

NEW HOME CONSTRUCTION

GREEN BUILDING GUIDELINES



NEW HOME CONSTRUCTION GREEN BUILDING GUIDELINES

These Green Building Guidelines are designed for the residential building industry

The Guidelines offer:

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

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

LOCAL RECYCLING AGENCIES

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

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

HOUSEHOLD HAZARDOUS WASTE FACILITIES

Serving Central County:

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

Serving East County:

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

Serving West County:

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

LOCAL WATER UTILITIES

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

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

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

Serving West County and portion of Central County:

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

Serving majority of Central County:

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

ENERGY UTILITY

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

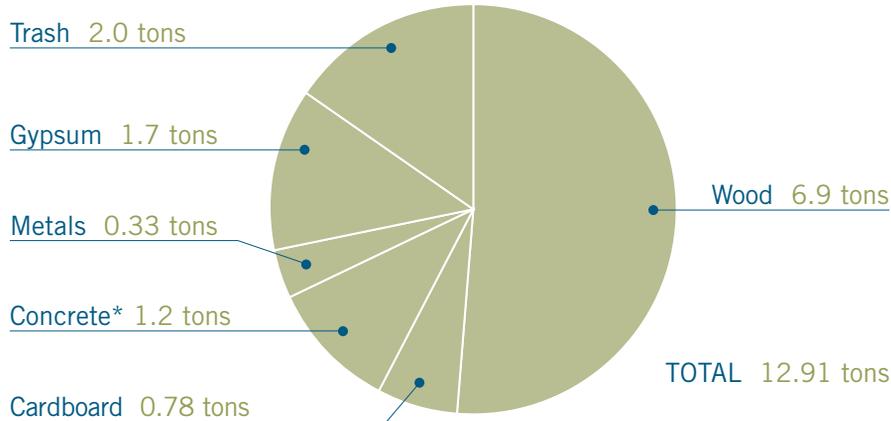
CONSTRUCTION & DEMOLITION RECYCLING

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

Reducing Construction and Demolition Waste

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

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



* Concrete figure includes waste generated by sidewalk pour.

Acknowledgements

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

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Disclaimer

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

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

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Chapter One:

Overview of Green Building

Overarching Principles of Green Building

1

Build for the long-term
Build a home to last at least 50 years.

2

Build for our children
Make their environment safe.

3

Build for the planet
Use materials from sustainable resources.

Introduction

Across the country, in response to buyer demand, homebuilders are constructing homes that are more energy-efficient, healthier and more durable – better known as “green building.” Builders are changing the way they design and build, while enjoying increased market share and faster sales.

About Green Building

Green building is a whole systems approach to the design, construction and operation of buildings – from the early stages of development through the final finishes in the home. This approach benefits both builders and homeowners by reducing resource consumption and improving livability.

Green building benefits are spread throughout the systems and features of the home. Green buildings use recycled-content building materials, consume less energy and water, have better indoor air quality and use much less wood fiber than conventional homes. Green homes reduce potentially carcinogenic volatile organic compounds and formaldehyde from the interior, and construction waste is often recycled and remanufactured into other building products.

Every builder struggles for market differentiation. Building green is a practical way to address issues buyers really care about. A green building dimension to your business adds a strong selling point. Building green is good for both the economy and the environment.

In response to growing interest in green building, a variety of public and private entities, including homebuilder associations and state and local governments, are creating partnerships to help build and sell green homes and communities. These efforts help market the benefits of green building and recognize builders who are constructing healthier, more durable homes.

Homebuyers increasingly see the added value in a green home. For some, it's energy savings and lower utility bills. For others, it's saving old-growth forests. For still others, it's knowing that their home is a healthier place for their children.

These *Green Building Guidelines* were developed to bring technical and marketing expertise to Alameda County builders. The Guidelines are the result of a collaboration among developers, builders, purchasing agents, sales staff, architects, building officials, green building experts, and staff of the Alameda County Waste Management Authority and Recycling Board. The expertise of these diverse stakeholders is reflected through a focus on practices and approaches that are most relevant to Alameda County.

Fundamental Objectives of Green Building

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.

Builders 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, builders can take advantage of a new generation of high-efficiency appliances and landscape water management systems.

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 reduce the potential of energy supply interruptions, 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 homeowners to enjoy the financial benefits year after year.

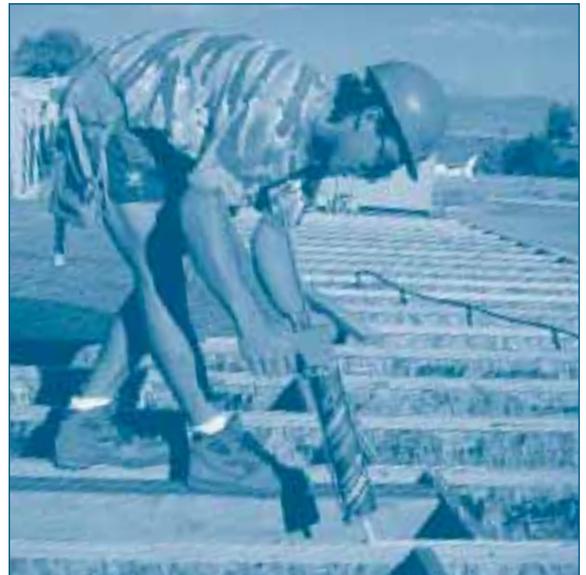
The first steps to increase energy efficiency are to add insulation wherever possible, install double-glazed/low-E windows and upgrade to high-efficiency appliances. Other energy upgrades include installing solar water heaters and photovoltaic panels.

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 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.

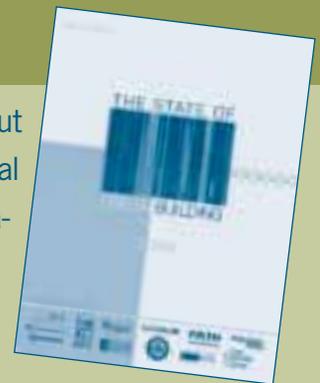
The building products industry has responded to these indoor pollution problems by developing alternative paint, finish, and adhesive products. For example, solvent-free adhesives used in flooring and countertops can eliminate many of the suspected and known human carcinogens. Paints, varnishes, and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



Using Solvent-Free Adhesives

Survey says...

The State of Green Building Survey, 2000 is quoted throughout the Guidelines. The survey was developed by Cahners Residential Group who partnered with industry manufacturers and associations in a first-of-its-kind, online green building survey aimed at consumers and builders. Posted at www.housingzone.com, web browsers were pointed to the survey from several major websites including Yahoo!, NAHB.com, and CNN. Consumers were asked more than 20 questions on green building while homebuilders completed 50 questions.



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 benefits the environment by addressing: resource conservation, energy efficiency and indoor air quality.

Cost Considerations

In the Survey, consumers were asked how much they were willing to pay for green options. Responses were:

WILLING TO PAY	% OF RESPONDENTS
up to \$10,000	19.5%
up to \$5,000	35.9%
up to \$2,500	31.8%
up to \$1,000	11.4%
up to \$500	1.4%

Prospective buyers are willing to put their money where their values are.

