-Content Trim
- Using Engineered Sheet Goods with No Added Formaldehyde

Flooring

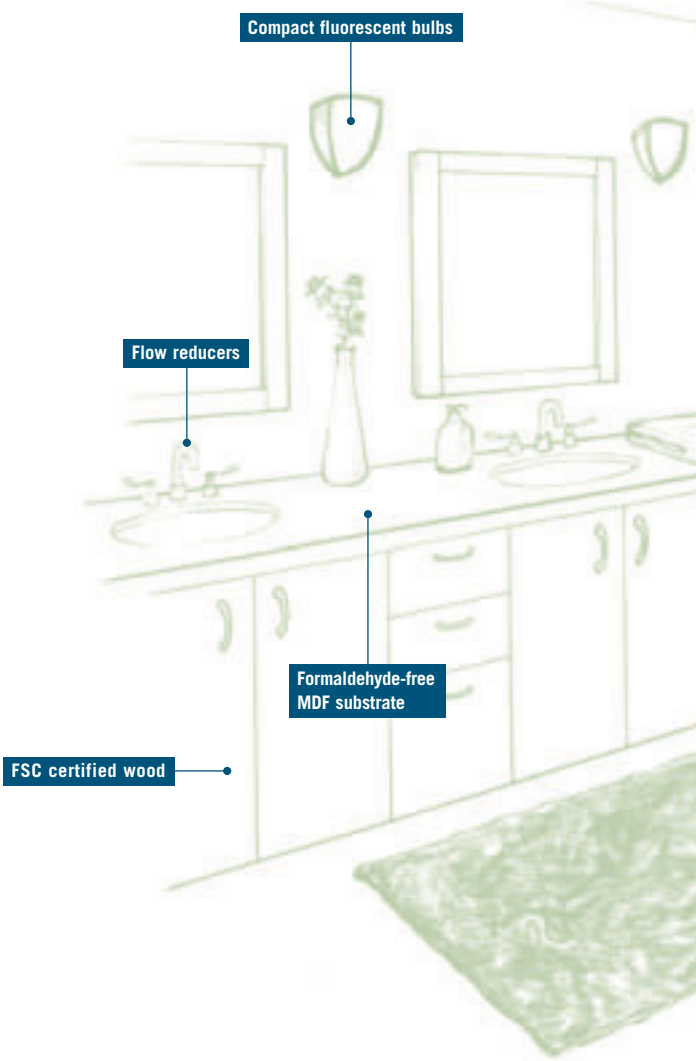
- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled-Content Ceramic Tile
- Install Natural Linoleum in Place of Vinyl
- Install Recycled-Content Carpet with low VOCs

Windows

- Install Energy-Efficient Windows
- Install Low Solar Heat Gain Coefficient Window Film on Single-Glazing

Bathroom

Consider the following green remodeling options in a bathroom.



Site

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- Salvage Reusable Materials

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- Use Wood I-Joists for Floors and Ceilings
- Use OSB for Subfloor and Sheathing
- Use Finger-Jointed, Engineered or Steel Studs for Vertical Applications
- Apply Advanced Framing Techniques

Plumbing

- Install Water Heater Jacket
- Convert Storage to Tankless Hot Water Heaters
- Insulate Hot and Cold Water Pipes
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- Replace Toilets with Ultra-Low-Flow Models
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Electrical

- Install Compact Fluorescent Light Bulbs
- Install Lighting Controls
- Install High Efficiency Ceiling Fans with CFLs
- Install Insulation-Compatible, Air-Tight Recessed Lighting Fixtures

