



*Planning Division*

## PLANNING COMMISSION STAFF REPORT

**TO:** Planning Commission  
**FROM:** Winston Wright, Associate Planner  
**DATE:** November 1, 2007  
**SUBJECT:** Green Building and Energy Efficiency Study Session

- 1) **Recommendation:** That the Planning Commission consider a report, discuss various green building practices and the programs adopted by other jurisdictions, and provide direction to staff as to which programs and policies to further develop into possible policies and/or development standards.
- 2) **Environmental Determination:** The study session before the Planning Commission is not a project as defined by California Environmental Quality Act (CEQA); therefore, the preparation of an environmental document is not necessary.
- 3) **Setting:** Many of the concepts and techniques associated with what is now considered "*green building*" date back thousands of years when structures were designed and built by builder-architects who relied on passive design and simple mechanical systems to heat, cool and light buildings. As new technologies became available development became less and less limited by environmental factors. Unfortunately, the application of some technologies compounded by the placement and design of some buildings results in the intensive use of non-renewable resources. Fortunately, there is a growing appreciation for the value of passive heating, lighting, and ventilation. Furthermore, technological advancement and the availability of new building materials provide opportunities for more efficient use of resources and structures can be designed to have less of an impact on the environment.

"Green building" is the practice of increasing the efficiency of buildings and their use of energy, water, and materials (including the use of renewable and recycled materials). These practices help reduce development's impact on human health and the environment. The objective of developing "a green building" is achieved through careful site planning, building design, material selection, building operation, ongoing maintenance, and the deconstruction of the building once it has outlived its usefulness.

Many cities and governmental agencies are developing green building goals, objectives, and standards that are integrated into the planning and development process. The following is a survey of some of the developed standards and guidelines.

- 4) **Established Rating Guidelines:** At the national level, the United States Green Building Council (USGBC) has set national standards for green buildings through its Leadership in Energy and Environmental Design (LEED) rating system. LEED awards credits to structures in six categories: 1) sustainable siting, 2) water efficiency, 3) energy and atmosphere, 4) materials and resources, 5) indoor environmental air quality, and 6) innovative design. Each structure achieves a LEED certification level ('certified,' 'silver,' 'gold,' or 'platinum') based on how many points it scores in each of these categories. The certification process is managed by USGBC and has associated fees. More detailed information about LEED can be obtained from [www.usgbc.org/LEED](http://www.usgbc.org/LEED).

The United States Environmental Protection Agency (EPA) established the ENERGY STAR system of labeling and certification. The labeling system covers over 50 product categories including common household appliances, air conditioning, lighting, and building materials. ENERGY STAR qualified appliances use 10–50% less energy and water than standard models and can save a typical home owner about \$80 a year in energy costs. ENERGY STAR qualified lighting provides bright, warm light but uses about 75% less energy than standard lighting and produces 75 percent less heat, and lasts up to 10 times longer. ENERGY STAR also has a certification process that is available to institutional and industrial buildings that can prove that they are among the most energy efficient 25% of the buildings in the nation. The system to evaluate a residential building is different. An ENERGY STAR home in California must be at least 15% more energy efficient than the energy code under which it is permitted, and include additional energy-saving features that are typically 20–30% more efficient than standard homes. The ENERGY STAR Indoor Air Package distinguishes homes with improved indoor air quality and certifies the highest level of energy efficiency. In addition to promoting energy efficiency, the Indoor Air Package specifications were developed to address issues like mold, radon, carbon monoxide, and toxic chemicals that can be found in common building materials. There are two paths to verifying that a home meets the ENERGY STAR guidelines. The Performance Path uses software to model the home's energy use to verify that it meets a target score. The Prescriptive Path is a set of construction specifications that meet program requirements. ENERGY STAR relies on third party verification by an inspector that is certified by the California Energy Commission to evaluate Home Energy Rating Systems (HERS). More detailed information about ENERGY STAR can be obtained from [www.energystar.gov](http://www.energystar.gov).

The non-profit sector also has several models to promote green building. Two such organizations in California are Global Green USA and Build It Green. Global Green USA has produced a guide "*Developing Green Building Programs: A Step-By-Step Guide for Local Governments*." This guide draws from experiences other jurisdictions and agencies have had developing their own green building programs. Global Green USA's guide is provided as Attachment A. Build It Green has collaborated with developers and state and local agencies to establish, "*New Home Construction Green Building Guidelines*." These guidelines are based on the Alameda County New Home Construction Guidelines developed in 2000, however they have been updated to expand their applicability and to incorporate measures from other green building

initiatives. These guidelines utilize the GreenPoint Checklist as a means of evaluating a project. The guidelines correlate with both LEED and ENERGY STAR criteria; however, Build It Green's system is tailored to California's environment and is conscientious of financial costs. This system provides for a third party evaluation and has associated fees. A list of some green building measures taken from Build It Green's green building guidelines are provided as Attachment B and the unabridged document is provided as Attachment C.

Given that the most widely used methods of establishing a green building are rating systems; the "greenness" for each building is relative. Not every green measure is appropriate for the proposed project, or can be financially justified.

- 5) **Current Regulation:** Through Title 24, *California's Energy Efficiency Standards for Residential and Non-Residential Standards*, the City of Oxnard already implements one of the country's most effective energy conservation regulations. Several cities and counties use Title 24 Energy Standards as a baseline for requiring additional efficiency requirements (i.e. 15% better than Title 24). All proposed local energy ordinances that mandate energy efficiency standards that exceed Title 24 requirements must receive prior approval by the California Energy Commission. Without a local energy ordinance that has been approved by the California Energy Commission, a discretionary permit cannot be denied because it lacks enhanced energy efficiency features beyond what is required under Title 24. Furthermore, the California Energy Commission is in the process of updating Title 24 to make the energy efficiency standards more stringent. Many energy efficiency advocates are waiting to see how the 2008 update will be formulated before designing new programs.

Aside from Title 24, the Planning Commission may desire to promote additional policies that further environmental stewardship. When doing so, the Planning Commission should weigh the costs and benefits of proposed measures. With this in mind, the Planning Commission should consider that conditions placed on development may conflict with State and Federal laws.

- 6) **What are other Jurisdictions Doing:** The following is a sample of green building programs and activities.
- a) **Education:** Numerous jurisdictions provide comprehensive information and funding sources available to the public associated with energy efficiency appliances, water conserving fixtures, public transportation opportunities, and waste reduction on a page of the City website and on handouts. New information is added to these sites as it becomes available.
  - b) **Teamwork:** Establish a "Green Team" with representatives from each of the city departments to establish "Environmental Accords." The accords would be a means to develop new policies and programs for a clean, healthy and safe environment. This is an all inclusive approach that would explore all aspects of sustainable development opportunities in City regulations.
    - i) Model the program after the United Nation's Urban Environmental Accord as adopted at the Mayor's Conference in Seattle.
    - ii) The City of Monrovia recently past an action plan based on these principals.

- iii) Focused on Energy, Waste Reduction, Urban Design, Urban Nature, Transportation, Environmental Health and Water.
- iv) Having a representative from each City agency assures that there is open cooperation and communication while avoiding jurisdictional conflicts.
- c) **Volunteer System:** Develop a volunteer "Green Building" rating system (City of Irvine & County of Santa Barbara)
  - i) Provide incentives to construct green projects.
    - (1) Expedited permit process like small business plan check
    - (2) Lower permit processing fees
  - ii) Points assigned based on "Green Building" techniques used.
  - iii) Requires City Staff to "score" a project and monitor the development
  - iv) Successful completion of a green project results in "Green Certification"
- d) **Mandated System:** Increase the energy efficiency requirements above Title 24 for all new projects and additions or require that set guidelines are followed:
  - i) City of Santa Monica (widely modeled)
    - (1) Applies to residential. & non-residential projects
    - (2) Projects must be designed to perform 10% better than Title 24 requirements
    - (3) Establishes "option packages" to improve efficiency
      - (a) High-performance glazing
      - (b) High-efficiency water heaters
      - (c) High-efficiency HVAC (or no cooling)
      - (d) Energy Star appliances
  - ii) City of Pasadena (Green Building Practices Ordinance)
    - (1) Applies to municipal buildings of 5,000 sq. ft. or more, non-residential projects of 25,000 sq. ft. or more, tenant improvements of 25,000 sq. ft. or more, and mixed use and multi-family residential buildings four stories in height or more.
    - (2) A project subject to the ordinance must register with USGBC and meet the minimum Certified Level established by LEED.
    - (3) Financial incentives through rebates are offered
  - iii) Marin County
    - (1) Applies to residential & non-residential projects
      - (a) Residential structures
        - (i) must perform at least 10% better than Title 24 or
        - (ii) meet criteria in a set checklist or
        - (iii) provide an on-site renewable energy system that produces 75% of the energy used on the site.
      - (b) Non-residential structures
        - (i) must perform at least 15% better than Title 24 or
        - (ii) meet criteria in a set checklist or
        - (iii) provide an on-site renewable energy system that produces 75% of the energy used on the site.
  - iv) City of Palm Desert
    - (1) Applies to residential & non-residential projects
      - (a) Non.-residential projects must be 5-10% better than Title 24 (depending on compliance approach)

- (b) Residential projects have requirements based on the size of the residential structures
  - (i) <4000 sq. ft. 10% better than Title 24
  - (ii) >4000 sq. ft. 15% better than Title 24
  - (iii) "Developer Supplied" appliances must be ENERGY STAR certified
  - (iv) At least one model home in a new subdivision must have a photovoltaic system installed. Buyers must be given the option of having a photovoltaic system installed with an explanation of costs and long term savings
  - (v) All new homes must have a conduit installed through the roofing and walls to allow the opportunity for future installation of a photovoltaic system.
- e) **Public Buildings:** Several public agencies have establish green building standards for all new public buildings based on the Leadership in Energy and Environmental Design (LEED) rating system.
  - i) LEED awards credits to structures in six categories; sustainable siting, water efficiency, energy and atmosphere, materials and resources, indoor environmental air quality, and innovation in design.
    - (1) Structures achieve a LEED certification level ('certified,' 'silver,' 'gold,' or 'platinum') based on how many points it scores in these categories
    - (2) Certification process assures that there is follow through with agreed upon materials and engineering
    - (3) The process can be costly
  - ii) The City may forego the certification process and use LEED as a guideline if it is financially infeasible to get certified.
- 7) **Funding for City Programs:** Investigate and apply for grants that are available for City driven energy efficiency programs
  - a) State and Federal incentive programs that may apply to City projects
  - b) Energy and Environmental/Efficiency Block Grant
    - i) S. 1419 & HR 3221
- 8) **Attachments:**
  - A. "A Step-By-Step Guide for Local Government"
  - B. Summary of Green Building Measures
  - C. "New Home Construction Green Building Guidelines."

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# **ATTACHMENT**

**A**

# DEVELOPING GREEN BUILDING PROGRAMS

A STEP-BY-STEP GUIDE FOR  
LOCAL GOVERNMENTS



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***A green building program is an innovative and effective way to improve local quality of life and create a more efficient City Hall.***

## Why Build Green?

Conventional building construction, use and demolition, together with the manufacturing of building materials, has multiple impacts on the local, regional, and global environment. In the United States, buildings account for:

- 65% of electricity consumption
- 30% of greenhouse gas emissions
- 30% of raw materials use
- 30% of landfill waste
- 12% of potable water consumption

In addition, numerous studies have shown a correlation between poor indoor air quality and respiratory health problems, leading to reduced productivity and increased absenteeism.

Green building is a proactive way to address these issues by creating buildings that:

- Minimize the use of resources
- Are healthier for people
- Reduce harm to the environment

## The Green Umbrella

A green building program can be the “umbrella” that brings your city’s programs together in a coordinated and streamlined way so that staff are working toward common goals.

Green building is a holistic process that addresses a broad range of issues including community and site design, energy efficiency, water conservation, resource-efficient material selection, indoor environmental quality, construction management, and building maintenance.



A green building program should build on a municipality’s existing efforts in recycling, water conservation, and stormwater management and promote coordination among departmentals. By integrating and enhancing your agency’s existing activities, green building programs stretch local tax dollars and create a more effective and efficient delivery of services.

## Show Environmental Leadership

As awareness of environmental issues continues to grow, being a good steward of the environment plays a major role in attracting progressive businesses and new residents. Establishing a green building program allows your city or county to showcase its environmental leadership and demonstrate that it is contributing to larger efforts to reduce resource consumption and waste generation, improve air and water quality, preserve natural resources, and create sustainable communities.

## Common Green Building Questions

### What are the benefits of green buildings?

Direct financial benefits of green buildings come from lower energy and water bills and the reduced need for maintenance and infrastructure. For example, designing for on-site water retention can lead to downsizing or eliminating storm water conveyance pipes. Indirect benefits of green buildings include improved health of residents and increased productivity of employees. The global benefits of green building include the protection of natural resources and the mitigation of climate change.

### Does it cost more to build green?

A common misperception is that green buildings cost significantly more than conventional buildings. In fact the increased cost for green buildings is typically 5%, depending on the features, building type, and location. In some projects, where green measures are considered early and fully integrated into the building design, there is no increased cost.

### Is it cost effective for the local government to develop and implement a green building program?

Developing and implementing a green building program is a practical and proactive way for your local government to address multiple issues under a common theme or “umbrella”. By linking and augmenting existing efforts and procedures green building adds significant value for relatively low additional cost and without overburdening staff or department budgets.

### Are green building materials hard to find?

A common myth is that green buildings require exotic, hard-to-find products. While a valid concern in the early days of green building, the supply and availability of green materials, such as recycled-content carpet or energy efficient appliances, is no longer a significant issue in most regions. As the demand for green buildings continues to grow rapidly, building material manufacturers are responding by either offering new green products or by improving the environmental performance of well-known product lines. For example, most national paint manufacturers now offer environmentally friendly products that have reduced levels of harmful volatile organic compounds (VOCs).

### Improve Quality of Life

The overall fabric of a community is enhanced when its buildings are constructed in a manner that is respectful of the surrounding built and natural environments. In addition to creating healthier places for people to live and work, green building programs can spark a broader discussion of the city’s sustainability in terms of how it builds buildings, operates infrastructure, and guides land use.

1978 (Title 24), and the establishment of building accessibility requirements by the Americans with Disabilities Act (ADA) in 1990.

Green building expands on these efforts by promoting energy efficiency and use of resource-efficient and healthy materials beyond code requirements, and incorporating products with reduced impact on global resources such as forests and the ozone layer.

### Green Building Related Local, State & Federal Regulations

\* LEED (Leadership in Energy and Environmental Design) is a voluntary, consensus-based national green building rating system administered by the U.S. Green Building Council.



### Stay Ahead of the Curve

Green building programs help cities or counties be proactive in how they plan and permit future development, keeping ahead of changing regulations.

Green building can be seen as the next step in the 100-plus year history of improving building standards to protect the health and safety of occupants. Important milestones include the 1901 New York City Tenement House Law that addressed fire safety and ventilation, the initial seismic standards developed for southern California in response to the 1933 Long Beach earthquake, the inclusion of energy efficiency as part of the California building code in

### Streamline Existing Programs

Many cities are already in the business of environmental protection -- through policies and programs that encourage energy efficiency, recycling, water conservation, open space preservation, and public health protection.