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

When green building is designed into the project from the beginning it need not cost more than conventional methods. Often, the homeowner and builder focus on the “up-front” costs (materials and installation) to incorporate green features into a home. When other factors are considered, such as lower maintenance and operation costs, many of the recommended strategies in these Guidelines offer tangible economic benefits to the homeowner. Energy upgrades alone usually result in a payback through lower monthly energy costs.

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



Chapter Two:

How to Start Building Green

Building green means new ways of thinking about common building practices. Generally, it is best to build from your existing market base, adding green features as the market evolves and matures. If you start gradually, you are less likely to make expensive mistakes. It is critical to carefully consider the changes you make and the additional costs you might incur. The earlier you start integrating alternative products and green design into your building process, the less it may cost you and the consumer in the long run.

How to Start Building Green

Getting Started

A strategic way to start building green is to develop various green options, describing environmental features and benefits to the homebuyer. Giving your customers a choice allows you to refine your product and market approach. Home buyers speak their own language, and understand and embrace green building only when it is explained in their terms. Energy efficiency, improved indoor air quality, water conservation and saving old-growth forests are terms that may have different meanings to different buyers. All these things together mean a new home that offers more value and a more comfortable and healthier living environment.

Knowing about the benefits of resource-efficient construction is one thing; spending money for those same features is quite another. According to the Survey, consumers were asked to choose their three most important upgrades when buying a new home. In top-down order, responses were:



When consumers were asked what are their three most important environmental issues, responses were:



When consumers think about a new home, they think about what it offers them, not necessarily what it does for the environment. Quality always rates highest next to location when buyers buy new homes. Green homes offer higher quality since most products were developed to perform better than the conventional products they replace.

The Guidelines and accompanying resources will assist you in developing and implementing green building packages into your building projects. What makes a home truly green is a combination of all of the features listed in the Guidelines. In this way, the home combines the collected benefits of resource conservation, energy efficiency and good indoor air quality. Offering segregated packages is a starting point to help clarify what your market is most interested in, so you can make the most appropriate incremental steps toward a truly green home.

Pleasant Hill CoHousing Common House, Pleasant Hill, CA



Green Building Packages

Below are samples of the types of “Green Building Packages” that could be developed to respond to consumer demands for green homes.

Natural Resource Package

Natural resource conservation is becoming more important to buyers every year. Saving forests for camping, fishing and hiking is a value that families hold for their children’s future. Conserving resources today by incorporating green alternatives is a great way to get your buyer’s attention. Using recycled content products in your homes “closes the loop” for families that are committed to recycling. Using water more efficiently only makes sense as population growth puts stress on a limited resource.

Consider offering the following as part of a Natural Resource Package:

- Engineered lumber – OSB, wood I-joists
- Recycled newsprint cellulose insulation
- Water-conserving plumbing fixtures
- Fiber-cement siding and trim
- Recycled-content decking
- Recycled-content carpet
- Treated wood that does not contain arsenic or chromium

Energy Efficiency Package

Energy upgrades are one of the first things that consumers would pay extra for – up to \$3000 – if they could expect to see a payback through lower monthly energy costs in two to three years. According to the Survey, only 2% of the homebuyers said they would not be willing to pay more in up-front costs for energy efficiency upgrades that would reduce monthly utility bills. 93% said that insulation should be above code as a standard feature of new homes.

Consider offering the following as part of an Energy Efficiency Package:

- Insulated foundation
- 2x6 wall framing with increased insulation
- Advanced sealing and caulking to reduce drafts
- Low-E windows
- High efficiency, sealed combustion furnace and hot water heater
- Fluorescent light bulbs

Indoor Air Quality Package

While energy efficiency is at the top of the consumer list, it is only the tip of their interests. Improved indoor air quality is also among the top three priorities for home buyers. 89% of those surveyed are aware that certain building materials emit chemicals into the living environment. 45% said that it was very important to live in a home free of toxic chemicals inside. Many of these substitutions are healthier for your trade contractors and employees as well.

Consider offering the following as part of an Indoor Air Quality Package:

- Less-toxic adhesives
- No-VOC paints
- Water-based wood floor finishes
- Natural linoleum upgrade from vinyl flooring
- FSC-certified wood or bamboo flooring instead of carpet
- Limited use or sealing of particleboard in cabinets and countertops

Chapter Three:

Green Building Checklist

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

Green Building Checklist

A. Community Design Issues

- 1. Orient Homes on East / West Axis for Solar Access
- 2. Orient Living Rooms and Porches to Streets and Public Spaces
- 3. Build Mixed-Use, Residential/Commercial, Walkable Communities
- 4. Design for Diverse Family Types
- 5. Provide "Granny Flats" Above Garages
- 6. Build Within 1 Mile of Public Transit Hub
- 7. Minimize Street Widths

B. Site

- 1. Recycle Job Site Construction and Demolition Waste 
- 2. Donate Unused Materials 
- 3. Install Drip Irrigation 
- 4. Minimize Disruption of Existing Plants and Trees
- 5. Incorporate Permeable Paving
- 6. Design Resource-Efficient Landscapes and Gardens 
- 7. Provide for On-Site Water Catchment / Retention

C. Foundation

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

D. Structural Frame

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

E. Exterior Finish

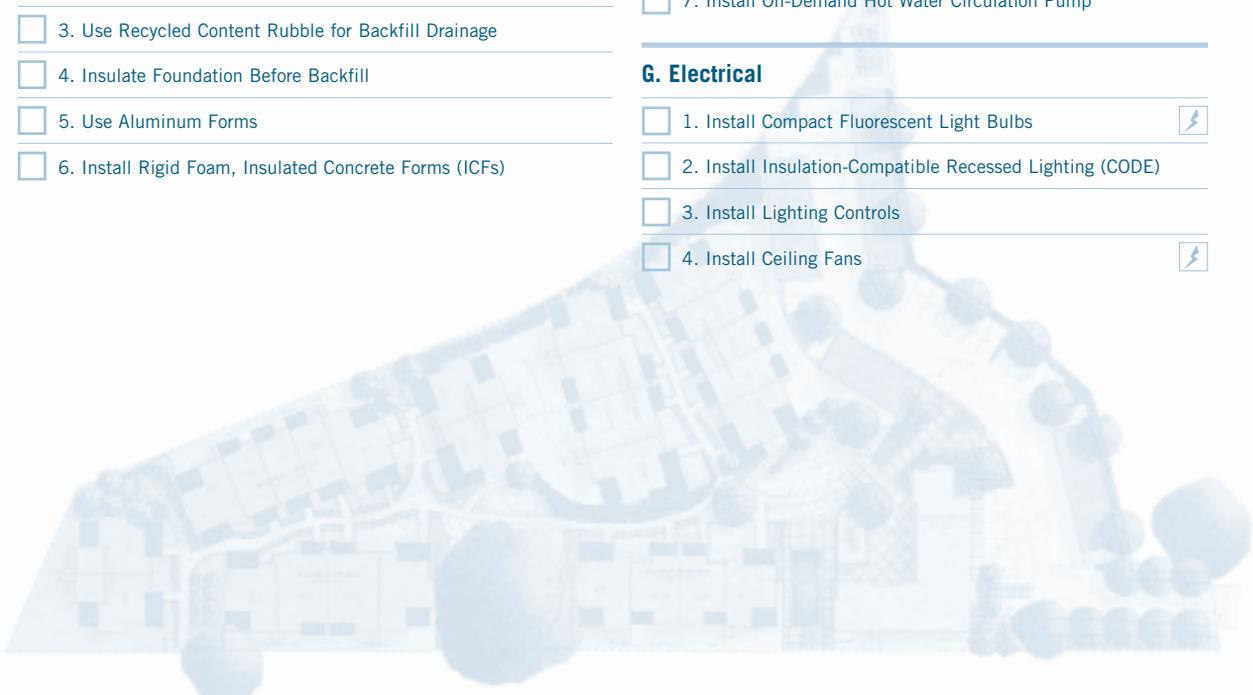
- 1. Use Sustainable Decking Materials
- 2. Use Treated Wood That Does Not Contain Chromium or Arsenic for Decking and Sill Plates
- 3. Use Alternative Siding Materials