Insulation

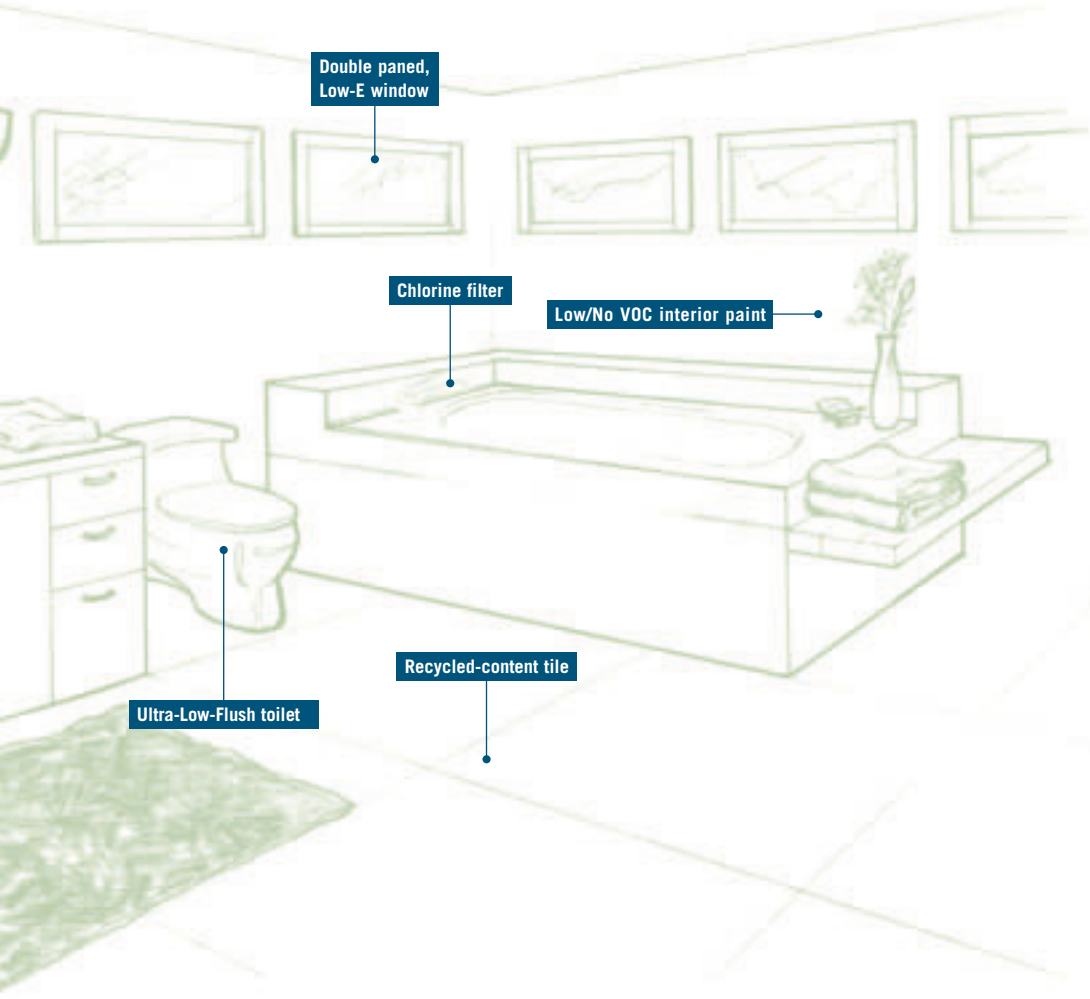
- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements
- Install Recycled-Content Fiberglass Insulation with No Added Formaldehyde
- Use Advanced Infiltration Reduction Practices
- Use Cellulose and Other Alternative Insulation
- Install Floor Insulation Over Crawl Space

Windows

- Install Energy-Efficient Windows
- Install Low Solar Heat Gain Coefficient Window Film on Single-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
- Install Sealed Combustion Units
- Install High Efficiency Filter