Examples of local policies and programs that relate to green building include:

- General Plan: land use, open space, transportation, and conservation elements
- Zoning Ordinance requirements for items such as parking, refuse enclosures and bicycle storage
- Low-water use landscaping ordinances
- Recycling requirements
- Building and energy codes
- Storm water pollution prevention programs

Other policies and programs that relate to environmental issues can include:

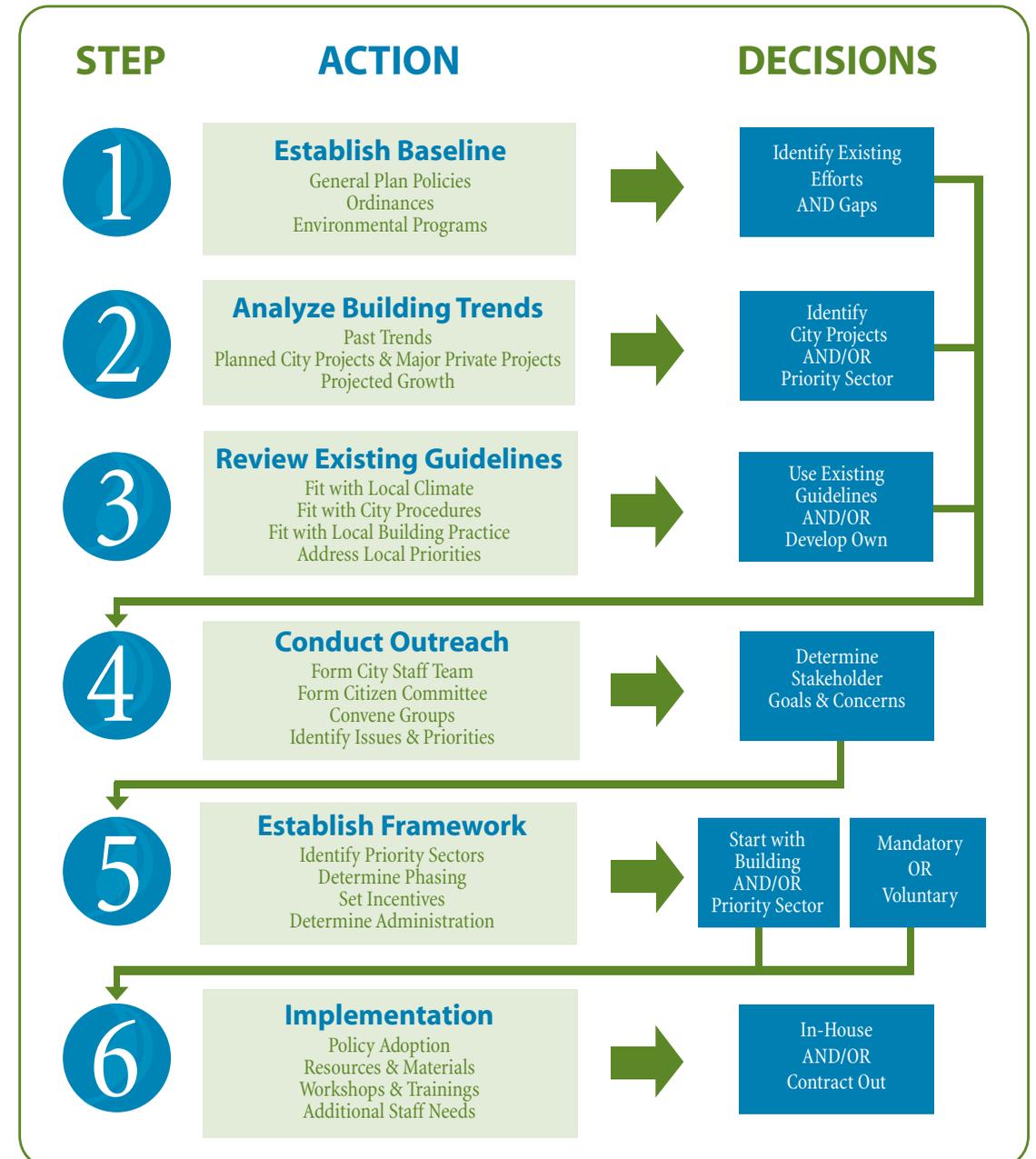
- Transit-Oriented Development Ordinances
- Local carbon dioxide (CO2) reduction commitments like the U.S. Conference of Mayors
- Adoption of U.N. Urban Environmental Accords

Unfortunately, programs often operate in isolation. For example, recycling staff may be unaware of what storm water management staff is trying to accomplish.

This can lead to a lack of coordination and understanding between programs and departments that may actually have the same or intertwining goals. A green building program helps to coordinate these efforts in a more efficient manner.

Green building methods are the future of building and construction regulations. Just as energy and stormwater considerations have been incorporated into building regulations, green building strategies and methods will likely be incorporated into building standards in the near future. Developing a green building program sooner rather than later will allow your municipality to stay ahead of the curve, leading the way towards sustainability rather than being regulated to do so. Developing your own program will also allow you to craft a program that speaks to local issues and concerns, which would likely not be addressed in broad mandates. The image on page 3 shows many of the major policy changes concerning building construction that have occurred over the past 30 years. The continuum also includes the stringent and comprehensive building criteria and building concepts that some cities have already adopted or are exploring.

The development of a green building program should follow a sequence of steps. For each step, specific actions lead to the development of information that enables stakeholders to make critical decisions regarding the purpose, structure, and implementation of the program.



## KEY ISSUES

What general policies already support or are complementary to green building?

What ordinances and regulations relate to green building?

What programs are provided by other utilities or regional agencies?

Where are the gaps?

**Many local policies and programs either support, link to, reward or directly overlap with components of green building.**

Analyzing existing programs and policies provides a context for a green building program and identifies current efforts that can be built on or expanded.

Some examples of green building related policies or programs that may already be in place include:

- General plan policies that support sustainability or resource conservation
- Recycling programs
- State or local energy codes
- Low-water use landscape and irrigation regulations
- Solar easement requirements
- Construction waste management requirements

### Conduct an Inventory

To conduct an inventory, explore areas such as the following:

- Sustainability goals or resolutions
- General Plan elements
- Local ordinances and regulations
- Municipal recycling, water conservation, and stormwater management programs.
- State and local utility efficiency programs, and

Look for instances of policies, programs and practices that support or encourage green-building related measures, such as:

- Incentives for transit-oriented, mixed-use, or compact developments
- Increased energy efficiency through goals or requirements to exceed local or state codes
- Rebates for the use of renewable energy systems such as solar hot water and photovoltaic panels
- Water conservation, efficiency, or reuse programs. This can include low-water use landscape regulations or educational programs on native and drought-tolerant landscapes

- Natural resources conservation, including encouragement of recycling and purchasing recycled products for use in public buildings
- Storm water management requirements
- Urban heat island mitigation through tree planting
- Resolutions to protect the ozone layer, reduce carbon emissions, or promote the use of environmentally preferable products
- Resolutions supporting the use of the precautionary principle – avoiding the use of materials that have a known risk of harming public health or safety.

The City of Pasadena, after reviewing its policies and programs, realized that many green building issues were already addressed to some extent through existing efforts. However, there was little coordination between programs, and a number of green building topics related to global issues such as forestry protection and ozone layer protection were not addressed. By developing a green building program, the City was able to coordinate existing environmental efforts and address the gaps. This process provided Pasadena with the opportunity to streamline and expand on the work already being performed. Once the green building program was in place, the city moved forward adopting the United Nations Urban Environmental Accords, which includes green building programs as a recommended action.

### Examples of Policies, Regulations and Programs

Below are several examples of city policies, regulations or programs that relate to green building goals or practices.

#### POLICY EXAMPLE

##### City of Pasadena General Plan

*Policy 5.6 - Human Values: Future development should reflect concern for the well-being of citizens - for workers, visitors, neighbors and passersby - and should embody the cultural values of the community; it should be accommodating, inspiring, inviting, and enduring.*

*Policy 9.5 - Stewardship of the Natural Environment: Encourage and promote the stewardship of Pasadena's natural environment, including water conservation, clean air, natural open space protection, and recycling. Encourage the use of native, water-conserving, and regionally appropriate landscaping.*

**ORDINANCE EXAMPLE****Emporia, Kansas**

ORDINANCE NO.95-32

**Objectives.** To promote the public health, safety, and general welfare of the citizens of Emporia, this Storm Water Management Ordinance is enacted for the general purpose of assuring the proper balance between the use of land and the environment.

Section 10-74. **Storm Water Management Plan Required.** It shall be the developer's responsibility to submit a storm water management plan, prepared by a licensed professional engineer or architect, to the city engineer in those cases as hereinafter required. The plan shall show that there will not be an increase in the quantity and rates of storm water emanating from the development area except in accordance with an approved storm water management plan as provided in this Article.

**PROGRAM EXAMPLE****Seattle, Washington Energy Program**

The utility Seattle City Light offers assistance and incentives that include technical assistance with conducting energy use modeling, and rebates for purchasing energy efficient appliances.

**Rochester, New York Reuse/Recycle Program**

Rochester's Materials Give Back program returns recycled materials and products to the public free of charge. Leaves are collected at curbside, treated, and turned into compost. Wood is collected and cut for use as firewood, or chipped and returned as wood chips. Holiday trees are chipped and converted into mulch. Excess chipstone, scrap lumber, and buildable fill are recovered and returned. Individuals use these materials for flower gardens, household beautification projects, or other home improvement projects.

**KEY ISSUES**

What is the character of local development?

What has been built in the past 3-5 years?

What private projects are in the development pipeline?

What public projects are expected?

*An effective green building program should be relevant to the types of buildings and construction activity typical to the city, as well as to projected development patterns and activity.*

Once existing policies and programs are identified the next step is to conduct a thorough analysis of your municipalities current and projected building trends.

The analysis should identify the following:

- Historic building trends
- Projected areas of growth and types of development
- Future public sector projects
- Major land owners' or developers' future plans

**Historic Development Trends**

It is important to understand the historical context and trends in the City or County's land development. By understanding what factors impacted development in the past, it is possible to determine how and where green building can best influence the future.

Some historical factors to study include:

- Trends in types of buildings that have been built in the past
- Trends, needs and issues that have been determined by policies or agencies, such as the General Plan, Specific Plans, or the redevelopment agency.

**Projected Development Trends**

Analyzing past and current development will help to predict what types of environmental impacts your city may experience as a result of construction and ensure that the green building program targets sectors where development will most likely occur: single-family homes, apartments, commercial and municipal buildings.

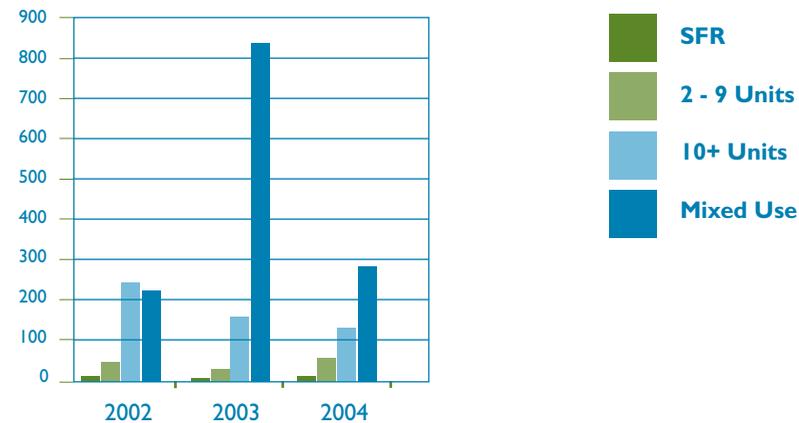
Consider major municipal projects that have been proposed or will be developed. Upcoming municipal projects provide an excellent opportunity to employ green building methods and showcase a city's or counties commitment to sustainability.

High-profile private developments represent an opportunity to incorporate green building methods and reduce related impacts on the surrounding environment. A green building program can help address these impacts and allow both public and private development to serve as showcases of sustainability.

### RESIDENTIAL UNIT COMPARISON

Compare total units between 1) new single family residential, 2) Projects 2-9 units, 3) Projects over 20 units, & 4) Mixed Use Projects

#### SFR - Only 56 New SFR in three years



The City of Irvine, in conducting its analysis, discovered that development had historically been low-density residential, but several recently proposed high-density and mixed-use projects indicate an emerging trend. This led the city to ensure that the green building program addressed both single-family and multi-family construction. Some factors to consider include:

- Current status of available land: infill, former agricultural land, brownfields, etc.
- Building types expected and needed (i.e., multi-family residential, single-family residential, commercial, mixed use, etc.)
- Potential locations of activity

### Existing Review and Permit Process

It is important to understand the steps of the building construction and review process so a green building program and its criteria can be seamlessly integrated with this process.

Some examples of common project review stages are:

- Zoning Conformance Review
- Conditional Use Permit
- Development Agreement
- Building Permit Plan Check
- Certificate of Occupancy

Any additional requirements that a green building program will place on developers should be set into place alongside the existing thresholds and requirements that developers are already familiar with. Builders will better receive a green building program, which does not slow down the building process.

### Summarize Your Analysis

Once a thorough analysis of the development picture is completed, summarize the findings to determine the sector with the greatest projected growth and with the most potential benefit from a green building program.

# STEP 3

## REVIEW EXISTING GUIDELINES AND PROGRAMS

### KEY ISSUES

Are there existing guidelines that can be used “off the shelf”?

Are there existing guidelines that can be modified for local conditions?

Should the city develop its own guidelines?

How will the guidelines fit into the overall program?

### Selecting the right guidelines for your local government is critical.

Green building guidelines are tools to get building professionals, consumers and city officials on the same page in terms of defining green building.

A number of good-quality green building guidelines and programs already exist. Many are time-tested and kept up-to-date by reputable third parties, making them easy for a municipality to adopt without large commitments of time or money. However, local needs may lead a public agency to develop specific local guidelines.

To determine what guidelines are a good fit, it is important to understand the differences between green building guidelines and green building programs. Guidelines serve as informational tools and provide parameters for developers, building professionals, and the general public. Programs enable the implementation of guidelines through technical assistance, incentives, and/or regulations. Generally, there are three types of guidelines:

#### Educational Guidelines

Educational guidelines provide a list of various green building practices and the benefits provided by each. Guidelines usually focus on specific building types such as residential, commercial or multi-family, and describe green building practices as they relate to each building type. No score or relative value is given to the practices. Such guidelines are useful for education, but cannot readily be used as the basis of a green building program.

#### Guidelines with Points

Guidelines with a scoring or rating component allocate points to the green practices.

Some guidelines leave the task of establishing the minimum score needed to officially designate a building as “green” to the individual municipality. In other instances, the scoring thresholds are pre-established, and each city or county must decide if the scoring works in its local context. Target levels can be mandated or encouraged via incentives. Because the scoring structure is already established, such guidelines are easier to adopt as the basis of a program.

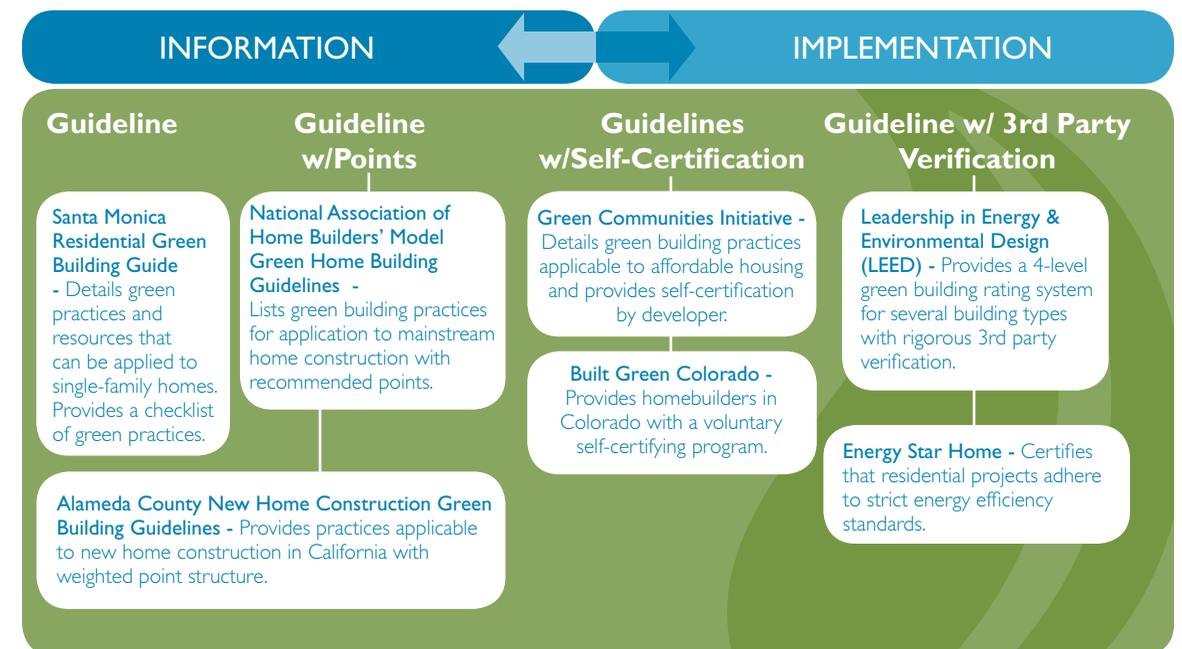
# STEP 3

## REVIEW EXISTING GUIDELINES AND PROGRAMS

### Guidelines with Certification and Verification

The final type of green building guideline includes verification and certification for designating a project as a “green building”. This can be conducted either by the builder, the city or county, or a third party. Such guidelines are typically part of a green building program in which an entity independent of the local government certifies that a building adheres to green standards. Two such entities and their programs are the US Green Building Council’s LEED program, and the US Environmental Protection Agency’s Energy Star Home program.