F. Plumbing

- 1. Insulate Hot and Cold Water Pipes
- 2. Install Flow Reducers in Faucets and Showerheads 
- 3. Install Chlorine Filter on Showerhead 
- 4. Install Tankless Water Heaters
- 5. Pre-Plumb for Graywater Conversion 
- 6. Install Water Filtration Units at Faucets
- 7. Install On-Demand Hot Water Circulation Pump

G. Electrical

- 1. Install Compact Fluorescent Light Bulbs 
- 2. Install Insulation-Compatible Recessed Lighting (CODE)
- 3. Install Lighting Controls
- 4. Install Ceiling Fans 



H. Appliances

- 1. Offer ENERGY STAR® Dishwasher 
- 2. Offer Horizontal Axis Washing Machine 
- 3. Offer Energy-Efficient Refrigerator 

I. Roofing

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

J. Insulation

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

K. Windows

- 1. Install Energy-Efficient Windows 

L. Heating, Ventilation and Air Conditioning (HVAC)

- 1. Use Duct Mastic on all Duct Joints (CODE)
- 2. Install Ductwork within Conditioned Space
- 3. Vent Range Hood to the Outside
- 4. Clean all Ducts Before Occupancy
- 5. Install Attic Ventilation Systems
- 6. Install Whole House Fan
- 7. Install 13 SEER or Higher AC 
- 8. Install 90% or Greater Efficiency Gas Forced Air Furnace 
- 9. Eliminate Wood Burning Fireplaces
- 10. Install Zoned, Hydronic, Radiant Heating
- 11. Install High Efficiency Particulate Air (HEPA) Filter
- 12. Install Heat Recovery Ventilation Unit (HRV)
- 13. Install Separate Garage Exhaust Fan

M. Renewable and Solar Energy

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

N. Indoor Air Quality / Finishes

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

O. Flooring

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

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

Chapter Four:

Green Building Methods and Materials

Every green feature listed in the Guidelines benefits the builder, homebuyer and the environment. The following lists each feature, describes the conditions under which it should be used, and the benefits. Identify the feature you have included in your homes and combine the benefits from the text to develop your sales story.

A. Community Design Issues

Community Design Issues

The following measures should be considered in the initial site planning and community design stages of new home developments. By considering issues such as lot orientation, storm-water management, access to transit, and minimizing street widths early on, many environmental benefits can be accrued at later stages of the project.

The following is a list of approaches that should be considered in the first stages of community design:

- 1. Orient Homes on an East/West Axis for Solar Access**
- 2. Orient Living Rooms and Porches to Streets and Public Spaces**
- 3. Build Mixed-Use, Residential/Commercial, Walkable Communities**
- 4. Design for Diverse Family Types**
- 5. Provide “Granny Flats” Above Garages**
- 6. Build Within 1 Mile of Public Transit Hub**
- 7. Minimize Street Widths**



Sacramento Street CoHousing, Berkeley, CA

B. Site

1. Recycle Job Site Construction and Demolition Waste

Description:

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

Application:

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

Benefit:

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

2. Donate Unused Materials

Description:

Unused or salvaged materials such as surplus wood, windows, doors and other uninstalled materials can be donated to organizations such as Habitat for Humanity or local Youth Build Programs.

Applications:

Materials should be clean and in good condition.

Benefit:

Donating unused materials reduces landfill deposits and helps local charitable organizations. Donations may be tax deductible. Refer to the Resource List for local organizations.

3. Install Drip Irrigation

Description:

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

Application:

Install drip irrigation systems in place of standard sprinkler systems for all landscape applications except turf.

Benefit:

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

4. Minimize Disruption of Existing Plants and Trees

Description:

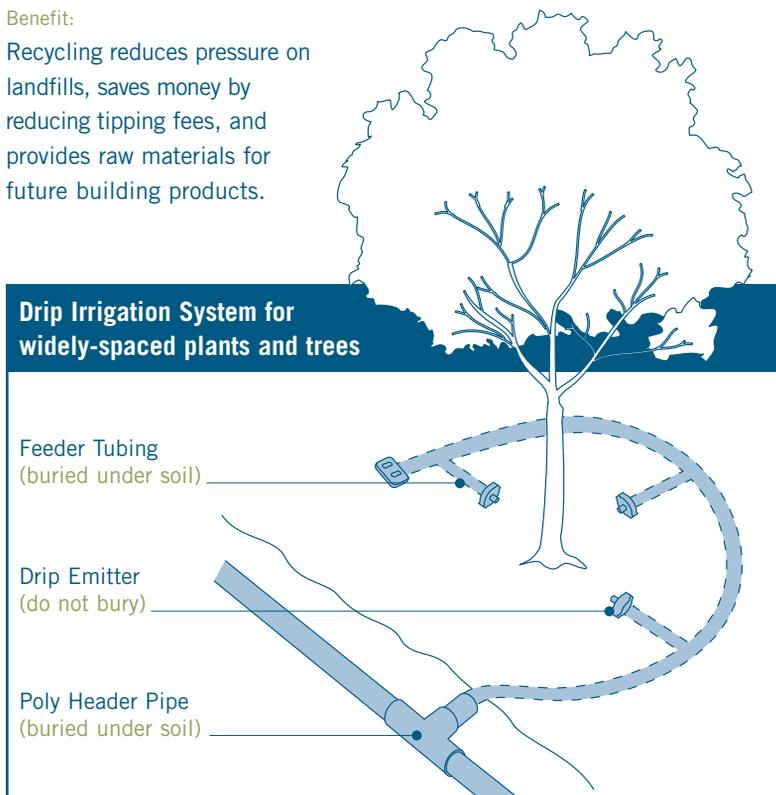
Through careful planning and construction practices, valuable trees and plants can be preserved and incorporated into new developments and neighborhoods.