Indoor Air Quality / Finishes

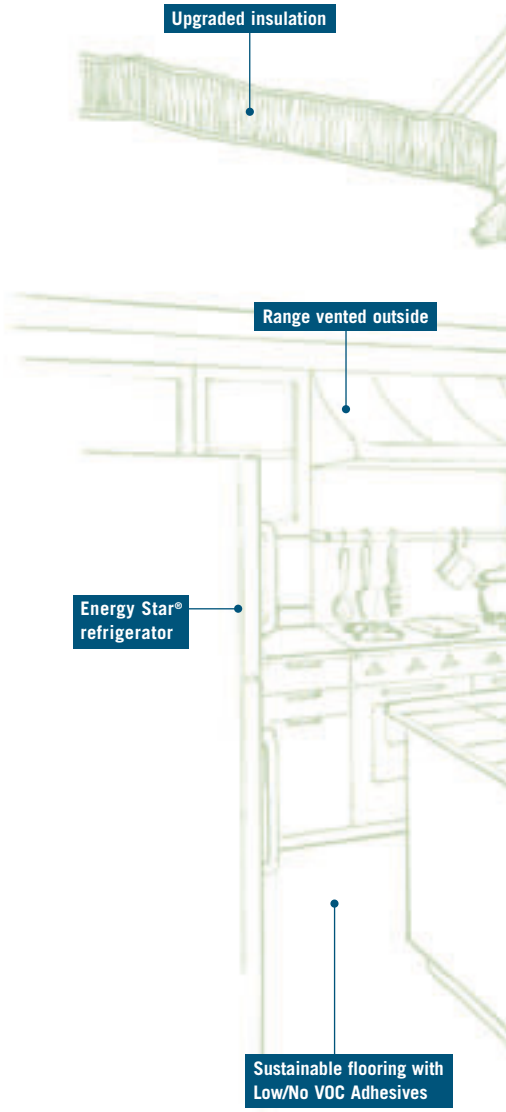
- Use Low/ No-VOC and Formaldehyde-Free Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Low/No VOC Adhesives
- Use Exterior Grade Plywood for Interior Uses
- Use FSC Certified Materials for Interior Finish
- Seal all Exposed Particleboard or MDF
- Using Finger Jointed or Recycled-Content Trim
- Use Salvaged Building Materials for Interior Finish
- Use Engineered Sheet Goods with No Added Formaldehyde

Flooring

- Use Recycled-Content Ceramic Tile
- Install Natural Linoleum in Place of Vinyl
- Use Exposed Concrete as Finished Floor
- Install Recycled-Content Carpet with Low VOCs

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 High Efficiency Ceiling Fans with CFLs
- Install Insulation-Compatible, Air-Tight Recessed Lighting Fixtures

Appliances

- Install Energy Star® Dishwasher
- Install Washing Machine with Water and Energy Conservation Features
- Install Energy Star® Refrigerator
- Install Built-In Recycling Center

Insulation

- Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirement
- Install Recycled-Content Fiberglass Insulation with No Added Formaldehyde
- Use Advanced Infiltration Reduction Practices
- Use Cellulose and Other Alternative Insulation
- Install Floor Insulation Over Crawl Space

Windows

- Install Energy-Efficient Windows
- Install Low Solar Heat Gain Coefficient Window Film on Single-Glazing

Heating, Ventilation and Air Conditioning (HVAC)