These programs can be more cost-effective for a local government because they are administered by another organization. Additional benefits include the objectivity of those verifying the project, and the fact that the programs are designed to be applicable to any area of the country, rather than a specific geographic region or climate zone.



## KEY ISSUES

What city departments should be included?

Who are the local architects and contractors?

Who is building in the city?

What organizations should be represented in a green building committee?

What format should be used for the meetings?

**Stakeholders that will be expected to participate in the program need to be involved in the program's development**

### Prepare an Outreach Plan

The outreach process should be a combination of information gathering and idea exchange. This is an opportunity to both educate people on environmental issues and the benefits of green building and listen to their experiences and concerns.

A good outreach effort involves both internal and external stakeholders.

As with the process of creating green buildings, early collaboration generates better results. Engaging in an open dialogue with these stakeholders will enhance the resulting program and give policymakers confidence about the feasibility of the proposed green building program and show that it has the support of the development community.

### Form the Green Building Team and Green Ribbon Committee

A staff Green Team, composed of city staff members that are developing the program, should meet regularly to discuss how the program would impact various city departments and existing project review and permitting procedures. Representatives from planning, public works, the city manager, and the building department should be included.

### Examples of Stakeholders

#### Internal Stakeholders

- Municipal employees from departments such as planning, environment, building and safety, recycling, waste management, public works, parks and recreation
- City Council and Planning Commissioners
- Staff responsible for designing and constructing municipal projects
- County Board of Supervisors
- City Manager's Office

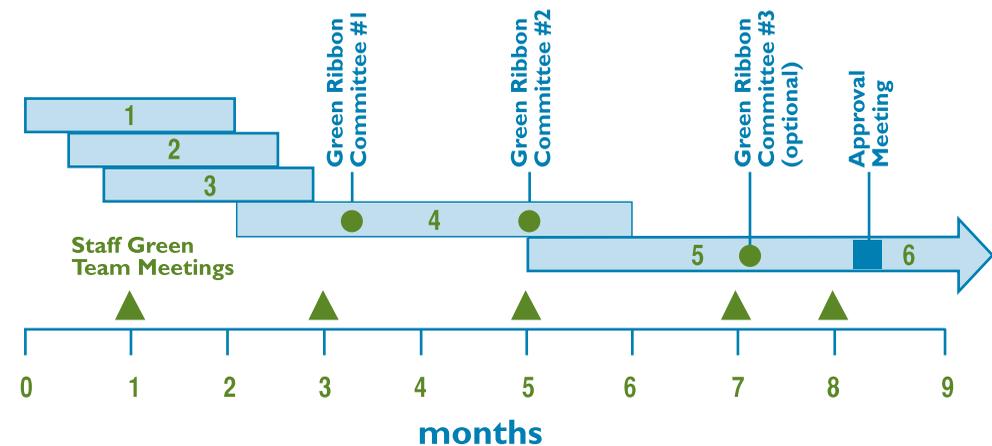
#### External Stakeholders

- Developers of residential and commercial properties
- Local contractors, builders and engineers
- Architects and designers
- Local suppliers of materials
- Local utility staff
- Energy and construction-related consultants
- Residents and property owners
- Local business owners
- Environmental advocates
- Community groups

The Green Ribbon Committee, composed of external stakeholders, should meet at least three times during the program development process. This will increase buy-in by keeping the process open, and by offering opportunities to help shape the green building program through feedback and commentary.

A good example of this outreach approach was used in the City of West Hollywood, California. The City formed both a "Green Building Team" composed of city staff, and a "Green Ribbon Committee" composed of external stakeholders. These two stakeholder groups helped to identify the goals, limitations and priorities of the program that was developed through a series of meetings and facilitated discussions over a nine month period.

### Typical Timeline



### Hold Green Ribbon and Green Team Meetings

#### Green Ribbon Meeting #1: Information Sharing

The first meeting also offers an opportunity to educate those unfamiliar with green building and share information between program developers and stakeholders. Information gleaned from analyzing existing policies, past construction trends, current building types and the format of other guidelines should be presented for discussion. Discussion should focus on critical local environmental issues (i.e. solid waste management, storm water management, energy conservation), current development trends, and approaches utilized by other local governments in establishing green building programs.

# 4

## OUTREACH TO STAKEHOLDERS

### Green Ribbon Meeting #2: Initial Proposals

The second meeting should focus on reviewing a draft version of the green building program and discussing its framework, guidelines, and incentives.



### Green Ribbon Meeting #3: Program Revisions

A third meeting should be held to review any modifications that have occurred to the proposed green building program. A fourth meeting can be held if needed to gain consensus on final details.

It is important to maintain communication with the Green Ribbon Committee, as they will be effective advocates when the program is presented for adoption. For example, Green Ribbon members may want to speak at Planning Commission, City Council, or other public meetings in favor of the program or provide context on program development to elected officials or the media.

### Staff Green Team Meetings

This group should meet as needed in a parallel schedule to the Green Ribbon Committee, to review analysis and public input, develop the proposed program structure, make suggestions on guidelines, and review issues of concern prior to the Green Ribbon Committee meetings.

At a minimum, at least two meetings should be scheduled during Steps 1-3, prior to each Green Ribbon Committee meeting, and at least once during Step 5.

# STEP 5

## DEVELOP GUIDELINES & GREEN BUILDING PROGRAM FRAMEWORK

### KEY ISSUES

**How should the program link to and be consistent with local ordinances, policies and programs?**

**What thresholds for participation should be established?**

**What guidelines should be used?**

**What departments and staff should be responsible?**

**Will the program be mandatory or voluntary?**

### *Setting up the program to reflect local needs and complement existing procedures sets the stage for effective implementation.*

In developing the program framework the issues include what building sectors to target, which guidelines to use, what are the thresholds for participating, incentives, and responsibility for administration.

Input gathered in earlier steps will help you to develop the program structure. For example, if Step 1 shows that there is an established set of ordinances, codes or other policies that relate to green building, these can be the basis of the program framework. If no such structure currently exists, the green building program should be developed independently. Step 2 shows that the majority of projected growth is in the commercial sector, then developing guidelines and incentives for commercial buildings should be prioritized.

Likewise, if stakeholder feedback conducted in Step 4 reveals that area developers have a strong interest in “fast track” permitting versus other incentives, that option should be given highest priority.

### Thresholds

The thresholds should address specific sectors (such as residential, commercial, and institutional) and what sizes of buildings will be mandatory and voluntary. Ideally, these thresholds should be consistent with existing procedures, such as the project size that requires a conditional use permit, a development agreement, or other municipal review and approval.

# STEP 5

## DEVELOP GUIDELINES & GREEN BUILDING PROGRAM FRAMEWORK

### Sample Framework

This chart offers a snapshot of the various elements that should be incorporated into your municipalities green building program, and includes typical thresholds and guidelines for various building types.

BUILDING TYPE	MANDATORY or VOLUNTARY	THRESHOLD	GUIDELINE	REQUIREMENT/ CRITERIA
Municipal Buildings	Mandatory Voluntary	> 5,000 sq. ft. < 5,000 sq. ft.	LEED-NC, EB & CI LEED-NC, EB & CI	LEED Silver Register w/LEED Complete & submit LEED checklist w/building permit
Commercial & Mixed-Use	Mandatory Mandatory	>100,000 sq. ft. >10,000 sq. ft.	LEED-NC, EB & CI LEED-NC & CI	LEED Certified Register w/LEED Complete & submit LEED checklist w/building permit
Multi-Family Residential	Mandatory	> 75 units	LEED-NC or LEED-Home	LEED Certified
Multi-Family Residential	Mandatory	>10 units and 4 stories & above	LEED-NC or LEED-Home	Register w/LEED Complete & submit LEED checklist w/building permit
Multi-Family Residential	Voluntary	4-10 units, 3 stories or less	Energy Star plus locally developed	Verification from a Home Energy Rater (HERS)
Tenant Improvements	Voluntary	>10,000 sq. ft. & requiring building permit	LEED	Register w/LEED Complete & submit LEED checklist w/building permit
Single-Family Residential/New Construction and Remodeling	Voluntary	n/a	Locally Developed Resource Guide	None

### Guidelines

The green building guidelines are the foundation of the program and therefore should be:

- Relevant to local conditions
- Consistent with existing policies and programs
- Compatible with rebates and incentives
- Supported by outreach and education programs

Ideally, existing guidelines can be used, thus shortening the program development period. But, after evaluating existing guidelines in Step 3 and Step 4, you may find that it best suits your city's needs to develop guidelines that address specific local development practices.

### Incentives

With a mandatory approach, incentives are not needed. If the program is voluntary, incentives are a must.

Developers typically view expedited processing as the most valuable incentive. But providing preferential treatment during the permitting process is not always possible due to staffing. More importantly, it is difficult to expedite processing consistently in all departments. Other possible incentives are reduced permit fees, the most common being a waiver of the energy-related review. Other incentives include property tax reductions, density or floor area ratio bonuses,

and parking reductions. Finally, public recognition through awards programs, articles in the local newspaper, and visits to the project by the mayor or other elected officials can be valuable from a marketing perspective, for both the project and for the developer. The heightened attention can increase sales or accelerate the lease-up period.

Providing incentives demonstrate to the public that the city or county is supportive of green building and is actively encouraging the recommended green building practices. Finally, incentives help offset the costs of the learning curve while builders begin to understand the nuances of the program.

### FINANCIAL INCENTIVES

#### State of Maryland Tax Credit

Maryland green building tax credit worth up to 8% of the total construction cost of a building. Buildings must be located in a priority funding area and at least 20,000 square feet. The tax credit uses the U.S. Green Building Council's LEED rating systems (i.e. LEED-NC, LEED-EB, LEED-CS and LEED-CI) as standards.

#### City of Santa Monica Grants

The city of Santa Monica's Green Building Program offers grants for new private sector buildings certified to LEED standards. Grants start at \$20,000 for a LEED-certified building and increase up to \$35,000 for LEED Platinum. All new construction and major renovation projects that fall in the commercial, affordable housing, mixed-use, and multifamily residential categories are eligible.

### Start-Up, Administrative and Marketing Costs

The type and intensity of the program directly impacts implementation costs. For example, the costs for a voluntary program based on existing guidelines will have low start-up costs, low administrative costs, and moderate education and marketing costs. An intensive program, with locally developed mandatory requirements and verification, will have high up-front and administrative costs, but lower marketing costs.

Start-up costs include printing and distributing the guidelines, holding workshops to introduce the program, and training staff. These costs can range from \$5,000 - \$20,000 depending on the type of printing, number of staff to be trained, and number and type of workshops.

Ongoing costs include salaries for current or new staff to support the program, any financial incentives, staff or consultant time to update the guidelines, reprinting, program marketing, and conducting future workshops.

Carefully consider what additional staff or consultants will be required to carry out the work effectively and what the additional staff costs will add up to over time. Ongoing costs can range from \$5,000 - \$10,000 annually for a program with limited staff support to over \$100,000 annually for a program with a dedicated staff person.

Funding the program offers an additional opportunity to gain internal buy-in and support. For example, if the funding comes from different departmental budgets, each department has a vested interest in the success of the program and will stay engaged.

# STEP 5

## DEVELOP GUIDELINES & GREEN BUILDING PROGRAM FRAMEWORK

### GREEN PROJECT EXAMPLES



#### **Municipal - Transit Maintenance Facility, Santa Clarita, CA**

This 11.8-acre project includes bus storage, maintenance facilities and office buildings. The project, which is aiming for LEED certification, uses straw bale insulation for increased energy efficiency and includes a photovoltaic canopy to reduce energy consumption.



#### **Commercial & Mixed-Use – Tricom Building, Pasadena, CA**

The first private sector, privately funded, LEED Silver Certified project in the San Gabriel Valley.

This building receives more than 50% of its electricity from solar power and uses recycled or reused materials throughout. The building is used for offices, warehouse and showroom space.

#### **Residential - Terramor Village, Ladera Ranch, CA**

Terramor Village in Southern California is one the country's largest examples of green residential development. For-sale single-family homes and townhomes built to Energy Star standards. Buyers can opt to increase the "green-ness" of their home through packages of upgrades that offer a selection of green finishes and features to be included in the home.

The following are examples of how guidelines can be applied to common building types:

#### **Municipal Projects**

Over 50 municipalities in the United States have decided to hold themselves to a high standard by adopting the LEED rating system for their own developments. Some examples of public buildings that were built to LEED standards include Santa Clarita's (California) Transit Maintenance Facility, the Scottsdale (Arizona) McDowell Village Senior Center, and the new Seattle City Hall.

#### **Commercial & Mixed-Use**

Most cities initially turn to LEED for private sector commercial and mixed-use projects. However, concerns with the administration and costs of the LEED certification process are often raised. Some local governments encourage projects be built to LEED standards by requiring registration but leaving certification (final verification that the building meets LEED standards) up to the developer. LEED is frequently required for large projects as part of the development agreement and recommended for smaller projects and tenant improvements. Examples of green commercial and mixed-use buildings include the Natural Resources Defense Council offices in Santa Monica, the Genzyme Center in Massachusetts, a Whole Foods Market in Sarasota, FL and the Tricom building in Pasadena.

#### **Residential**

Some examples of green building guidelines that apply to residential construction include Alameda County Waste Management Authority's New Home Green Building Guidelines, Built Green Colorado, Earth Craft, and LEED for Home. Your local government will need to decide if green building guidelines will be mandatory or voluntary for residential construction, and if they will address both new construction and remodeling projects. Green residential projects include custom-built homes, multi-family homes, single-family production, and remodeling.

# STEP 6

## IMPLEMENTATION: ADOPTION, PHASING, & TRAINING

### *A well-developed and thorough implementation plan is critical to program success.*

Implementing the program involves gaining approval from the city council, training and hiring staff, preparing outreach and education materials, and offering workshops and other green building events for the community at large.

A well-developed plan for launching the program includes:

- Adoption
- Phasing of the components
- Training staff
- Providing a source of funding for marketing and incentives
- Preparing for future revisions and improvements.

#### **Program or Policy Adoption**

Gaining support from the local governing body lays the foundation for successful implementation. Conducting a study session to "demystify" green building early in the process can set the stage for a good reception by the city council when it is time to present an ordinance or resolution.

A study session provides time to introduce the council to the language and benefits that green building offers to your city, and to address any concerns prior to requesting approval of a specific ordinance or resolution. This is particularly important for a city council that has not previously dealt with green building issues and may lack familiarity with the topic.

Council support can take the form of a general green building resolution or a specific ordinance. For voluntary measures, clear direction from the city council enables staff to move forward with confidence. For mandatory measures, an ordinance is essential.

#### **Phasing**

The capacity of staff to manage and incorporate the green building program into their workflow is a key to determining when and how each segment of the green building program should be implemented.

Most cities start the program by announcing that an upcoming public project will be built to green standards, then initiating the private sector portion.

#### **Training and Workshops**

When the green building program is ready to be implemented, builders, developers, homeowners, city or county staff, and the general public will need to be trained on any new technologies, methods, materials or processes.

### KEY ISSUES

What existing staff need training?

Are new staff members required?

Who will administer the program?

What is the funding source for the program?

What ongoing resources and support are needed?

From the outset, it is critical that staff be fully prepared to provide guidance on the new program. Training on any new permitting or application review procedures should be a top priority.

Workshops for the general public can offer topics like “Green Building 101” to familiarize people with the terminology and details of green building. Other workshops can delve into the nuances of the green building program and still others can offer specific technical training for designers and builders. These workshops also provide an opportunity to stay connected with the stakeholders and offer assistance in bringing builders up to speed.

In offering workshops, first determine if your city possesses the requisite knowledge in-house, or if there are local resources to assist you. To locate such resources, consult the U.S. Green Building Council’s website (see Appendix); the “Membership” section can help you identify member consultants in your area. Your local utility also may know of consultants knowledgeable about green building.