Applications:

A landscape survey should be completed to determine the feasibility of preserving or relocating mature trees and shrubs.

Benefits:

Preserving existing, mature landscape features helps prevent soil erosion, maintains existing sources of natural cooling, diverts waste from landfills, and adds a unique character to the community.



5. Incorporate Permeable Paving

Description:

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

Application:

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

Benefit:

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

6. Design Resource-Efficient Landscapes and Gardens

Description:

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

Application:

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

Benefit:

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



Resource-Efficient Garden

7. 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.



Job Site Recycling,
Foothill Glen Housing,
Union City, CA

C. Foundation

1. Incorporate Recycled Flyash in Concrete

Description:

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

Application:

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

Benefit:

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

2. Reuse Form Boards

Description:

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

Application:

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

Benefit:

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

3. Use Recycled Content Rubble for Backfill Drainage

Description:

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

Application:

Use recycled materials for foundation backfill.

Benefit:

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



5. Use Aluminum Forms

Description:

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

Application:

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

Benefit:

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



Insulated Concrete Forms (ICFs)

4. Insulate Foundation Before Backfill

Description:

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

Application:

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

Benefit:

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

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

Description:

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

Application:

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

Benefit:

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

D. Structural Frame

1. Substitute Solid Sawn Lumber with Engineered Lumber

Description:

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

Application:

A. Floor Joist

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

B. Non-Load Bearing Header

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

C. Structural Headers and Beams

Engineered lumber should be used whenever structural members are required. They substitute for 4x12 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 where solid wood framing is required. Certified framing materials and plywood are available at many local suppliers. Refer to the Resource List located in back pocket.

Benefit:

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

3. Use Wood I-joists for Floors and Ceilings

Description:

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

Application:

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

Benefit:

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

Engineered Wood I-joist



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

Description:

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

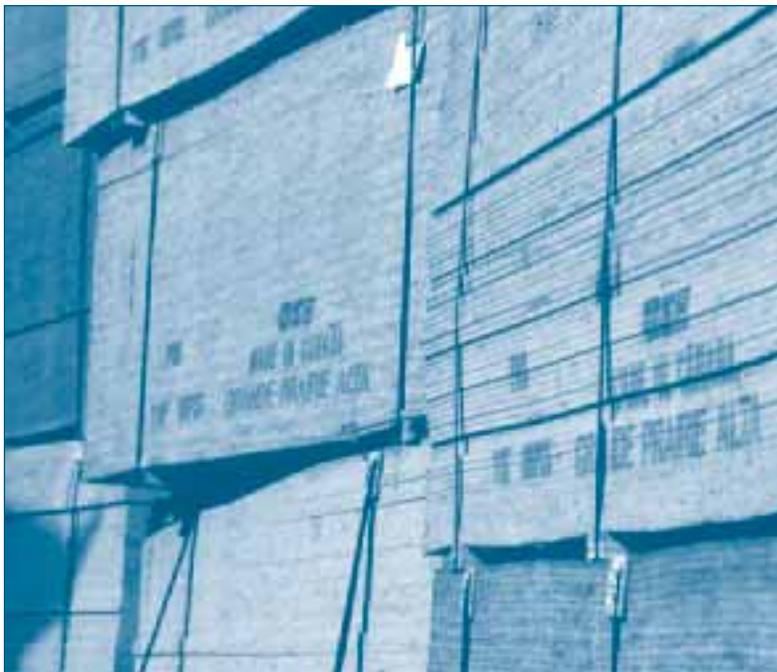
Application:

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

Benefit:

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

Oriented Strand Board



5. Use Finger-Jointed Studs

Description:

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

Application:

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

Benefit:

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

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

Description:

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

Application:

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

Benefit:

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

7. Use Reclaimed Lumber

Description:

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

Application:

Use reclaimed lumber for non-structural applications, in place of new material.

Benefit:

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

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

Application:

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

Benefit:

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



Recycled Content Decking

3. Use Alternative Siding Materials

A. Use Recycled Content Siding

Description:

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

Application:

Use hardboard where wood siding is installed.

Benefit:

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

B. Use Fiber-Cement Exterior Siding

Description:

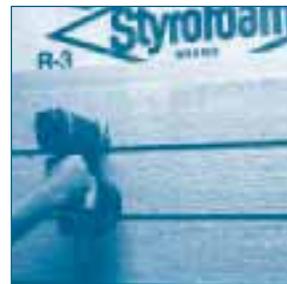
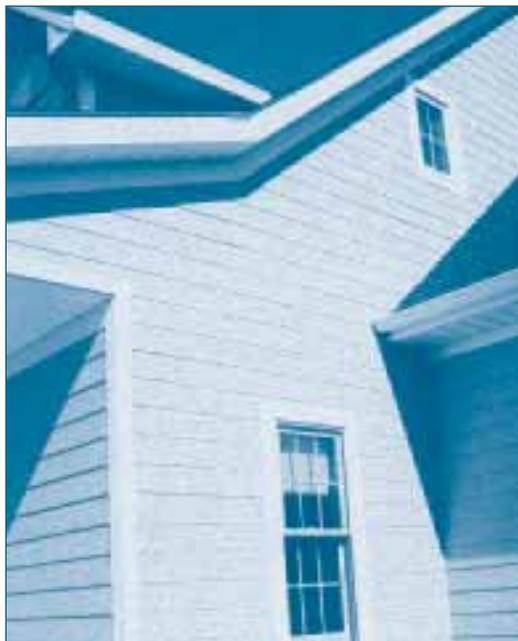
Fiber-cement siding is composed of cement, sand and cellulose fibers. It is available in shingles, planks or 4x8, 4x9 and 4x10 sheets. It is textured to look like wood siding or stucco finish.

Application:

Fiber-cement siding can be cut with a carbide or diamond-tipped saw blade, snapper shears or with a guillotine cutter. Dust protection and control are required when cutting with a circular saw.

Benefit:

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



Fiber-Cement Siding

F. Plumbing

1. 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.

2. Install Flow Reducers in Faucets and Showers

Description:

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

Application:

Use flow reducers on all faucets and showers that accept reducers.

Benefit:

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

3. Install Chlorine Filter on Showerhead

Description:

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

Application:

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

Benefit:

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

4. Install 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:

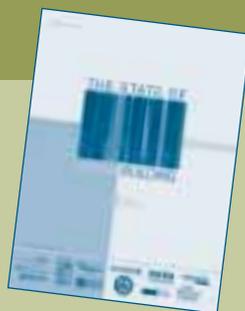
Install tankless water heater as close to the point of use as possible. The device should have a variable-set thermostat and be appropriately sized. Gas tankless water heaters typically have more capacity than electric tankless heaters.

Benefit:

Conventional 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.

Survey says...

In terms of resource conserving features, consumers' top choices were:



Water-saving washers and dishwashers	84%
Water-conserving faucets and fixtures	64%
Recycled content decking	63%
Engineered lumber	62%

5. Pre-Plumb for Graywater Conversion

Description:

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

Application:

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

Benefit:

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

6. Install Water Filtration Units at Faucets

Description:

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

Application:

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

Benefit:

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

7. 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.