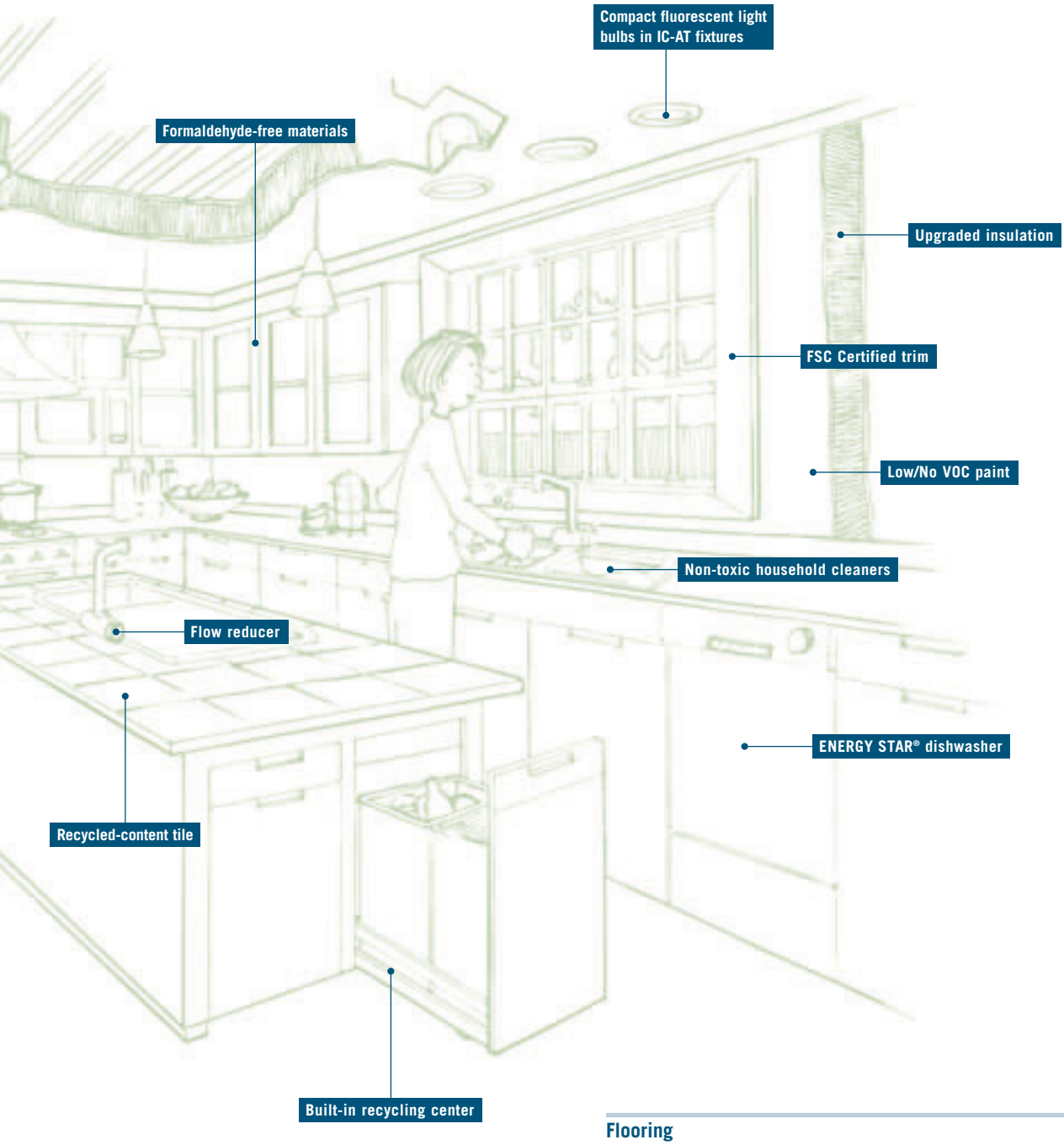
- Use Duct Mastic on all Duct Joints
- Vent Range Hood to the Outside
- Install Sealed Combustion Units
- Install High Efficiency Filter

Natural Heating and Cooling

- Install Overhangs or Awnings over South Facing Windows
- Plant Deciduous Shade Trees on the West and South Sides

Indoor Air Quality / Finishes

- Use Low/No-VOC Paint
- Use Low VOC, Water-Based Wood Finishes
- Use Low/No VOC Adhesives
- Use Exterior Grade Plywood for Interior Uses
- Use FSC Certified Materials for Interior Finish
- Seal all Exposed Particleboard or MDF
- Using Finger Jointed or Recycled-Content Trim
- Use Salvaged Building Materials for Interior Finish
- Use Engineered Sheet Goods with No Added Formaldehyde



Flooring

- Select FSC Certified Wood Flooring
- Use Rapidly Renewable Flooring Materials
- Use Recycled-Content Ceramic Tile
- Install Natural Linoleum in Place of Vinyl
- Use Exposed Concrete as Finished Floor

Notes