### Educational Materials

Developing effective educational materials to hand out at the building permit center and other prominent locations is an important part of the marketing strategy. There are many examples of brochures and handouts that can serve as a model. As a growing number of municipalities adopt green building programs; many of them have placed informational materials (as well as guidelines, case studies, and other information) on their websites. Examples include the City of Seattle, WA, the City of Santa Monica, CA, the City of Austin, TX, Arlington County, VA and Sarasota County, FL.

### Marketing the Program

In addition to providing general information about green building and the specific green building program a city has created or adopted, it is important to dedicate time and resources to growing the public perception of the program. Developing and distributing consistent outreach materials to promote the program is an important step in building and maintaining a brand for the program.

Using a consistent name and logo in marketing the program is essential. A good marketing approach is also a communication tool to inform developers about the incentives offered.

The following are examples of local government green building logos:



## Green Building Basics

**Global Green USA – Green Building Resource Center**  
[www.globalgreen.org/gbrc](http://www.globalgreen.org/gbrc)

**US Green Building Council**  
[www.usgbc.org](http://www.usgbc.org)

**GreenerBuildings.Com**  
[www.greenerbuildings.com](http://www.greenerbuildings.com)

**Environmental Building News**  
[www.buildinggreen.com](http://www.buildinggreen.com)

**Healthy Building Network**  
[www.healthybuilding.net](http://www.healthybuilding.net)

**Environmental Design & Construction Magazine**  
[www.edcmag.com](http://www.edcmag.com)

**Green Home Guide**  
[www.greenhomeguide.com](http://www.greenhomeguide.com)

**Rocky Mountain Institute**  
[www.rmi.org](http://www.rmi.org)

**Natural Resources Defense Council**  
[www.nrdc.org/cities](http://www.nrdc.org/cities)

## Tools for Building Green

**Construction Waste Calculator**  
[www.wastematch.org/reuse/calculator.htm](http://www.wastematch.org/reuse/calculator.htm)

**BEES (Building for Environmental & Economic Sustainability)**  
[www.bfrl.nist.gov/oae/software/bees.html](http://www.bfrl.nist.gov/oae/software/bees.html)

**Whole Building Design Guide**[www.wbdg.org](http://www.wbdg.org)**California Integrated Waste Management Board Sustainable Building Tool Kit**[www.ciwmb.ca.gov/GreenBuilding/](http://www.ciwmb.ca.gov/GreenBuilding/)**EarthCraft House**[www.earthcrafthouse.com](http://www.earthcrafthouse.com)**Materials and Products****GreenSpec Directory--BuildingGreen's product directory**[www.buildinggreen.com](http://www.buildinggreen.com)**Environmental Home Center**[www.environmentalhomecenter.com](http://www.environmentalhomecenter.com)**Oikos - Green Building Products and News**[www.oikos.com](http://www.oikos.com)**Energy****U.S. Department of Energy - Energy Efficiency & Renewable Energy**[www.eere.energy.gov/buildings](http://www.eere.energy.gov/buildings)**Home Energy Saver**[www.homeenergysaver.lbl.gov](http://www.homeenergysaver.lbl.gov)**Energy Star**[www.energystar.gov](http://www.energystar.gov)**Leadership in Energy & Environmental Design (LEED)**[www.usgbc.org/LEED](http://www.usgbc.org/LEED)**Alameda County Waste Management Authority**[www.stopwaste.org](http://www.stopwaste.org)**Collaborative for High-Performance Schools (CHPS)**[www.chps.net](http://www.chps.net)**Green Communities Initiative**[www.enterprisefoundation.org/resources/green](http://www.enterprisefoundation.org/resources/green)**Third Party Certified Materials & Products****Forest Stewardship Council**[www.fscus.org](http://www.fscus.org)**GreenGuard**[www.greenguard.org](http://www.greenguard.org)**Green Seal**[www.greenseal.org](http://www.greenseal.org)**Scientific Certification Systems**[www.scscertified.com](http://www.scscertified.com)**US Environmentally Preferable Products Database**[www.epa.gov/opptintr/epp](http://www.epa.gov/opptintr/epp)**Carpet and Rug Institute--CRI**[www.carpet-rug.com](http://www.carpet-rug.com)**California Integrated Waste Management Board Recycled-Content Product Database**[www.ciwmb.ca.gov/rcp](http://www.ciwmb.ca.gov/rcp)**Green Building Case Studies****California Integrated Waste Management Board**[www.ciwmb.ca.gov/GreenBuilding/](http://www.ciwmb.ca.gov/GreenBuilding/)

This website has links to case studies in California (by building type, including schools, public facilities, commercial buildings, etc.) and outside California, as well as links to other websites with case studies.

**American Institute of Architects Top Ten Green Projects**

<http://www.aiaopten.org/hpb/>

Annual selection by AIA's Committee on the Environment of the top projects in terms of resource and energy efficiency and other green design criteria. Winners are profiled online.

**American Institute of Architects Top Ten Green Projects**

<http://www.aiaopten.org/hpb/>

**Affordable Housing Design Advisor**

[www.designadvisor.org](http://www.designadvisor.org)

Resources and in-depth examples of affordable housing, with a section devoted to green affordable housing. Includes projects selected in the annual AIA Show You're Green Awards.

**Municipal Green Building Programs****City of Austin, TX**

[www.ci.austin.tx.us/greenbuilder](http://www.ci.austin.tx.us/greenbuilder)

**City of Santa Monica, CA**

<http://www.greenbuildings.santa-monica.org/>

**City of San Jose, CA**

<http://www.sanjoseca.gov/esd/natural-energy-resources/greenbuilding.htm>

**City of Seattle, WA**

[www.cityofseattle.net/sustainablebuilding/](http://www.cityofseattle.net/sustainablebuilding/)

**City of Scottsdale, AZ**

<http://www.scottsdaleaz.gov/greenbuilding/>

**Greenbuilder.com**

[www.greenbuilder.com/general/BuildingSources.html](http://www.greenbuilder.com/general/BuildingSources.html)

Greenbuilder.com has a list of government green building programs (state, county, city) as well as utility and building industry programs and rating systems.

**ABOUT GLOBAL GREEN USA**

Global Green USA is a national environmental organization addressing three of the greatest challenges facing humanity:

- Stemming global climate change by creating green buildings and cities
- Eliminating weapons of mass destruction that threaten lives and the environment.
- Providing clean, safe drinking water for the 2.4 billion people who lack access to clean water.

Through the Local Government Green Building Initiative, Global Green works in partnership with local governments and other public entities to demonstrate the benefits of green building, outline options for establishing green building programs that protect local quality of life and the environment, provide training for staff and constituents, and encourage the development of incentives for green building projects. Current and past partners include San Mateo County, the Los Angeles Unified School District, the Los Angeles Community College District and the Cities of San Francisco, Los Angeles, Santa Monica, West Hollywood, Santa Clarita, Pasadena, Irvine, and New Orleans.





# DEVELOPING GREEN BUILDING PROGRAMS



A STEP-BY-STEP GUIDE FOR  
LOCAL GOVERNMENTS

**ATTACHMENT**

**B**

# Summary of Green Building Guidelines

Mostly From  
Build It Green

1. **Community Design:**
  - a. Develop infill sites to preserve open space and green fields.
  - b. Cluster homes and build at higher residential densities to preserve open space.
  - c. Provide a diversity of residential unit types, design layouts to accommodate disabilities, and allow "granny flats" to make it more likely that residents can remain in their homes as they age.
  - d. Provide a mix of uses and services within a development area to reduce vehicle trips.
  - e. Provide pedestrian and bicycle links from residential areas to other uses to reduce vehicle trips and promote a healthy lifestyle.
  - f. Create an open community where doors and living areas face common areas and streets to promote safety through casual observation and community interaction.
  - g. Minimize the width of streets to limit impermeable areas and preserve open space.
2. **Site Planning:**
  - a. Recycle and/or reuse existing buildings onsite to reduce waste.
  - b. Retain existing specimen trees to provide shade and protect top soil.
  - c. Layout subdivisions and streets to optimize solar exposure for all homes.
  - d. Orient homes with their long axis running east-west and minimize east and west facing windows to improve passive solar performance.
  - e. Locate windows to catch prevailing winds and allow cross ventilation.
  - f. Incorporate roof overhangs, awnings, trellises, and shade trees to selectively control solar heat gain.
  - g. Use permeable paving wherever feasible to reduce off-site storm water run-off and pollution.
  - h. Design resource efficient landscapes and provide for storm water treatment through landscaped drainage swales.
  - i. Reduce light pollution to save energy and minimize neighborhood disruption.
3. **Foundation:**
  - a. Incorporate recycled flyash from coal-burning power plants or slag from steel plants into concrete mix and recycled rubber from tires into asphalt.
  - b. Design and build structural pest controls to prevent premature structural damage from termites.
  - c. Use recycled-content aggregate base wherever Class 2 aggregate is specified.
4. **Structural Frame:**
  - a. Apply optimal value engineering to reduce the amount of lumber used in a project and improve energy efficiency.
  - b. Use engineered lumber to reduce the amount of lumber used in a project and the longevity of a structure.
  - c. Use Forest Stewardship Council (FSC) certified lumber assures that the forest from which the wood was harvested is managed in a sustainable manner.

- d. Use solid wall systems such as structural insulated panels (SIPs) and insulated concrete forms (ICFs) for walls and roofs to enhance energy efficiency by improving thermal massing.
  - e. Reduce pollution entering the home from the garage by providing a tight seal and an exhaust fan.
  - f. Install overhangs and gutters to protect the structure from water intrusion to increase the lifespan.
  - g. Use recycled materials wherever possible.
5. **Exterior:**
- a. Use recycled content or FSC certified decking to conserve natural resources. If wood is going to be used outside the structure use treated wood that does not contain chromium or arsenic.
  - b. Use durable siding and roofing materials to extend the lifespan of the structure.
  - c. Use light colored roofing materials to reflect heat away from the home and reduce cooling costs.
6. **Insulation:**
- a. Install insulation that exceeds Title 24 requirements.
  - b. Utilize insulation with a high recycled content.
  - c. Utilize insulation that has low emissions of formaldehyde and other volatile organic compounds (VOCs) to enhance indoor air quality.
7. **Plumbing:**
- a. Locate the water heater close to the usage points to reduce heat loss in the pipes.
  - b. Provide on-demand hot water circulation pump for larger homes to reduce waiting time.
  - c. Utilize tankless water heaters for energy efficiency.
  - d. Insulate hot water pipes to reduce heat loss and promote energy efficiency.
  - e. Install only high efficiency toilets to conserve water.
8. **Heating, Ventilation, and Air Conditioning**
- a. Appropriately size the HVAC system for the home it is intended for to promote energy efficiency.
  - b. Install sealed combustion furnaces that utilize outdoor air instead of indoor air for combustion to safeguard indoor air quality.
  - c. Install HVAC unit and ductwork within conditioned space or place the ductwork under attic insulation to conserve energy.
  - d. Use duct mastic on all duct joints and seams to prevent conditioned air leaks and conserve energy.
  - e. Install ceiling fans instead of, or in addition to, air conditioning. Ceiling fans can draw warm air upward in the summer and push it downward in the winter. An average "whole house fan" uses one-tenth the electricity of an air conditioning system.
  - f. If air conditioning is going to be provided, install high efficiency air conditioning units with environmentally responsible refrigerants.
  - g. Install high efficiency HVAC filters to reduce indoor air quality problems.
  - h. Install exhaust fans in the kitchen and bathrooms that vent to the outdoors to reduce indoor moisture and indoor air quality problems.

- i. Don't install wood burning fireplaces and do not install gas fireplaces unless their listed efficiency exceeds 60%. Wood fireplaces are a source of indoor and outdoor air pollution. Most gas fireplaces are extremely inefficient and are mostly for decorative purposes.
- j. Install zoned, hydronic, radiant heating instead of force air systems for energy efficiency and comfort.

#### **9. Finishes**

- a. Use Low-VOC or Zero-VOC paint to reduce indoor air-pollution.
- b. Use Low-VOC, water based wood finishes to reduce indoor air-pollution.
- c. Use recycled-content paint to reduce waste.
- d. Use "environmentally preferable" materials that are recycled, reclaimed, FSC certified, or rapidly renewable resources such as bamboo.
- e. Use finger-jointed materials as this process uses wood efficiently and is highly durable.
- f. Use materials that produce low formaldehyde emissions to protect indoor air quality.

#### **10. Flooring**

- a. Use "environmentally preferable" materials that are recycled, reclaimed, FSC certified, or rapidly renewable resources such as bamboo.
- b. Use exposed slab-on-grade concrete as flooring to reduce material use.
- c. Use CRI Green Label Plus certified carpet to minimize VOC and formaldehyde emissions.
- d. Provide thermally massive floors such as wood and tile to reduce heating and cooling energy use.

#### **11. Renewable Energy**

- a. Plant deciduous shade trees along the east and west side of the building.
- b. Install solar water heating system to reduce energy use.
- c. Pre-wire for photovoltaic systems or
- d. Install photovoltaic system to reduce energy costs.

#### **12. Appliances**

- a. Install water and energy efficient dishwasher to reduce energy use by at least 25% and save water.
- b. Install water and energy efficient clothes washing machine to save up to 9,400 gallons a year.
- c. Install an ENERGY STAR certified refrigerator to reduce an annual household energy bill by 10% compared to a house with a standard refrigerator.

**ATTACHMENT**

**C**



**Build It Green**  
*Smart Solutions From The Ground Up*

2005 Edition

# NEW HOME CONSTRUCTION GREEN BUILDING GUIDELINES





2005 Edition

# **NEW HOME CONSTRUCTION GREEN BUILDING GUIDELINES**



## About Build It Green

Build It Green is a professional non-profit membership organization whose mission is to promote healthy, durable, energy- and resource-efficient buildings in California. Supported by a solid foundation of outreach and education, Build It Green connects consumers and building professionals with the tools and technical expertise they need to build quality green homes. Build It Green fosters collaboration with key stakeholder groups to accelerate the adoption of green building standards, policies, and programs.

In addition to providing these Guidelines for educational purposes, Build It Green offers the following companion resources at [www.BuildItGreen.org](http://www.BuildItGreen.org):

- Green Points calculator
- List of references for all Guidelines measures
- Innovation checklist for approaches beyond the measures described in the Guidelines
- Cross-referencing with other residential initiatives (e.g. ENERGY STAR® Indoor Air Package, LEED-H, CA Green Builder and the NAHB Guidelines)
- Addendums that explain how to use the Guidelines in conjunction with other programs
- Information about new practices and materials or corrections that are identified after publication

## Disclaimer

*These Guidelines are provided exclusively for general education and informational purposes and as a public service of Build It Green, a California non-profit corporation registered under Section 501(c)(3) of the Internal Revenue Code. Build It Green authorizes you to view these Guidelines for your use and to copy any part of them as-is. In exchange for this authorization: (i) you agree not to alter, sell or publish the Guidelines in any way without first receiving written permission from Build It Green; and (ii) you waive, release and covenant not to sue Build It Green and all others affiliated with developing these Guidelines from any liability, claims and actions, both known and unknown, for any losses, damage or equitable relief you may now have a right to assert or later acquire, arising from such use or reliance on the Guidelines. Unauthorized use of these Guidelines is prohibited and a violation of copyright, trademark and other laws.*

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# Foreword

These residential Guidelines were developed for the following reasons:

- To provide local governments with an educational tool for city staff, builders and homeowners interested in green residential construction
- To present a range of voluntary measures for builders to choose from when constructing a green home in California
- To create a policy foundation for local governments interested in implementing a green building program
- To establish regional consistency in green building guidelines to increase predictability for builders
- To integrate varying residential initiatives in order to achieve greater simplicity and local applicability
- To offer a set of guidelines developed by an independent, third-party source.

## Guidelines Development Process

The New Home Construction Guidelines were developed through a collaborative process that included the following steps:

These guidelines are based on the Alameda County New Home Construction Green Building Guidelines, which were first developed in 2000 through a collaborative process and public-private partnership among builders, green building experts, and local government staff in Alameda County. Representatives from major production builders, including Centex Homes, Greenbriar Homes, Ponderosa Homes, Pulte Homes, Shea Homes, Signature Properties, Silverwood Homes, and Toll Brothers, provided input and direction in the development of the original Guidelines.