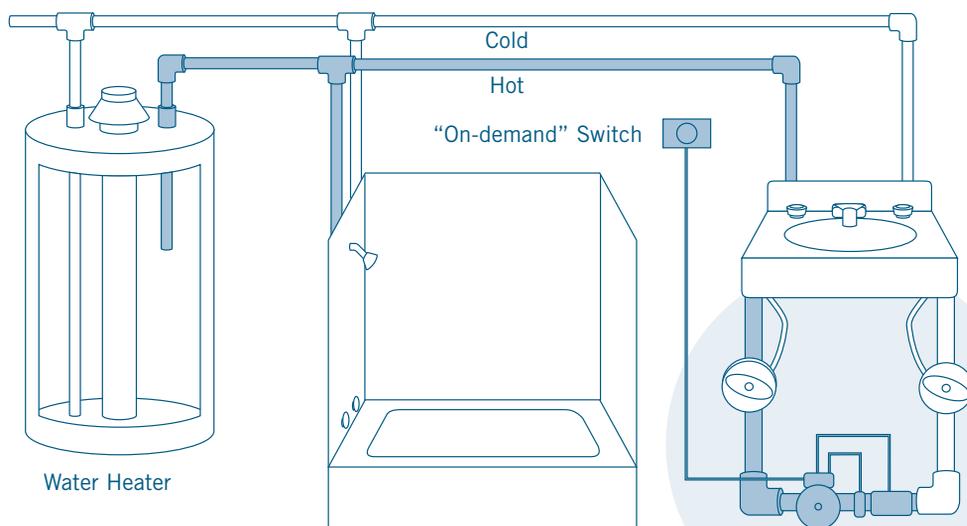
Application:

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



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

Benefit:

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

2. Install Insulation-Compatible (IC) Recessed Lighting Fixtures

Description:

Conventional recessed fixtures allow heat to be exhausted into the attic space. IC fixtures are sealed, allowing insulation to be blown on top to keep the heat in.

Applications:

Use IC fixtures in soffits and under insulated spaces.

Benefits:

Typical recessed fixtures lose heat as well as allow hot attic air to infiltrate into the house in summer months. IC fixtures dramatically reduce the amount of heat loss/gain through these openings.

3. Install Lighting Controls

Description:

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

Application:

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

Benefit:

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

4. Install Ceiling Fans

Description:

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

Application:

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

Benefit:

Ceiling fans can reduce the need for air conditioning and heating.

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 +

H. Appliances

1. Offer ENERGY STAR® Dishwasher

Description:

ENERGY STAR® dishwashers use water and energy more efficiently.

Application:

Select ENERGY STAR® dishwashers.

Benefit:

Water-efficient dishwashers are also energy-efficient because most energy consumed by dishwashers is used to heat water.

2. Offer Horizontal Axis Washing Machine

Description:

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

Application:

Select ENERGY STAR® horizontal axis 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.



Horizontal Axis Washing Machines

3. Offer Energy-Efficient Refrigerator

Description:

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

Application:

Select ENERGY STAR® rated refrigerators.

Benefit:

ENERGY STAR® refrigerators can save over 10% of the total annual electrical bill. Check with your local utility company for rebate programs.



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

I. Roofing

1. Select Light Colored Roofing

Description:

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

Application:

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

Benefit:

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

2. Select Safe and Durable Roofing Materials

Description:

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

Application:

Applicable anytime roofing material is specified.

Benefit:

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



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



J. 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:

Insulate walls and ceilings to exceed Title 24 standards by at least 15%

City/Community	Zone	City/Community	Zone
Alamo	12	Martinez	12
Antioch	12	Moraga	12
Bay Point	12	Mount Diablo	12
Bethel Island	12	Oakley	12
Blackhawk	12	Orinda	12
Brentwood	12	Pacheco	12
Briones Reservoir	12	Pinole	3
Byron	12	Pittsburg	12
Clayton	12	Pleasant Hill	12
Concord	12	Port Chicago	12
Crockett	12	Richmond	3
Danville	12	Rodeo	3
Diablo	12	Saint Mary's College	12
Discovery Bay	12	San Pablo	3
El Cerrito	3	San Ramon	12
El Sobrante	3	Tassajara	12
Hercules	3	Vine Hill	3
Knighten	12	Walnut Creek	12
Lafayette	12		

Contra Costa County encompasses two different climate zones (Zone 3 and 12) as identified by State of California Title 24 Building Code. Each zone has specific requirements as set forth in Title 24.

Survey says...



In terms of energy efficiency features, consumers have the following preferences:

Insulation above code	83%
High efficiency furnaces	83%
Passive solar features	76%
ENERGY STAR® Certification	61%

2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation

Description:

Many fiberglass insulation products include recycled glass, formaldehyde-free binders, non-asphalt adhesives or colored dyes.

Application:

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

Benefit:

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

3. Use Advanced Infiltration Reduction Practices

Description:

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

Application:

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

Benefit:

Reduction in infiltration increases comfort and reduces energy bills.

4. Use Cellulose Insulation

A. Walls

Description:

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

Application:

This installation is appropriate for new construction. Spray cellulose must be left for several days to dry before drywall is hung.

Benefit:

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

Spray Cellulose Insulation



B. Ceilings

Description:

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

Application:

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

Benefit:

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



K. 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 selecting windows, look for models with the following energy saving features:

A. Double-Paneled Windows

Description:

Double glazing insulates almost twice as well as single glazing.

Application:

Install double-paneled windows whenever possible.

Benefit:

High quality double-paneled 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-paneled 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-paneled windows.

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-paneled 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:

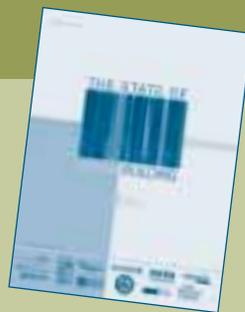
Consider specifying wood windows as standard window packages.

Benefit:

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

Survey says...

When asked what their most important environmental issues are, consumers said:



Saving energy	78%
Using recycled content products	56%
Improving indoor air quality	38%
Saving old-growth forests	36%
Slowing global warming	33%

L. Heating, Ventilation and Air Conditioning (HVAC)

1. Use Duct Mastic on all Duct Joints

Description:

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

Application:

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

Benefit:

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

2. Install Ductwork within Conditioned Space

Description:

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

Application:

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

Benefit:

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

3. Vent Range Hood to the Outside

Description:

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

Application:

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

Benefit:

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

4. Clean all Ducts Before Occupancy

Description:

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

Application:

Clean or vacuum all ductwork before occupancy to eliminate dust. Clean ducts before carpet is laid and finishes are applied. Reduce dust build-up by temporarily blocking registers at time of duct installation.