The Guidelines were updated in 2005 to expand its applicability throughout California, address changes in Title 24, and incorporate measures from other residential green building initiatives such as the California Green Builder program, National Association of Home Builders guidelines, and the pilot draft LEED for Homes checklist.

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Build It Green—a professional non-profit organization whose mission is to promote green building in California—expanded and facilitated the stakeholder process to include input from its various councils, including the Public Agency Council, Builders Council, Non-Profit Network, and Suppliers Council.

Publicly available information, scientific data, and third-party standards were referenced in the development of these Guidelines. The Guidelines are intended to be a living document, and will be regularly updated as additional technical and quantitative information becomes available, measurement tools such as Life Cycle Assessment become more accessible, and new green measures are developed.



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# Chapter One:

## Overview of Green Building

*“As our population along the coast increases, our resources are decreasing and it is only responsible to build homes that use less water and energy if the technology is available and cost-effective.”*

—Amy Christopherson Bolten, Christopherson Homes

### Overarching Principles of Green Building

1

Build for the long-term  
Build durable homes & livable communities.

2

Build for our children  
Make their homes, communities & environment safe.

3

Build for the planet  
Use natural resources wisely.

# Introduction

In response to growing concerns about building quality, health, quality of life, energy costs and dwindling natural resources, an increasing number of California homebuilders are embracing “green building.” This holistic approach to homebuilding emphasizes quality construction, energy efficiency, good indoor air quality and livable neighborhoods. As you’ll discover in these Guidelines, green building provides myriad benefits to California’s homebuilders, homeowners and communities.

## Does green building really matter?

Green building means improving our design and construction practices so that the homes we build today will last longer, cost less to operate, and won’t harm people’s health. It also involves protecting natural resources and improving the built environment so that people, communities and ecosystems can thrive and prosper.

With the budget and time pressures we’re all under today, is it really worth the extra effort? Increasingly, builders, developers, real estate professionals, policy-makers and homeowners agree that it is worth the effort. Better homes, it turns out, are also better for business. Developers, builders and other real estate professionals who follow “building as usual” practices may find themselves at a competitive disadvantage as regulatory and market forces shift the industry toward built environments that are healthier, more resource efficient and less polluting.

Green building is gaining momentum in California, and for good reason. To meet expected population growth between now and 2020, approximately 220,000 housing units need to be added annually. That’s 3.3 million homes over the next 15 years.

Imagine the demands that all those homes will put on our water and energy supplies, forests, farmlands, recreational areas, roadways and municipal infrastructure.

Green building offers solutions to meeting those demands while minimizing environmental impacts. By building durable, healthy homes that consume less energy, water and other resources, today’s green homebuilders are helping to safeguard the well-being and prosperity of Californians today and for decades to come.

# Fundamental Objectives of Green Building

There's nothing mysterious about green building—it's really just applied common sense. To move forward with greening your construction project, it is helpful to think of green building as quality design and construction achieved through the convergence of four fundamental objectives:

1. Conserve natural resources
2. Use energy wisely
3. Improve indoor air quality
4. Plan for livable communities

## Conserve natural resources

Conventional building construction and operation consumes large quantities of wood, water, metals, fossil fuels and other natural resources. Even though the majority of the materials used to build a home are put to good use, vast quantities of resources are wasted. In fact, building an average 2,000-sq. ft. house produces about 7,000 pounds of waste.

Much of this waste is avoidable. Careful management of the construction process makes a big difference. There are also many well-established homebuilding practices that help protect natural resources. For example, advanced framing techniques can substantially reduce lumber requirements without compromising structural integrity. Using engineered lumber and wood products certified by the Forest Stewardship Council can help protect old-growth forests.

There are many effective building strategies that conserve natural resources, as well as provide benefits such as cost savings. These include using durable products such as roofing materials with 40- or 50-year warranties, and specifying recycled-content products that divert waste from landfills. Recycled-content decking, reclaimed lumber and other products put waste to good use, while providing quality and durability that

often exceed conventional materials. For example, decking materials made of recycled plastic mixed with wood waste fibers can last up to five times longer than wood decking, and never needs to be treated or painted.

Water is another critical resource. California residences use 5.6 million acre-feet of applied water annually. Our prosperity and ability to meet the needs of our growing population hinge on having adequate supplies of clean, fresh water. Homes built and landscaped to use water wisely make a tremendous contribution to protecting our shared resources. An added benefit is lower expenses for the homeowner. Today's builders can take advantage of a new generation of cost-effective, high efficiency appliances and landscape water management systems.

## Use energy wisely

New houses in California must be built to the most stringent energy code in the country, but given the state's projected population growth, even this may not be enough to keep demand for energy in check. Generation and use of energy are major contributors to air pollution and global climate change. With homes accounting for roughly 31% of the electricity consumed in the state, it is clear that homebuilders have a significant role to play in helping our society address energy-related concerns now and in the coming decades.

Energy efficiency is the cornerstone of every green home. Improving energy efficiency and using renewable energy sources are effective ways to reduce the potential of energy supply interruptions, improve air quality, reduce the impacts of global warming, and slow the rate at which we need to build new power plants.

Energy efficiency also makes good sense for homeowners: an energy-efficient house saves money by reducing utility bills year after year, and provides other valuable benefits. Better insulation, for example, reduces uncomfortable drafts, and double-pane windows make for a quieter home.

### Improve indoor air quality

On average, Americans spend 90% of their time indoors, yet the air in new homes can be ten times more polluted than outdoor air, according to the U.S. Environmental Protection Agency. Children are particularly vulnerable when it comes to air pollution. A report in the New England Journal of Medicine states that 40% of children will develop respiratory disease, in part due to the chemicals in their homes.

A common source of indoor air pollution is the off-gassing of chemicals found in many building materials. Kitchen cabinets, countertops, shelving and furniture may be made from particleboard or medium density

fiberboard. These pressed-wood products are typically made with adhesives that release urea formaldehyde—a known human carcinogen—into the home for years after installation. Also, many paints, floor finishes, adhesives and sealants emit unhealthy volatile organic compounds (VOCs). That “new house smell” is a telltale sign that there are harmful chemicals in the indoor environment.

Fortunately, the building products industry is responding to these indoor pollution problems by developing safer products, including low-VOC paints, cleaners and adhesives. These products are now commonly available from most major suppliers at costs comparable to conventional products. California also now has specifications available for some materials to assure that they are low emitting and safe.

Poor indoor air quality is also often caused by biological contaminants, such as mold that grows as a result of moisture infiltration due to inadequate ventilation, poor design and maintenance, and other factors. Dust, another major source of air pollution inside homes, can be reduced by installing permanent front door walk-off mats and by using hard surface flooring materials such as natural linoleum, bamboo, wood or wood alternatives, or concrete.

Pleasant Hill CoHousing Common House, Pleasant Hill, CA.



## Plan for livable communities

California's homebuilders and homebuyers are making decisions today that will affect the quality of our lives for decades to come. New construction, whether of a single home or a large development, contributes to the state's economic vitality and helps meet our pressing need for more housing. At the same time, every new home places additional demands on our supplies of land, water and energy, and on our infrastructure of roads, sewers and other services.

Green building offers homebuilders, community leaders and California residents sensible solutions that improve an individual home's performance and provide broad-based community benefits. These benefits range from cleaner air to reduced traffic congestion, from more appealing recreational opportunities to greater economic vitality.

For local municipalities, green building can provide many economic benefits. Developments designed to reduce dependence on cars help ease traffic congestion, which can improve business productivity. Mixed-use developments encourage economic vitality and a diversified municipal tax base. Infill projects help revitalize older urban areas and allow public funds to be used for upgrading existing services such as schools, transit and sewers, rather than diverting limited funds to the development of new services.

For California residents, developments designed to cluster homes help preserve open space for recreation,

views and natural habitats. Pedestrian- and bicycle-friendly neighborhoods provide people with opportunities to exercise and get to know their neighbors. Higher density urban infill developments allow people to live closer to where they work, shop and go to school, which means less time spent driving and more time for family, community and personal activities.

Clearly, green building cannot solve all the social, economic or environmental challenges facing California's communities. Still, green building gives homebuilders a valuable set of strategies for meeting residents' expectations for livable, healthy, sustainable communities.

Centex Homes, PowerSave Plus home at Lunaria in Windemere, San Ramon.



# The House as a System

A house is an intricate system made up of interdependent components. Changing one aspect of this system can create a ripple of effects in other areas. Builders were reminded of this when they began building tighter houses in the 1970s in response to rising energy costs. Tightly sealing the thermal envelope reduced heating and cooling costs but sometimes had unintended results, such as increased indoor air pollution due to inadequate ventilation or problems with mold due to moisture trapped within the structure.

The solution was not to return to the days of leaky, uncomfortable houses that wasted energy. Instead, what grew out of this experience was a new approach to home building, called the whole-house systems approach. In collaboration with building-science researchers, home-building associations and government agencies such as the U.S. Department of Energy's Building America program, many home builders across the nation are now successfully using this approach. It emphasizes strategic planning, systems analysis, and testing and verification to ensure that improvements in one area won't jeopardize health, safety, affordability, durability, profitability and other vital concerns.

Ideally, home builders should incorporate green building into their practices as part of this whole-house systems approach. This requires taking into account the interaction of many factors: the building's structure and thermal envelope; heating, cooling, water heating and electrical systems; renewable energy systems; the site's climate, topography, landscaping and surrounding structures; aesthetics; health and safety requirements; and how the occupants will use the house.

For example, a green builder concerned with improving the performance of the whole house will not merely select a more energy-efficient heating and cooling system and call it a day. Instead, the builder will look for opportunities to improve the thermal envelope and decrease heating and cooling loads, such as by reducing air leakage, designing and locating ductwork to minimize energy losses, increasing insulation, and choosing low-e windows. These improvements may allow the use of significantly smaller—and less costly—heating and cooling systems. Properly sized HVAC systems also lower the owner's energy costs and provide greater comfort.

According to Building America, a whole-house systems approach can reduce the energy consumption of new houses by as much as 40% with little or no effect on the cost of construction. Usually the decisions made as part of a whole-house approach yield multiple benefits.

For example, framing the home with 2x6 studs spaced at 24 inches allows increased insulation compared to conventional 2x4 studs spaced at 16 inches. Increased insulation saves heating and cooling energy and improves comfort. Also, as mentioned above, it may allow the downsizing of heating and cooling equipment. What's more, the 2x6 framing technique reduces wood use and labor costs.

The whole-house systems approach requires that the design and construction process be highly integrated. This involves:

- Careful planning and attention to detail from the outset of design through all the phases of construction.
- Understanding of building science principles, including the principles of air, heat and moisture flow.
- Good communication among the entire team, including the developers, architects, engineers, builders, trade contractors, and material suppliers.
- Proper sequencing of decision-making and building activities throughout the entire design and construction process.
- Adequate training and supervision to ensure quality construction.
- Testing and verifying performance during and after construction, and establishing a feedback loop to improve future designs based on the testing results.

Building America provides detailed information about the whole-house systems approach on their website, [www.eere.energy.gov/buildings/building\\_america](http://www.eere.energy.gov/buildings/building_america).

It's no coincidence that green homes designed with a whole-house systems approach are better homes. Improving building performance takes time and care, but can significantly reduce energy needs, improve health and comfort, and reduce builder risk and cost.

# Cost Considerations

There are many reasons to build green. These include concern for the environment, desire for higher quality buildings, health considerations and interest in creating an environmentally friendly image for your business. Although some individual green building strategies may cost more, the benefits of adopting a green approach to homebuilding are remarkable.

## Balancing costs and benefits

These Guidelines recommend methods and materials that range in cost—some of them cost no more or even less than conventional options. In fact, when a home is designed from the outset to be green, it need not cost more than a conventionally built home. While not all measures recommended in these Guidelines will be applicable to your project, the measures included are relevant and reasonable for residential developments built today.

Some of the recommended measures do cost more initially, but this additional cost needs to be evaluated in the context of the longer-term benefits provided: utility cost savings, better indoor air quality for residents, healthier jobsites for workers, and longer building life. When considering green building measures, it is very important to balance upfront design, product and construction costs with these other significant benefits.

Pacific Gas and Electric Company  
WE DELIVER ENERGY™

**ELECTRIC ACCOUNT DETAIL**

Service ID #: 1239872345  
Billing Days: 29 days

Charges  
Rate Schedule: ENET B  
09/24/2003 - 10/22/2003  
Net Charges \$4.28

**TOTAL CHARGES \$4.28**

Usage Comparison	Days Billed	Kwh Billed	Kwh per Day
This Year	29	0	0.0
Last Year	19	0	0.0

Sample utility bill for a zero net energy home.

## How green building can reduce costs

While the health and environmental benefits of green building are well established, many people still assume that green building costs more. But taking a whole-house systems approach to green building, as described on the previous page, can actually reduce construction and operating costs compared to standard practice. This integrated approach to green building can help steer the design away from expensive solutions and toward cost-effective ones.

During schematic design, for example, the team might consider strategies such as simplifying a building's wall structure by changing the wall articulation to a flat wall with bolted-on overhangs and thick trim. Such a change can often save money and materials, but would be costly to do once construction documents were underway.

To give another example, a design team that takes a whole-house systems approach might recommend increasing the exterior wall thickness to accommodate more insulation, which could result in reducing the size and cost of the heating system.

The key to reducing costs is to evaluate opportunities as early as possible in the design process because the range of cost-effective solutions narrows as the design progresses. Consider framing techniques. During schematic design, the design team might decide to incorporate advanced framing techniques. These techniques, as described in the Guidelines, reduce wood and construction costs while maintaining structural integrity and meeting building code. But if framing changes aren't considered until much later in the design or construction process, significant cost- and resource-saving opportunities may be missed.

Green building is pushing the design and construction industry to do things that may be new, such as taking a whole-house systems approach to design and construction. Learning new practices sometimes involves an initial outlay of time and money. But green buildings are more than just buildings. They are the end result of a collaboration between people on all levels of design and construction who are committed to improving on past practices and improving homes for today and the future.

# Chapter Two:

## How to Start Building Green

These Guidelines are for developers, builders and homeowners planning to construct a single-family residential project in California. The Guidelines provide a range of green building practices that can be implemented by people who are new to green construction as well as those aiming for higher levels of building performance.

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*“Ponderosa Homes believes green homes are kinder to the environment and provide substantial economic and comfort benefits. Homeowners can expect lower utility bills, higher resale values and reduced maintenance.”*

—Dennis Swickard, Ponderosa Homes

# How to Start Building Green

For building professionals, building green involves 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 green strategies into your building process, the less it may cost you and the consumer in the long run.

Local governments can facilitate green building by providing educational opportunities and considering incentives for better quality construction. Builders value incentives that save them time in the development process or allow them to differentiate their homes in the marketplace. Incentives can include streamlined or expedited permitting, offering community recognition or partnering with organizations that offer consumer marketing programs.

## Taking steps toward building green

The measures in these Guidelines range from basic, common sense recommendations such as venting bathroom fans to the outside, to more sophisticated strategies such as installing renewable energy systems.

No matter where you are on the green building spectrum—from novice to expert—you will find resources, design ideas, and real-world advice that you can put to use today.

If you are new to green building, you can start taking steps right away toward creating healthier and more energy- and resource-efficient homes. Inside these Guidelines, you'll find many strategies that are easy to implement and add virtually no cost.

As your team's experience with green building grows, you'll likely find yourselves scaling up to even healthier and more effective design and construction practices. The Green Points checklist described in Chapter Three provides a very convenient way for you to track green features in a particular project, as well as benchmark your progress over time as you and your company gain experience with green building.

If you are experienced with building green homes, some of the approaches and practices recommended here may already be part of your daily practice. In that case, these Guidelines will help you employ more advanced green-building strategies that will reinforce your organization's leadership position.



# What's Inside the Guidelines

The measures in these Guidelines are listed in the Green Points checklist (Chapter 3) and described in detail in Chapter 4. The measures are grouped into sections corresponding to the various stages of construction. This organization will help you understand which green building measures can be incorporated at various points of a construction project. However, it's essential that each measure be considered and planned for holistically prior to designing a home.

The Guidelines include a few sidebars titled "Building Basics." These are green building practices that are required by California or local codes. They are included for educational purposes and are not listed in Green Points.

The sections are briefly summarized here:

**Community Design and Planning.** These measures are not part of the Green Points checklist because they may not be in the developer's or builder's control. This section includes strategies to help preserve open space; promote social interaction, physical activity and community safety; and make homes more accessible to people of all physical abilities.

- A. Site.** Site measures include recommendations for managing the construction process to minimize disruptions to the building site, reduce waste, and prevent pollution of air, soil and waterways.
- B. Landscaping.** These measures offer strategies to keep pollutants out of waterways, reduce water use, promote healthy soils, create fire-safe landscaping, and reduce excessive outdoor lighting.
- C. Foundation.** New-home builders have the opportunity to make the buildings green from the ground up. This section includes suggestions for incorporating recycled flyash in concrete, using frost-protected shallow foundations in cold climates, and installing radon-mitigation measures where appropriate.
- D. Structural Frame.** These measures address the building's structural frame, including the walls, floors and roof. Following these recommendations will result in more durable buildings that use energy and other resources more efficiently.
- E. Exterior Finish.** This section focuses on siding, roofing and decking materials that will hold up well for decades and help protect the home from moisture damage, fire, and general wear-and-tear.

- F. Plumbing.** This section addresses ways in which builders and homeowners can save water and energy by designing the plumbing system to reduce hot-water runs, insulating hot water pipes and installing water-efficient toilets.
- G. Appliances.** High efficiency residential appliances can significantly cut a home's energy and water use. This section recommends choosing dishwashers, clothes washers, and refrigerators that exceed minimum federal efficiency standards.
- H. Insulation.** The measures in this section encourage proper insulation installation techniques, and the use of insulation products with recycled content and low or no formaldehyde emissions.
- I. Heating, Ventilation and Air Conditioning.** These measures provide two main, and complementary, benefits: energy efficiency and better indoor environmental quality. Houses with high-efficiency heating and cooling equipment tend to be more comfortable. Effective ductwork and ventilation provide better indoor air quality.
- J. Building Performance.** This section provides cost-effective recommendations for designing and building high performance homes that meet or exceed the state's building energy efficiency standards.
- K. Renewable Energy.** These measures describe solar hot water systems that reduce water heating energy costs, and photovoltaic systems that generate electricity from sunlight.
- L. Finishes.** Many conventional interior materials, including particleboard, paints and sealants, offgas noxious chemicals into the home. Most of the measures in this section describe healthier options for paints, trim, cabinets and countertops that perform well and are readily available. Other measures promote environmentally preferable materials for interior finishes.
- M. Flooring.** This section provides recommendations for a wide range of finish flooring materials that are attractive, long-lasting and environmentally friendly.
- N. Other.** This section encourages innovative approaches to green building that go beyond the basic measures described in these Guidelines.

# Chapter Three:

## New Home Green Points

The Green Points checklist offers builders, homeowners and municipalities a tool to assess how environmentally friendly or green a home is. Green Points was developed with the cooperation of local builders, city planners and building officials. Each green measure has been assigned a Green Points value based on its benefits to the homeowners and the environment, as well as its ease of implementation. In the future, the checklist may be adjusted to reflect current best practices as well as new products and technologies.

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*“Centex Homes continues to pursue sustainable building methods and practices in all our Northern California neighborhoods. The Green Points Checklist provides a meaningful way to gauge our progress.”*

—Jeff Jacobs, Centex Homes

# New Home Green Points 2005 EDITION

The Green Points checklist is based on the various green features incorporated into the home. A home can be considered green if it earns 50 points or more, and meets the following minimum points per category:

Energy (11), Indoor Air Quality/Health (5), Resources (6), and Water (3). Additional points can be achieved from any category to add up to a total of 50.

POINTS PER CATEGORY		Community	Energy	IAQ/Health	Resources	Water
<b>A. Site</b>						
1.	Protect Native Soil and Minimize Disruption of Existing Plants & Trees					
	a. Protect Native Topsoil from Erosion and Reuse after Construction	1				1
	b. Limit and Delineate Construction Footprint for Maximum Protection					1
2.	Deconstruct Instead of Demolishing Existing Buildings On Site				3	
3.	Recycle Job Site Construction Waste (Including Green Waste)					
	a. Minimum 50% Waste Diversion by Weight (Recycling or Reuse)				Pre	
	b. Minimum 65% Waste Diversion by Weight (Recycling or Reuse) (total 2 points)				2	
	c. Minimum 80% Waste Diversion by Weight (Recycling or Reuse) (total 4 points)				2	
4.	Use Recycled Content Aggregate (Minimum 25%)					
	a. Walkway and Driveway				1	
	b. Roadway Base				1	
	<b>Site=Total 12</b>	<b>1</b>			<b>9</b>	<b>2</b>
<b>B. Landscaping</b>						
1.	Construct Resource-Efficient Landscapes					
	a. No Invasive Species listed by Cal-IPC are Planted					1
	b. No Species Will Require Shearing				1	
	c. 75% of Plants are California Natives or Mediterranean Species					1
2.	Use Fire Safe Landscaping Techniques	1				
3.	Minimize Turf Areas in Landscape Installed by Builder					
	a. All Turf Will Have a Water Requirement Less than or Equal to Tall Fescue					2
	b. Turf Not Installed on Slopes Exceeding 10% or in Areas Less than 8 Feet Wide					2
	c. Turf is <33% of Landscaped Area					2
	d. Turf is <10% of Landscaped Area (total 4 pts)					2
4.	Plant Shade Trees		1			1
5.	Implement Hydrozoning: Group Plants by Water Needs					1
6.	Install High-Efficiency Irrigation Systems					
	a. System Uses Only Low-Flow Drip, Bubblers, or Low-flow Sprinklers					1
	b. System Has Smart (Weather Based) Controllers					2
7.	Apply 2 inches Compost into the Top 6 to 12 inches of Soil					2
8.	Mulch All Planting Beds to greater of 2" or Local Water Ordinance					1
9.	Use Salvaged or Recycled-Content Materials for Non-Plant Landscape Elements (50% of elements use 50% or more recycled/salvaged material)				1	
10.	Reduce Light Pollution from Site Lighting by Shielding Fixtures and/or Directing Light Downward	1				
	<b>Landscape=Total 23</b>	<b>2</b>	<b>1</b>		<b>2</b>	<b>18</b>
<b>C. Foundation</b>						
1.	Incorporate Recycled Flyash in Concrete					
	a. 20% Flyash (total 1 points)				1	
	b. 25% Flyash (total 2 points)				1	
2.	Use Frost-Protected Shallow Foundation in Cold Areas (Climate Zone 16)				3	
3.	Use Radon Resistant Construction (In At-Risk Locations Only)			1		
	<b>Foundation=Total 6</b>			<b>1</b>	<b>5</b>	

POINTS PER CATEGORY	Community	Energy	IAQ/Health	Resources	Water
<b>D. Structural Frame and Building Envelope</b>					
1. Apply Optimal Value Engineering (Advanced Framing)					
a. 2x4 Studs at 24-Inch On Center Framing				1	
b. Door and Window Headers Sized for Load				1	
c. Use only Jack and Cripple Studs Required for Load				1	
2. Use Engineered Lumber					
a. Beams and Headers				1	
b. Insulated Engineered Headers		1			
c. Wood I-Joists or Web Trusses for Floors				1	
d. Wood I-Joists for Ceilings				1	
e. Engineered or Finger-Jointed Studs for Vertical Applications				1	
3. Use FSC Certified Wood					
a. Dimensional Studs (Minimum 40% - 2 pts; Min. 75% - 4 pts)				4	
b. Panel Products (Min. 40% - 1 pt; Min. 70% - 2 pts)				2	
4. Design Energy Heels on Trusses (75% of Attic Insulation Height at Outside Edge of Exterior Wall)		1			
5. Design Trusses to Accommodate Ductwork		1			
6. Use Oriented Strand Board (OSB)					
a. Subfloor				1	
b. Sheathing				1	
7. Use Recycled-Content Steel Studs for 90% of Interior Wall Framing				1	
8. Use Solid Wall Systems (Includes SIPs, ICFs, and Any Non-Stick Frame Assembly)					
a. Floors		2		2	
b. Walls		2		2	
c. Roofs		2		2	
9. Thermal Mass Walls: 5/8-Inch Drywall on All Interior Walls Weigh More than 40 lb/ft <sup>3</sup>		1			
10. Design and Build Structural Pest Controls					
a. Install Termite Shields and Separate All Exterior Wood-to-Concrete Connections by Metal or Plastic Fasteners/Dividers				1	
b. All New Plants Have Trunk, Base, or Stem Located At Least 36" from Foundation				1	
11. Reduce Pollution Entering the Home from the Garage					
a. Tightly Seal the Air Barrier between Garage and Living Area			1		
b. Install Separate Garage Exhaust Fan			1		
12. Install Overhangs and Gutters					
a. Install 16-Inch Overhangs and Gutters (total 1 points)				1	
b. Install 24-Inch Overhangs and Gutters (total 2 points)		1			
<b>Structural Frame and Building Envelope=Total 38</b>		<b>11</b>	<b>2</b>	<b>25</b>	
<b>E. Exterior Finish</b>					
1. Use Recycled-Content (No Virgin Plastic) or FSC-Certified Wood Decking				2	
2. Install a Rain Screen Wall System				2	
3. Use Durable and Non-Combustible Siding Materials				1	
4. Select Durable and Non-Combustible Roofing Materials				2	
<b>Exterior Finish=Total 7</b>				<b>7</b>	
<b>F. Plumbing</b>					
1. Distribute Domestic Hot Water Efficiently					
a. Insulate Hot Water Pipes from Water Heater to Kitchen					1
b. Insulate All Hot Water Pipes or Install On-Demand Hot Water Circulation System in Conjunction with F.I.a.		1			1
c. Locate the Water Heater within 25 Feet of All Fixtures					1
d. Use Engineered Parallel Piping		1			
2. Install Only High Efficiency Toilets (Dual-Flush or <=1.3 gpf)					3
<b>Plumbing=Total 8</b>		<b>2</b>			<b>6</b>

POINTS PER CATEGORY		Community	Energy	IAQ/Health	Resources	Water
<b>G. Appliances</b>						
1.	Install ENERGY STAR® Dishwasher					
	a. ENERGY STAR®		1			
	b. Dishwasher Uses No More than 6.5 Gallons/Cycle		1			1
2.	Install ENERGY STAR® Clothes Washing Machine with Water Factor of 6 or Less		1			3
3.	Install ENERGY STAR® Refrigerator					
	a. ENERGY STAR®: 15% above Federal Minimum		1			
	b. Super Efficient Home Appliance (SEHA) Tier 2: 25% above Federal Minimum		1			
4.	Install Built-In Recycling Center				2	
<b>Appliances=Total 11</b>			<b>5</b>		<b>2</b>	<b>4</b>
<b>H. Insulation</b>						
1.	Install Insulation with 75% Recycled Content					
	a. Walls and/or Floors				1	
	b. Ceilings				1	
2.	Install Insulation that is Low-Emitting (Certified Section 01350)					
	a. Walls and/or Floors			1		
	b. Ceilings			1		
3.	Pre-Drywall Inspection Shows Quality Installation of Insulation		1			
<b>Insulation=Total 5</b>			<b>1</b>	<b>2</b>	<b>2</b>	
<b>I. Heating, Ventilation &amp; Air Conditioning</b>						
1.	Design and Install HVAC System to ACCA Manual J, D, and S Recommendations		4			
2.	Install Sealed Combustion (Direct Vent) Units in Conditioned Space					
	a. Furnaces			2		
	b. Water Heaters			2		
3.	No Fireplace or Sealed Gas Fireplace with Efficiency Rating not less than 60%			1		
4.	Install ENERGY STAR® Ceiling Fans with CFLs in Living Areas and Bedrooms		1			
5.	Install Ventilation System for Nighttime Cooling					
	a. Whole House Fan		1			
	b. Automatically Controlled Integrated System		2			
	c. Integrated System with Variable Speed Control		3			
6.	Install Air Conditioning with Non-HCFC Refrigerants	1				
7.	Design and Install Effective Ductwork					
	a. Install HVAC Unit and Ductwork within Conditioned Space		3			
	b. Use Duct Mastic on All Duct Joints and Seams		1			
	c. Install Ductwork under Attic Insulation (Buried Ducts)		1			
	d. Pressure Balance the Ductwork System for Master Bedroom		1			
	e. Protect Ducts during Construction and Clean all Ducts before Occupancy			1		
8.	Install High Efficiency HVAC Filter (MERV 6+)			1		
9.	Install Zoned, Hydronic Radiant Heating with Slab Edge Insulation		1	1		
10.	Install Mechanical Ventilation System					
	a. Any Whole House Ventilation System That Meets ASHRAE 62.2		1	2		
	b. Install ENERGY STAR® Bathroom Fan			1		
	c. All Bathroom Fans Are on Timer or Humidistat			1		
11.	Use Low-Sone Range Hood Vented to the Outside			1		
12.	Install Carbon Monoxide Alarm(s)			1		
<b>HVAC=Total 34</b>		<b>1</b>	<b>19</b>	<b>14</b>		
<b>J. Building Performance</b>						
1.	Design and Build High Performance Homes (2 pts each 1% energy efficiency above T-24)		30			
2.	House Obtains ENERGY STAR® with Indoor Air Package Certification			5	2	
3.	Inspection and Diagnostic Evaluations					
	a. Third Party Energy and Green Building Review of Home Plans		1	1	1	
	b. Blower Door Test Performed		1			
	c. House Passes Combustion Safety Backdraft Test			1		
<b>Building Performance=Total 42</b>			<b>32</b>	<b>7</b>	<b>3</b>	

POINTS PER CATEGORY		Community	Energy	IAQ/Health	Resources	Water
<b>K. Renewable Energy</b>						
1.	Pre-Plumb for Solar Hot Water Heating		4			
2.	Install Solar Water Heating System		10			
3.	Install Wiring Conduit for Future Photovoltaic (PV) Installation and Provide 200 square feet of South-facing Roof		2			
4.	Install Photovoltaic (PV) Panels (1.2kw - 6 pts; 2.4kw - 12 pts; 3.6kw - 18 pts)		18			
<b>Renewable Energy=Total 34</b>			<b>34</b>			
<b>L. Finishes</b>						
1.	Provide Permanent Walk-Off Mats and Shoe Storage at Home Entrances			1		
2.	Use Low/No-VOC Paint					
	a. Low-VOC Interior Wall/Ceiling Paints (<50gpl VOCs - Flat; <150gpl VOCs - Non-Flat)			1		
	b. Zero-VOC Interior Wall/Ceiling Paints (<5gpl VOCs - Flat)			3		
3.	Use Low VOC, Water-Based Wood Finishes (<150gpl VOCs)			2		
4.	Use Low-VOC Construction Adhesives (<70gpl VOCs) for All Adhesives			2		
5.	Use Recycled-Content Paint				1	
6.	Use Environmentally Preferable Materials for Interior Finish:					
	A) FSC-Certified Wood, B) Reclaimed Lumber, C) Rapidly Renewable					
	D) Recycled-Content or E) Finger-Jointed					
	a. Cabinets (50% Minimum)				1	
	b. Interior Trim (50% Minimum)				1	
	c. Shelving (50% Minimum)				1	
	d. Doors (50% Minimum)				1	
	e. Countertops (50% Minimum)				1	
7.	Reduce Formaldehyde in Interior Finish (Section 01350)					
	a. Subfloor (50% Minimum)			1		
	b. Cabinets (50% Minimum)			1		
	c. Interior Trim (50% Minimum)			1		
	d. Shelving (50% Minimum)			1		
8.	After Installation of Finishes, Test of Indoor Air Shows Formaldehyde Level <27ppb			3		
<b>Finishes=Total 22</b>				<b>16</b>	<b>6</b>	
<b>M. Flooring</b>						
1.	Use Environmentally Preferable Flooring: A) FSC-Certified or Reclaimed Wood, B) Rapidly Renewable Flooring Materials (Cork, Linoleum, Bamboo, Natural Fiber Carpet), C) Recycled-Content Ceramic Tiles, D) Exposed Concrete as Finished Floor or E) Recycled-Content Carpet					
	15% of Floor Area				1	
	30% of Floor Area				1	
	50% of Floor Area				1	
	75% of Floor Area				1	
2.	Floors Provide Thermal Mass: Use Tile or Concrete for Floors		1			
3.	Flooring Meets Section 01350 or CRI Green Label Plus requirements (50% Min.)			2		
<b>Flooring=Total 7</b>			<b>1</b>	<b>2</b>	<b>4</b>	
<b>N. Other</b>						
These points are given for innovative approaches or local priorities not listed above. Points will be evaluated and awarded by the municipality where project is located						
1.	Incorporate Green Points Checklist in Blueprints	Pre				
2.	Develop Homeowner Manual of Green Features/Benefits		1	1		1
3.	Community Design Measures and Local Priorities: Maximum of 20 points.	20				
4.	Innovation: List innovative measures that meet the green building objectives of the Guidelines. Maximum of 20 points total.	20				
<b>Other=Total 43</b>			<b>20</b>	<b>1</b>	<b>1</b>	<b>1</b>
		<b>Community</b>	<b>Energy</b>	<b>IAQ/Health</b>	<b>Resources</b>	<b>Water</b>
Total Available Points		24	107	45	64	31
Points Required from Specific Categories		-	11	5	6	3
Additional Points from Any Category						25
<b>MINIMUM POINTS REQUIRED</b>						<b>50</b>

# Chapter Four:

## Green Building Measures

Every green feature in these Guidelines benefits the builder, homebuyer and the environment. This chapter lists each feature, discusses the conditions under which it should be used, and describes the benefits. A few green building practices are required by California or local codes. These “Building Basics” are included for educational purposes and are not numbered or listed in the Green Points Checklist.