Benefit:

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

5. Install Attic Ventilation Systems

Description:

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

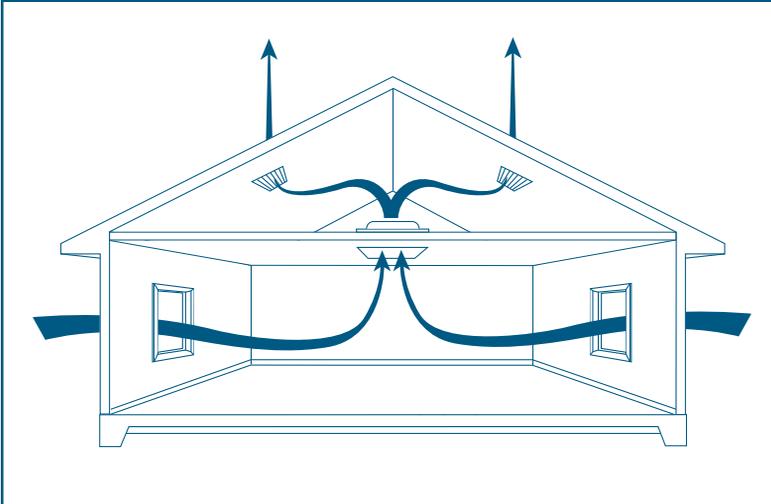
Application:

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 vents.

Benefit:

Attics can reach 140°-160° 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.

Air Flow with Whole-House Fan



6. Install Whole House Fan

Description:

Whole house fans work by continuously replacing warm indoor air with cooler outdoor air, especially at night.

Application:

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

Benefit:

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

7. Install 13 SEER or Higher Air Conditioning with Non-HCFC Refrigerants

Description:

Air conditioning equipment is one of the greatest loads on power grids. The higher the SEER number the less power is required to provide comfort. Some new AC units use alternatives to HCFCs as the refrigerant.

Application:

Higher SEER units (13-17 SEER) are installed like any other AC equipment. New 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. Using non-HCFC refrigerants (such as HFC) eliminates depletion of the ozone layer in case of leakage during replacement. Leaking CFCs contribute to the depletion of the ozone layer.

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

Description:

High efficiency furnaces convert gas to heat with greater efficiency.

Application:

Install high efficiency furnace in place of conventional furnace. 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.

9. Eliminate Wood Burning Fireplaces

Description:

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

Application:

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

Benefit:

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

10. 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.

11. Install High Efficiency Particulate Air (HEPA) Filter

Description:

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

Application:

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

Benefit:

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

12. Install Heat Recovery Ventilation Unit (HRV)

Description:

An HRV is a mechanical ventilation system that recovers heat from exhausted indoor air and transfers it to the incoming fresh air stream.

Application:

The unit should be designed into the HVAC system to capture heat from exhausted air from the house.

Note: Use of this equipment is particularly appropriate with blower door test results of less than .35 Natural Air Changes per Hour (NACH).

Benefit:

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

Radiant Floor Heating



13. Install Separate Garage Exhaust Fan

Description:

According to the U.S. Environmental Protection Agency (EPA), 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 and ceiling adjacent to the garage.

Application:

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

Benefit:

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

M. Renewable and Solar Energy

1. Incorporate Natural Cooling

Description:

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

Application:

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

Benefit:

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

2. Incorporate Passive Solar Heating

Description:

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

Application:

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

Benefit:

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

3. Pre-Plumb for Solar Water Heating

Description:

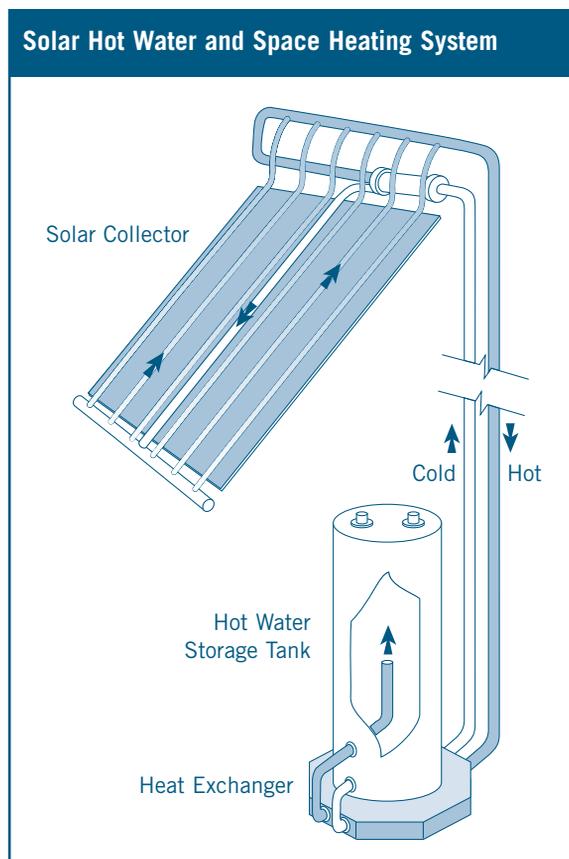
Insulated copper pipes are installed from the attic to a hot water closet or mechanical room for future solar installation. This option allows the homeowner to install an active solar system at a later date if they desire.

Application:

Provide south-facing roof area for collectors and access for piping to a mechanical room.

Benefit:

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



4. Install Solar Water System

Description:

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

Application:

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

Benefit:

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

Photovoltaic Panel System



5. Install Photovoltaic (PV) Panels

Description:

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

Application:

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

Benefit:

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

Installing Photovoltaic Panels



N. Indoor Air Quality / Finishes

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

Description:

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

Application:

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

Benefit:

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

2. Use Low VOC, Water-Based Wood Finishes

Description:

Conventional solvent-based wood finishes can “offgas” for months, and can be harmful to children. “Offgassing” means the solvents are continuously released into the air, which contributes to poor indoor air quality. 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 Solvent-Free Adhesives

Description:

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

Application:

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

Benefit:

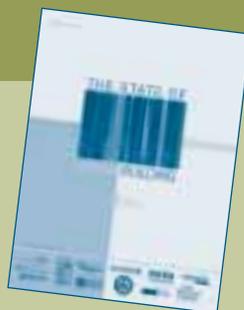
Solvent-free adhesives are often stronger, emit fewer pollutants, and reduce the potential harmful impacts on the health of the occupants and installers.

Low/No-VOC paint



Survey says...

In rating improved indoor air quality features, the majority of consumers said the following should be standard:



Formaldehyde-free insulation	85%
Low VOC Paint	73%
Heat recovery ventilation unit	70%

4. Substitute Particleboard with Formaldehyde-Free Materials

Description:

Particleboard is made from wood fibers and an adhesive that contains urea-formaldehyde, a suspected human carcinogen. The formaldehyde is continuously released, which contributes to poor indoor air quality. Particleboard is typically used for cabinets, countertops, stair treads, and shelving.

Application:

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

Benefit:

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



Cabinets Using Exterior Plywood Substrate (left)

5. Use Exterior Grade Plywood for Interior Uses

Description:

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

Application:

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

Benefit:

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

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

Description:

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

Application:

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

Benefit:

Reduces formaldehyde exposure to residents, particularly children, who are 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.