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*“Green Building is about combining land use planning and building construction to create communities that are better for people. It is time for homebuilders to combine stewardship of the environment with economic growth to create a healthier and more environmentally sustainable future.”*

—Don Babbitt, Heartwood Communities

# Community Design and Planning

Community design and planning measures have a substantial influence on the overall environmental impact of a home. The following green building practices are recommended in the Guidelines but not listed separately in Green Points because they may not be in the developer's or builder's control. Projects may receive points for these measures in Section N of Green Points.

## 1. Develop Infill Sites

### Description:

Infill development reduces pressure to develop greenfields such as open space and farmland by reclaiming abandoned and underutilized sites and buildings.

### Application:

When selecting a development site, choose built urban settings where public infrastructure is already in place. Give preference to locations that are: in a downtown area; targeted for revitalization; close to major employment centers; and/or within an urban growth boundary or designated for development by the local jurisdiction. Also, locate the project within walking distance of a major transit stop; look for locations where good transit service already exists or work with officials to bring public transit to the area.

### Benefit:

Urban infill allows public funds to be used for maintaining or upgrading existing services such as schools, transit and sewers, rather than diverting limited funds to the development of costlier new services.

## 2. Cluster Homes and Keep Size in Check

### Description:

On a given site, there are often many options for placing and orienting homes. Paying careful attention to land use and home size can help conserve natural resources.

### Application:

### A. Cluster Homes for Land Preservation

Two strategies for minimizing developed areas are clustering homes and building upward instead of outward. Besides preserving open space, certain clustered designs also use building materials and energy efficiently due to shared walls or roofs.

### B. Conserve Resources by Increasing Density

Developments that allow for more households on a given site reduce pressure to develop greenfields or open space. Where there is access to public transit or commercial activities, dense developments offer the advantage of shorter commutes, less dependence on cars, and walkable communities.

### C. Design Homes for Reasonable Size

Homes can be designed to be comfortable and spacious without being excessively large; smaller, more compact homes conserve land, building materials and energy.

### Benefit:

Minimizing the development footprint and providing permanent open spaces can help protect the local ecosystem and enhance the community. Homes that are clustered and not overly large may cost less to build.

## 3. Subdivision Layout and Orientation

### Description:

Summer temperatures in neighborhoods that have large expanses of pavement exposed to the sun can be several degrees warmer than neighborhoods with shaded pavement. Homes that are oriented without regard to solar access may require excessive energy to heat and cool. Planning strategies that take solar access into account can address these concerns.

### Application:

Plan streets and lot layouts to provide for shading of streets by trees to reduce this "heat island" effect.

Keeping streets narrow will make them easier to shade by trees and will contribute to traffic calming, improving safety.

Orient homes on an east-west access to facilitate passive solar design, reduce heating and cooling energy use, and facilitate placement of rooftop solar electric and solar thermal systems. Use alley ways, greenbelts, and other methods to provide good solar access to the homes.

### Benefit:

Planning for solar access and shading can create more pleasant neighborhoods, lower homeowners' energy bills, and reduce reliance on fossil fuel-based energy.

## 4. Design for Walking and Bicycling

### Description:

Walking and bicycling are inexpensive, healthy forms of transportation but they are often incompatible with conventional car-based development patterns. Convenience, safety and aesthetics are key factors in promoting travel by foot and bicycle.

### Application:

#### A. Provide Pedestrian Access to Neighborhood Services

Build pedestrian-friendly communities that combine residential and commercial spaces so that people can shop, play and meet their daily needs close to where they live.

#### B. Include Pedestrian Pathways that Connect to Recreation

Many new home developments include plans for new roadways and pedestrian paths. Where applicable, connect walkways to places of interest, such as parks, stores, and recreation areas. Use landscaping buffers to separate sidewalks from roadways.

#### C. Design Traffic-Calming Elements to Encourage Walking and Bicycling

Design 10-foot vehicle travel lanes, rather than the standard 12-foot lanes, to discourage fast driving. Use the remaining right of way for bike lanes. Consider rumble strips, bulbouts and raised crosswalks to reduce speeding.

### Benefit:

Walking and bicycling are inexpensive, healthy forms of physical activity, transportation and neighborhood interaction. Traffic-calming measures reduce pedestrian injury rates and increase neighborhood economic activity and public safety.

## 5. Design for Safety and Social Gathering

### Description:

Design buildings and landscapes to deter crime and promote safety through casual observation and community interaction.

### Application:

Design all home entrances so that outside callers can be seen from inside the home. Place tall windows with low sill heights at front doors, or use transparent panels in the doors so any occupant, including children and the disabled, can view all visitors.

Orient porches to streets and public spaces to provide natural surveillance. Help keep the community safe and neighborly by orienting windows so that residents can easily view and feel comfortable using nearby areas such as outdoor benches, pathways, pocket parks, children's play areas and other features that promote socializing.

### Benefit:

While it may be possible to deter some crime with tall fences, gates, video surveillance and bright lights, these elements also deter outdoor play and neighborliness. Creating a greater sense of community in residential areas results in safer and more inviting living.

## 6. Design for Diverse Households

### Description:

Simple universal design elements make it much more likely that residents can remain in their homes as they age, if they become temporarily or permanently disabled,

or if they wish to have elderly relatives join their household.

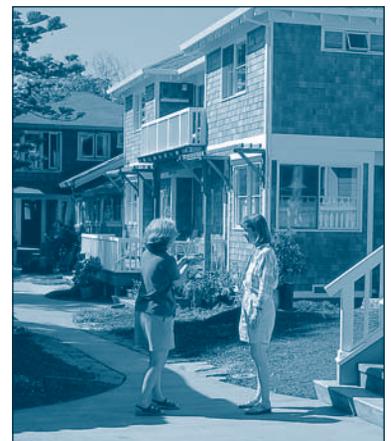
### Application:

Design homes so that at least one prominent entrance (not from a garage) has a zero-step clearance, with less than 1/2-inch difference in height. Design all main-floor interior doors and passageways to have a minimum 32-inch clear passage space to accommodate disabled persons. Locate at least a half-bath on the ground floor with blocking in the walls for grab bars. Ideally, also locate a bedroom on the ground floor. Consider providing a full-function, independent unit that would allow extended family members to reside at home yet maintain independence.

### Benefit:

Over the long term, money can be saved and remodeling waste minimized if homes are designed from the outset to accommodate changing occupant needs and a wider range of physical abilities.

Sacramento Street Cohousing, Berkeley.



# A. Site

## 1. Protect Native Soil and Minimize Disruption of Existing Plants and Trees

### Description:

Soil is a valuable, living resource that should be protected. Through careful planning and construction practices, valuable soil as well as mature trees and other plants can be preserved and incorporated into new landscapes and neighborhoods.

### Application:

Complete a landscape survey to determine the feasibility of preserving or relocating mature trees, shrubs

and native vegetation. Protect trees and shrubs from construction equipment by placing temporary fencing beyond their driplines. Create or preserve wildlife corridors adjacent to open space, wild lands and creeks.

Evaluate the soil. Design for minimum building and hardscape footprints and little or no grading. Limit and delineate the construction footprint; restrict heavy equipment that compacts soil, including cars, to areas that will be paved or built over. When grading is unavoidable, existing horticulturally suitable

topsoil shall be stockpiled and re-spread during final landscape grading. Identify areas to be paved as a place to store native topsoil during construction. Protect stored soil from erosion, amend with compost, and re-spread after construction. Any new soil shall be similar to existing soil in pH, texture permeability, and other characteristics, unless evidence is provided that a different type of soil amendment approach is justified.

### Benefit:

Healthy soils can significantly reduce storm runoff, reduce fertilizer

## BUILDING BASICS

### Incorporate Passive Solar Design

Passive solar heating involves storing the sun's energy during the day in building materials that have high thermal mass; those materials later convey their heat to interior spaces, reducing the need for furnace operation. Passive cooling involves using overhangs and other exterior window shading to keep the sun out in summer, taking advantage of thermal mass to moderate temperature swings, ventilating the home with cool night air, and other practices to reduce or eliminate air conditioner operation.

Some of the energy benefits derived from passive strategies can be evaluated using California Building Energy Efficiency Standards (Title 24) compliance models. Consider implementing these passive strategies:

- a. Plan subdivision lots and street layout to optimize solar access for all homes. See *Subdivision Layout and Orientation* in Community Design and Planning.
- b. Orient the home with the long axis running east-west and minimize east- and west-facing windows to improve passive solar performance.
- c. Use wall and floor materials that improve thermal mass. For additional information, see *Provide Thermally Massive Walls* in Section D: Structural Frame and Building Envelope and *Provide Thermally Massive Floors* in Section M: Flooring.
- d. Design windows to catch prevailing breezes and provide cross ventilation. Install high windows, skylights or cupolas with securable low windows to create a stack effect that exhausts rising hot air and draws in cooler outdoor air.
- e. Incorporate roof overhangs, awnings, trellises and shade trees to selectively control solar heat gain through windows. See *Plant Shade Trees* in Section B: Landscaping.
- f. Reduce solar heat gain through exterior surfaces by using light exterior colors or paints with reflective pigments, ENERGY STAR® roofing materials, and/or radiant barrier roof sheathing. Roofing materials are available that have a reflectance greater than 0.75 and an emittance greater than 0.70. See Building Basics in Section J: Building Performance for application details.
- g. Install energy-efficient windows (double-paned, low-conductivity frames and low-e coating). There are two types of low-e glazing. One is heat rejecting (hard coat) and the other is heat receiving (soft coat). The recommended south glazing for passive solar buildings is low-e hard coat, heat receiving glazing with a U-factor of .33 and a solar heat gain coefficient (SHGC) of .65 See Building Basics in Section J: Building Performance for additional information about windows.

and pesticide requirements, improve water quality and conserve irrigation water. Protection of existing mature landscape features helps prevent soil erosion, maintains sources of natural cooling, diverts waste from landfills, preserves nature and adds value to the community.

## 2. Deconstruct Instead of Demolishing Existing Buildings

### Description:

Deconstruction of existing buildings is a good way to salvage quality building products that have not yet reached the end of their usable life, even if the building or part of it has. Salvaged materials are often less expensive to purchase than new materials, and may be of higher quality, especially salvaged wood.

### Application:

Whole house deconstruction requires a team of workers experienced in dismantling buildings. Locate a demolition contractor who offers deconstruction services or an organization specializing in salvaged materials. In some cases, deconstruction may cost more than traditional demolition, but donating the salvaged materials to a nonprofit or charity may result in a substantial tax deduction that can offset the cost.

Common salvageable materials include timber, doors, sinks, fencing, bricks, tile, pipes, hardware and light fixtures. Reclaimed lumber, in the form of studs, beams, flooring and trim, is among the most valuable and available of salvaged building products.

### Benefit:

Reusing building materials typically generates less waste and pollution than recycling does.

## 3. Recycle Job Site Construction Waste

### Description:

Each year over 4,000,000 tons of construction and demolition (C&D) debris is disposed of in California landfills. This represents 21% of the statewide waste stream, but in newer communities C&D waste sent to landfills can be as high as 50%. Construction waste generally consists of wood, drywall, metal, concrete, dirt and cardboard. It can also include plant debris (green waste) from the landscape. Much of this material can be reused or recycled.

### Application:

Identify the types and quantities of materials generated at the job site and reuse or recycle at least 50% of the construction debris, including green waste. Allocate space for recycling bins and containers on the job site and train workers. Separate green waste from other materials. Contact the California Integrated Waste Management

Board at [www.ciwmb.ca.gov](http://www.ciwmb.ca.gov) for more information on recycling facilities.

### Benefit:

Reuse and recycling of construction debris conserves natural resources and slows the rate at which landfills reach capacity. In addition, builders can save money by lowering disposal fees.

## 4. Use Recycled-Content Aggregate for Walkway, Driveway and Roadway Base

### Description:

Virgin aggregate comes from sources such as riverbeds and quarries where mining activities may disturb the environment. Recycled aggregate consists mainly of crushed concrete and crushed asphalt pavement. Recycled concrete and asphalt crushed to 3/4-inch meets the California Department of Transportation's (CalTrans) specification for Class 2 Aggregate Base.

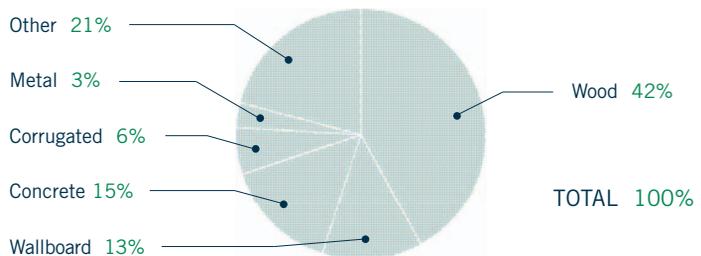
### Application:

Use wherever Class 2 aggregate is specified; for example as drainage backfill, and under driveways, sidewalks and building slabs.

### Benefit:

Recycled aggregate puts waste materials to good use.

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



Source: Based on waste generation studies for three residential developments in Alameda County (1999–2004) and compiled by Matthew J. Southworth, P.E. – Civil Engineer

# B. Landscaping

## BUILDING BASICS

### Control Stormwater Runoff

Land development and construction activities can significantly alter natural drainage patterns and pollute stormwater runoff.

Excessive stormwater runoff can erode residential landscapes and local streams, and stress local stormwater drainage systems, increasing flood risks. Keeping sediment and pollutants out of storm drains helps protect local creeks, reservoirs and the ocean. Increases in impervious surfaces are directly related to reductions in water quality in nearby creeks, rivers, lakes and bays.

Because controlling stormwater runoff is critical to protecting water quality, many projects will need to file a Notice of Intent (NOI) and prepare a Stormwater Pollution Prevention Plan (SWPPP) per the State General Construction NPDES Permit. Be sure to contact your local municipality for during-construction and post-construction stormwater quality control requirements.

During construction and grading, use stormwater Best Management Practices (BMPs) to control erosion and to prevent sediment and pollutants from entering storm drains. Erosion control protects the soil surfaces whereas sediment control traps soil particles after they have been dislodged. Consider implementing these BMPs during the construction stage:

- a. Schedule grading so that disturbed slopes are stabilized and revegetated during the non-rainy season. Minimize and delineate the area to be disturbed.
- b. Trap sediment on site using a combination of effective erosion and sediment control measures. Place barriers around storm drain inlets to pond water and allow sediments to settle out.
- c. Cover construction materials and stored topsoil exposed to rain; store wastes under cover and dispose of properly.
- d. Install temporary concrete washout areas for use by contractors to prevent pollution from entering storm drains.
- e. Educate on-site workers to practice good housekeeping practices and implement best management practices to prevent stormwater pollution.
- f. Inspect and maintain control measures before and after each rainstorm.