Medium Density Fiberboard (right)

7. Seal all Exposed Particleboard or MDF

Description:

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

Application:

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

Benefit:

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

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

Description:

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

Application:

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

Benefit:

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

9. Use Finger-Jointed Trim

Description:

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

Application:

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

Benefit:

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



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.



O. Flooring

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

Description:

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

Application:

Use FSC certified wood in place of conventional hardwood flooring.

Benefit:

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

2. Use Rapidly Renewable Flooring Materials

Description:

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

Application:

Use these alternative flooring materials in place of conventional hardwood.

Benefit:

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

3. Use Recycled Content Ceramic Tile

Description:

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

Application:

Install recycled content tiles wherever conventional tiles are specified.

Benefit:

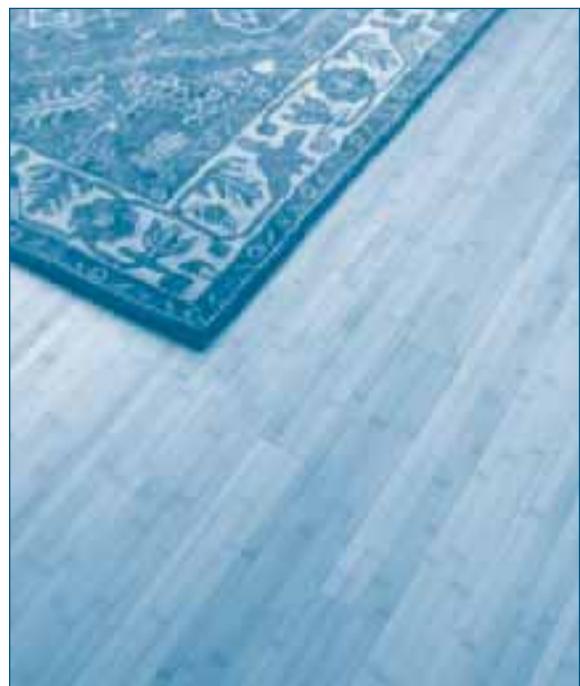
Some recycled content ceramic tile is very dense which significantly reduces the amount of moisture and stains that are absorbed into the tile, making it more durable and easier to maintain.

Survey says...

96% of consumers surveyed were willing to pay more for green building features if they improved quality, durability and the health of the house. How much more?

\$500	1%
\$1000	11%
\$2,500	32%
\$5000	36%
\$10,000+	20%

Bamboo Flooring





Natural Linoleum

4. Use Natural Linoleum in Place of Vinyl Flooring

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.

Ingredients of Natural Linoleum



5. Use Exposed Concrete as Finish Floor

Description:

For slab-on-grade construction, 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 slab-on-grade construction. Finish must be designed and constructed when slab is being poured.

Benefit:

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

6. Install Recycled Content Carpet and Underlayment

Description:

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

Application:

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

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.



Chapter Five: Selling Green Homes

Lot 50

Plan 30

SOLD

2791 N. Broadway

Selling Green Homes

Every green product has a benefit for your customers, and selling what you build is an important aspect of building green. The combination of green products and practices you choose creates a “story” of how your homes protect the environment, reduce air pollution, conserve natural resources and save money.

To be a successful green builder, train your sales staff to tell the stories behind the products. Even if the story is just a list of benefits, you leave a lasting impression on your buyers.

Market Differentiation

While green features don't always sell the home at first blush, they make buyers think and will often bring them back. Emphasize that green doesn't necessarily cost more and can often save money in the long run. Buyers are becoming very sophisticated as publications like Better Homes and Gardens, Redbook, Family Circle, Sunset, and home improvement magazines feature more green building stories.

Marketing green provides unique opportunities. By distinguishing your company from other builders, you can step into a new arena of recognition. By thinking outside of the traditional marketing box you can engage the public. Even in a seller's market where homes are sold before they are finished, building green creates a lasting image for the company. Your homes draw public curiosity and interest, and your story is attractive to the news and trade media. People start to identify you as the builder who cares, which engenders loyalty and creates referrals in slower times.

Educate Your Sales Staff

Sales are everything. It doesn't matter how well built or how green the house is if your sales staff doesn't communicate the value of building green to your customers. Your sales staff are your greatest advocates – take the time to train them about green features and benefits. If they feel confident, and understand that building green adds value to their customers, they will have the tools to close a sale that might otherwise get away.

Convey the Benefits

It is important to complement green option packages with a marketing program that clearly identifies the benefits. Concepts such as energy efficiency, indoor air quality, and resource conservation, while easy to describe, do not necessarily address homeowner concerns. One way to address this is to sort the features in terms that are important to the buyer. Use the Green Building Benefits as a tool to assist you in creating marketing materials that address green building features. Each green feature is discussed in detail in Chapter 4. Use these benefits to assemble the story of how your homes are different from those built by the competition.



The following is a list of green building features that help 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 offering the following:

- Recycled content decking and siding
- FSC Certified wood framing
- Engineered lumber
- Wood I-joists
- Finger-jointed studs
- Interior steel studs
- Solvent-free adhesives
- Natural linoleum flooring
- Recycled content ceramic tile

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 offering the following:

- Fiber-cement siding
- Recycled content decking and siding
- Natural linoleum flooring
- Recycled content ceramic tile
- Resource-efficient landscapes and gardens

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 offering the following:

- Foundation/slab insulation
- Increased wall and ceiling insulation
- Spray cellulose in walls and ceilings
- Advanced infiltration reduction
- 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:

- No-VOC paints
- Natural linoleum in place of vinyl flooring
- Elimination of particleboard and medium density fiberboard (MDF)
- Solvent-free adhesives
- Water-borne wood finishes
- Clean ducts before occupancy
- Exhaust fan in attached garages
- Range hood vented to outside
- Whole house water filter
- HEPA filter on furnace
- Heat Recovery Ventilator (HRV)
- Sealing of particleboard and MDF
- Chlorine filter on showerhead

Chapter Six: Summary of Green Building Benefits

A. Community Design Issues

BENEFITS

1. Orient Homes on E/W Axis for Solar Access	Reduces the need for energy and lowers utility bills.
2. Orient Living Rooms and Porches to Streets and Public Spaces	Fosters community living.
3. Build Mixed Use, Residential/Commercial	Creates walkable communities, reduces smog and automobile use.
4. Design for Diverse Family Types	Opens housing market to wider range of buyers.
5. Provide "Granny Flats" Above Garages	Creates more affordable housing.
6. Build within 1 Mile of Public Transit Hub	Reduces dependence on automobiles and reduces smog.
7. Minimize Street Widths	Slows traffic.

B. Site

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. Donate Unused Materials	Reduces landfill deposits, helps local charitable organizations. Donations may be tax deductible.
3. Install Drip Irrigation	Reduces landscape water use and lowers water costs.
4. 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.
5. Incorporate Permeable Paving	Reduces the volume of polluted water that flows into rivers or the Bay, reduces irrigation requirements as well as lowers risk of flooding.
6. Design Resource-Efficient Landscapes and Gardens	Helps conserve water, reduces use of chemicals, and creates healthier soil and plants.
7. Provide for On-Site Water Catchment/Retention	Reduces the need to use treated, potable water for lawns and gardens.

C. Foundation

1. Incorporate Recycled Flyash in Concrete	Increases the strength and durability of the concrete and reduces the amount of cement needed.
2. Reuse Form Boards	Saves money and conserves resources as solid sawn lumber is becoming increasingly expensive and scarce.
3. Use Recycled Content Rubble for Backfill Drainage	Saves money and natural resources by using recycled materials.
4. Insulate Foundation Before Backfill	Reduces energy loss and utility bills by minimizing heat loss.
5. Use Aluminum Forms	Reduces wood use, and despite higher initial cost, will pay for themselves quickly.
6. Install Rigid Foam, Insulated Concrete Forms (ICFs)	ICFs are not subject to rot and results in a better insulated foundation.

D. 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	Guarantees 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 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.
5. Use Finger-Jointed Studs	Uses recycled content materials, is straighter and stronger than solid sawn studs, and eliminates crooked walls, thereby reducing material waste.
6. Use Structural Insulated Panels (SIPs) for Walls/Roof	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.
7. Use Reclaimed Lumber	Reduces resource consumption and landfill deposits, and is often of higher quality than new lumber.

Summary of Green Building Benefits

E. 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 particularly harmful to children who play on structures built with treated wood.
3. Use Alternative Siding Materials	Lasts longer, is fire-resistant, and reduces maintenance costs.

F. Plumbing

1. Insulate Hot and Cold Water Pipes	Saves energy and water, and reduces water heating costs.
2. Install Flow Reducers in Faucets and Showerheads	Lowers water bills, saves water and is a low cost option.
3. Install Chlorine Filter on Showerhead	Eliminates chlorine absorbed by skin.
4. Install Tankless Water Heaters	Saves energy, is quicker and more reliable.
5. Pre-Plumb for Graywater Conversion	Cuts down on the use of potable water for outside irrigation and lawn watering.
6. Install Water Filtration Units at Faucets	Reduces contaminants in water.
7. Install On-Demand Hot Water Circulation Pump	Hot water arrives quicker to fixture, saving water and energy.

G. Electrical

1. Install Compact Fluorescent Light Bulbs	Lowers energy bills and reduces need for energy production.
2. Install Insulation-Compatible Recessed Lighting	Reduces the amount of heat loss/gain.
3. Install Lighting Controls	Reduces need for energy and lowers energy bills.
4. Install Ceiling Fans	Reduces the need for air conditioning.

H. Appliances

1. Offer ENERGY STAR® Dishwasher	Reduces water and energy use, and lowers utility bills.
2. Offer Horizontal Axis Washing Machine	Uses 40% less water and 50% less energy than conventional top loading washers.
3. Offer Energy-Efficient Refrigerator	Reduces energy and can save over 10% on utility bill.

I. Roofing

1. Select Light Colored Roofing	Reduces heat buildup through the roof, increases occupancy comfort, roofing lasts longer and decreases air conditioning bill.
2. Select Safe and Durable Roofing Materials	Reduces landfill deposits and saves money on replacement costs.

J. Insulation

1. Upgrade Wall and Ceiling Insulation to Exceed Title 24 Requirements	Lowers utility bills, improves comfort, decreases heating and cooling requirements and makes home quieter.
2. Install Recycled Content, Formaldehyde-Free Fiberglass Insulation	Reduces indoor air quality problems due to formaldehyde binders, and can contain up to 30% recycled glass.
3. Use Advanced Infiltration Reduction Practices	Reduces drafts, and lower bills.
4. Use Cellulose Insulation	Lowers energy bills, uses recyclable materials, and contains no formaldehyde.

K. Windows

1. Install Energy-Efficient Windows	Lowers utility bills, and provides greater comfort.
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Summary of Green Building Benefits

L. Heating, Ventilation and Air Conditioning (HVAC)

BENEFITS

1. Use Duct Mastic on all Duct Joints	Improves indoor air quality, and keeps the homes more comfortable.
2. Install 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 Attic Ventilation Systems	Increases comfort and reduces air conditioning use.
6. Install Whole House Fan	Reduces electricity usage, and moves large volumes of air to achieve comfort at higher temperatures without air conditioning.
7. Install 13 SEER or Higher Air Conditioning with Non-HCFC Refrigerants	Saves money and energy, reduces peak load problems, and non-HCFC refrigerants reduce ozone layer depletion.
8. Install 90% or Greater Efficiency Gas Forced Air Furnace	Reduces air emissions, costs less to operate, and saves natural resources.
9. Eliminate Wood Burning Fireplaces	Reduces pollutant particulate matter by 75-90%.
10. Install Zoned, Hydronic, Radiant Heating	Saves energy by only heating the zone that requires heat.
11. Install High Efficiency Particulate Air (HEPA) Filter	Makes living space healthier, and reduces microparticulates from the air.
12. Install Heat Recovery Ventilation Unit (HRV)	Improves indoor air quality and reduces energy.
13. Install Separate Garage Exhaust Fan	Creates healthier indoor environments.

M. Renewable and Solar Energy

1. Incorporate Natural Cooling	Reduces need for air conditioning, and is a low cost item to incorporate into home and yard.
2. Incorporate Passive Solar Heating	Reduces heating requirements by 30-50%, saves energy and money.
3. Pre-Plumb for Solar Water Heating	Saves money if a solar system is to be installed in the future.
4. Install Solar Water System	Reduces the use of gas or electricity, and pay back in as little as seven years.
5. Install Photovoltaic (PV) Panels	Decreases reliance on conventional power plants, and is cost effective in areas that require night lighting such as outdoor lights.

N. Indoor Air Quality / Finishes

1. Use Low/No-VOC and Formaldehyde-Free 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 home installers and occupants.
3. Use Solvent-Free Adhesives	Improves indoor air quality, and are healthier for occupants and installers.
4. Substitute Particleboard with Formaldehyde-Free Materials	Reduces formaldehyde exposure to occupants.
5. Use Exterior Grade Plywood for Interior Uses	Reduces formaldehyde exposure to occupants.
6. Substitute Formaldehyde-Based Medium Density Fiberboard (MDF)	Improves indoor air quality.
7. Seal all Exposed Particleboard or MDF	Reduces exposure of harmful emissions to occupants.
8. Use FSC Certified Trim Material	Assures the long-term availability of these precious woods while protecting ancient, old-growth forests.
9. Use Finger-Jointed Trim	Uses material more effectively, saves money and resources, and is straighter and more stable than conventional clear wood.

O. 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 Tile	Uses recycled content materials and is easy to maintain.
4. Install Natural Linoleum in Place of Vinyl Flooring	Reduces exposure to toxins, and is healthier for occupants and installers.
5. Use Exposed Concrete as Finish Floor	Eliminates the need for additional flooring materials, is easy to maintain, and very durable.
6. Install Recycled Content Carpet and Underlayment	Saves resources, diverts waste from landfills, is more resilient and colorfast than carpet made from virgin fibers.