Post-construction activities include protecting the stormwater by implementing permanent stormwater controls. Consider incorporating the following BMPs into your project:

- a. Minimize the total amount of impervious paved area used for roadways, driveways, walkways, and patios by avoiding large

expanses of contiguous impermeable surfaces.

- b. Install gravel, porous concrete and permeable pavers that allow stormwater to percolate through and infiltrate into subsurface drainage systems or the ground. This reduces stormwater runoff and filters out sediments.
- c. Direct stormwater runoff from hardscapes toward adjacent landscaped areas that are graded to receive the excess water; this will help recharge groundwater, filter pollutants, and water vegetation.
- d. Construct rainwater catchment systems such as ponds, cisterns and other rainwater collection basins. Stormwater ponds collect, retain and filter runoff during and after a storm. The pond's natural chemical, physical and biological processes remove suspended solids, metals and dissolved nutrients.
- e. Create a biofilter, such as a swale, to slow the flow of stormwater into storm drains and allow pollutants to settle and decompose. This will reduce sedimentation and other pollutants in the water. Large planting beds designed as swales can absorb stormwater from a building's downspouts.

## 1. Construct Resource-Efficient Landscapes

### Description:

Conventional landscapes are monocultures that require high inputs of water and chemicals and are often planted without regard for climate and soil conditions. California native plants are adapted to our soils, wildlife, rainfall and climate. Invasive plants used in landscaping often escape into natural areas, where they can spread rapidly, out-compete natives, degrade wildlife habitat, and increase the wildfire fuel load.

### Application:

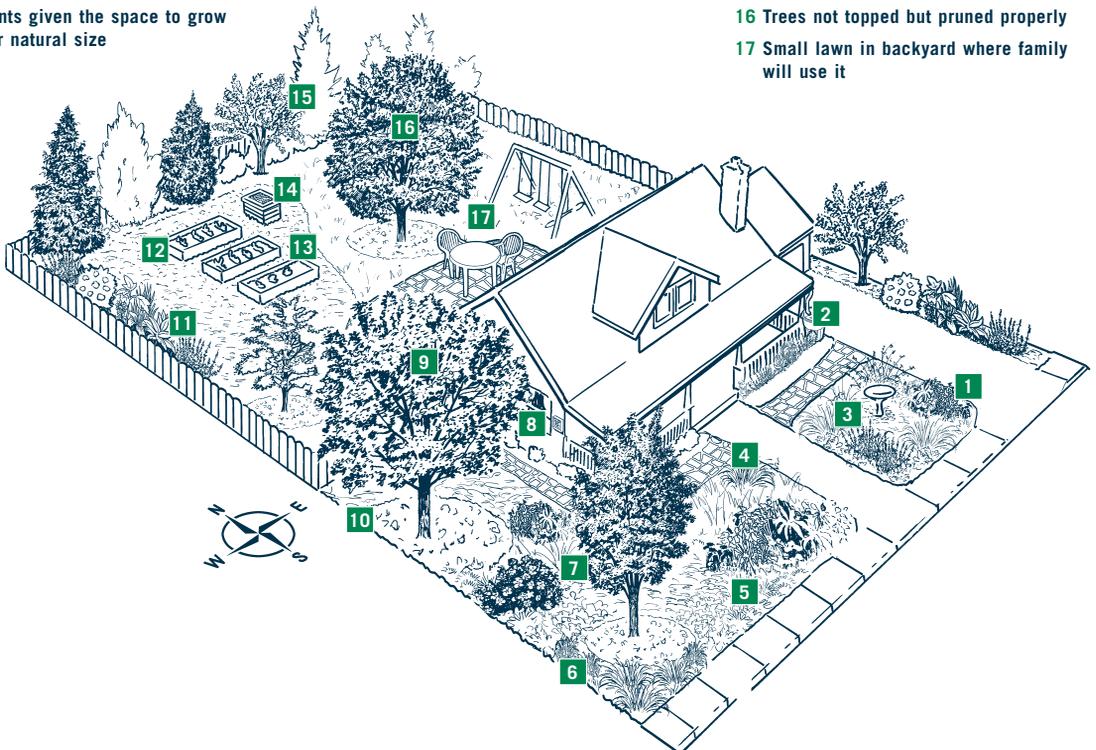
Evaluate the climate, exposure, and topography of the site and assess the soil. Select drought-tolerant, California native or other Mediterranean species that are appropriate for the site soil and microclimates. Plant a variety of trees, shrubs and other perennials and limit annuals. Give plants plenty of room to mature, reducing the need for pruning and shearing. Prune and water appropriately. Limit turf to the smallest area that will meet recreational needs. Include a site for composting and mulching plant debris. Find out

which invasive species are problematic locally; do not include them in the planting palette and eliminate any from the site before planting. (See [www.Cal-IPC.org](http://www.Cal-IPC.org) for a list of local invasive species for your area.)

### Benefit:

A diverse landscape of native species supports beneficial birds, bees and other insects and may resist disease and other pests better than one with little variety. Choosing plants appropriately will also reduce the amount of plant debris sent to landfills.

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



## 2. Use Fire-Safe Landscaping Techniques

### Description:

California's hot, dry climate makes fire protection an important consideration for landscape design, especially because new home developments are increasingly located adjacent to areas that may be prone to wildfires. Simple landscaping design practices can help defend the homes by reducing fuel accumulation and interrupting the fire path.

### Application:

Determine whether the site is in a high-risk area. Map the site, identifying exposure to prevailing winds during the dry season and steep slopes that can increase wind speed and convey heat. Identify adjacent wildlands or open space, as well as south- and west-facing slopes and their vegetation, particularly species that burn readily.

For sites adjacent to fire sensitive open space or wildlands, create defensible space around buildings; this is an area where vegetation is modified to reduce fuel load and allow firefighters to operate. Use irrigated, low-growing, fire-resistant vegetation, patios, paving stones and other low-risk features in the zone immediately surrounding the structure. Specify plants with low fuel volume and/or high moisture content. Avoid plants with high oil content or that tend to accumulate an excessive amount of dead wood or debris.

Do not plant trees and shrubs at distances where limbs and branches will reach the house or grow under

overhangs as they mature. To minimize fire ladders, do not plant dense hedges or space tall vegetation too closely together. Use mulch (except fine shredded bark) and decomposed granite to control weeds and reduce fuel for fires. Construct roofs, siding and decks with fire-resistant materials. Consider alternatives to wood fences, such as rock walls.

### Benefit:

Fire-safe landscaping and building reduces risk of harm to residents and firefighters, and protects valuable personal and community assets.

## 3. Minimize Turf Areas

### Description:

Lawns (or turf) are useful for recreation and relaxation, but turf requires frequent watering and application of fertilizers or other chemicals to stay green during California's long dry season.

### Application:

Replace decorative lawns with water-conserving California native groundcovers or perennial grasses, shrubs and trees. If lawns are desired, plant in small areas where they are most likely to be used for play and relaxation. Choose plant species that have a water requirement less than or equal to tall fescue. Avoid planting turf on slopes greater than 10% or in irregularly shaped areas that cannot be irrigated efficiently. Avoid turf in isolated areas (driveway strips) or other areas less than 8 feet wide on the shortest side, unless irrigated with subsurface irrigation or micro spray heads.

### Benefit:

Minimizing turf conserves water. If a 1,000-square-foot lawn needs 1 inch of water per week, reducing it to 500 square feet can save approximately 10,000 gallons of water per dry season. Chemical use may also be decreased, thereby protecting the quality of local waterways and aquifers.

## 4. Plant Shade Trees

### Description:

During summer months, the sun heats up homes, which makes air conditioners work harder and drives up peak utility demand. Large shade trees keep direct sun off the roof, walls and windows in the summer, thereby lowering cooling costs and increasing comfort while providing an attractive landscape.

### Application:

Augment the existing tree cover on the site, particularly to the west of the building, by planting drought-tolerant, California native or other Mediterranean tree species that are appropriate for the site soil and microclimates. Plant trees to shade walls, windows and paved areas. If the building design includes passive solar heating, do not plant trees too close to the home's south side. Avoid planting trees too close to utilities. Plant a variety of deciduous trees and give them plenty of room to mature, reducing the need for pruning and shearing.

### Benefit:

Shade trees can create a microclimate that is up to 15°F cooler than the surrounding area, and can

reduce summer air-conditioning costs by 25 to 40%. Peak utility demand is at its highest during late afternoons in the summer; shade trees play an important role in reducing this demand. Trees provide numerous additional benefits including cleansing the air, creating habitats for birds, providing play places for children, making neighborhood more beautiful and increasing property values.

### 5. Implement Hydrozoning: Group Plants by Water Needs

#### Description:

Different plants have different water requirements. Dividing the landscape into low, medium and high water-use zones prevents overwatering.

#### Application:

Group plants by water needs, creating irrigation zones based on the plants' water requirements and their exposure. Delineate each hydrozone on the site, irrigation and planting plans. Place thirstier plants in relatively small, highly visible areas and if possible, in spots that naturally collect water. Plant the larger perimeter areas with drought-adapted species. Install separate irrigation valves for different zones. Consider that some California natives do not tolerate water in the summer after they are established; be sure to separate them from plants that need irrigation.

#### Benefit:

Hydrozoning matches irrigation to the plants' water requirements, conserving water and fostering resistance to pests. Plant mortality is also reduced, saving time and money.

### 6. Install High Efficiency Irrigation Systems

#### Description:

With increasing demand on our water resources, efficient irrigation is vital to California landscapes. Drip and bubbler irrigation technologies apply water to the soil at the plant root zones at the rate the soil can absorb it, and are often more appropriate than overhead sprinklers in areas that are narrow, oddly shaped or densely planted, or in areas such as parking lots and medians. Low-flow sprinkler heads apply water uniformly and slowly.

#### Application:

Design the irrigation system to meet the requirements of your local water conservation ordinance. Install drip, subsurface drip or low-flow sprinklers in place of standard sprinkler systems for all landscape applications.

Upgrade to new "smart" (weather-based) irrigation controllers that have at a minimum the following capabilities: 1) water budgeting feature, 2) automatic periodic adjustments to the irrigation program, accomplished through external sensors, internally stored historical weather data or a provider-supplied signal, 3) multiple start times, 4) run-times able to support low-volume applications, 5) irrigation intervals for days of the week or same-day intervals, and 6) more than one operating program (for example, A=turf, B=shrubs, C=water features). If necessary, turn off the irrigation system or valve for the landscape or hydrozone that includes all California natives, once the plants are established.

#### Benefit:

High efficiency irrigation systems minimize overspray and evaporation and reduce runoff, dramatically reducing landscape water use while preventing disease and minimizing weed growth that results from overwatering.

### 7. Apply Compost to Promote Healthy Topsoil

#### Description:

A robust, living soil with sufficient organic content is the foundation of a water-conserving, resource-efficient, low-impact landscape. Adding good quality compost before planting brings life to the soil and feeds existing soil organisms, fueling many natural processes that supply nutrients, minimize disease and improve soil quality.

#### Application:

Assess the soil quality on site: have the soil professionally analyzed for texture, nutrient and organic matter content and pH, especially if the topsoil was not protected during construction. Request the laboratory recommendations be made for organic or environmentally friendly amendments.

Incorporate 2 to 4 inches of compost into the top 6 to 12 inches of soil, or as much as is required to bring the soil organic matter content to 3.5% for turf and 5% for planting beds, except for plant species that will not thrive in such soils. Use fully stabilized, certified compost as a soil amendment where appropriate. Loosen all planting and turf areas to a minimum depth of 6 inches prior to final landscape grading.

Topdress with compost around established shrubs and trees and on turf.

**Benefit:**

Compost can increase permeability, water-holding capacity, and plant nutrient availability and improve the ability of the soil to filter pollutants. This encourages healthy plant growth, improves water quality, reduces the need for irrigation, and lowers water bills.

## 8. Mulch All Planting Beds

**Description:**

Mulch is any material spread evenly over the surface of the soil. Organic materials, including chipped landscape debris, are preferable over inorganic materials because they supply nutrients over time and provide wildlife habitat.

**Application:**

Apply and maintain a minimum of 2 inches of natural mulch to all soil surfaces or at least until plants grow to cover the soil. Do not place mulch directly against any plant stem or tree. Designate areas under trees and away from hardscapes or storm drains as repositories for fallen leaves to remain as mulch. Buy mulch produced from urban plant waste debris, or from local suppliers within a 150-mile radius.

**Benefit:**

Mulch can conserve water, reduce weed growth and simplify maintenance operations.

## 9. Use Salvaged or Recycled-Content Materials for Landscape Elements

**Description:**

Landscaped elements present many opportunities for using salvaged or recycled materials. Recycled plastic or recycled composite lumber makes a very durable landscape edging; broken concrete can make a very attractive retaining wall or path and tumbled glass cullet a beautiful walkway.

**Application:**

Use salvaged or recycled-content materials for hardscapes (planting beds, patios, decks, walls, walkways and driveways) and other landscape features (for example, edging, benches, play equipment). If recycled plastic or composite lumber is not appropriate, use sustainably harvested wood (FSC certified).

**Benefit:**

For landscaping and hardscaping, recycled plastics or composites are generally much more durable than wood because they do not rot, crack or splinter or require ongoing wood treatments.

## 10. Reduce Light Pollution

**Description:**

Light pollution occurs when outdoor light fixtures let excess light escape onto neighboring properties and into the night sky.

**Application:**

Avoid outdoor lighting where it is not needed. Use motion and photosensor

lights for security, rather than all night illumination. Exterior lighting that provides low contrast on critical areas, such as sidewalks and home entrances, is better for visual acuity than overlighting. Eliminate all unshielded fixtures, such as floodlights. Look for fixtures certified by the Dark Sky Association for light pollution reduction ([www.darksky.org](http://www.darksky.org)).

**Benefit:**

Reducing light pollution minimizes neighborhood or wildlife habitat disruption and saves energy.



Landscape before and after an upgrade that reduced lawn size, increased diversity, improved property values, cut water bills by 50% and reduced maintenance costs by 20%.

# C. Foundation

## 1. Incorporate Flyash in Concrete

### Description:

Flyash is a byproduct of coal-burning power plants. It is typically land-filled, but can be an inexpensive and quality substitute for a portion of the Portland cement in concrete. Concrete suppliers routinely replace 10 to 15% of the Portland cement in their mixes with flyash.

### Application:

Typically, up to 50% of cement can be replaced with flyash in residential concrete mixes. However, high-volume flyash mixes may require longer cure times than standard concrete.

### Benefit:

Flyash improves the performance of concrete by increasing strength, reducing permeability and reducing corrosion of reinforcing steel. Using flyash also reduces the amount of water and cement needed, thereby decreasing the overall environmental impacts of cement production and water sourcing.

## 2. Use Frost-Protected Shallow Foundation in Cold Areas (Climate Zone 16)

### Description:

Foundations in cold climates are typically quite large, sitting deep below the frost line to reduce the possibility of heaving damage from the freeze-thaw cycle. A frost-protected shallow foundation (FPSF) is surrounded by insulation, which, in effect, raises the frost line to just below the surface, allowing reduced excavation and foundation wall depths.

### Application:

Excavate the foundation perimeter to 16 inches rather than the 36 to 48 inches typical for cold climates. Place insulation horizontally 4 feet extending out from the foundation, against the outside face of the foundation wall, and under the entire slab.

### Benefit:

An FPSF typically results in a reduction of both concrete use and labor of up to 40%. Reducing excavation minimizes soil compaction and vehicle disturbance. Finally, the insulation under an FPSF can significantly moderate the foundation temperatures, making the home more energy efficient and comfortable.

## 3. Use Radon-Resistant Construction (in At-Risk Locations Only)

### Description:

Radon gas is naturally emitted by some soils and rocks. The U.S. Environmental Protection Agency estimates that exposure to radon may be the second leading cause of lung cancer, after cigarette smoking. In California about 1% of homes have radon levels above the recommended mitigation level (4 picocuries). Most of these homes are located in the Sierra foothills and coastal mountains and foothills.

### Application:

Use radon-resistant construction if a home is being built in EPA Radon Zone 1 or identified by the California Department of Health Services as having above average risk ([www.cal-iaq.org/RADON](http://www.cal-iaq.org/RADON)). Lay a perforated pipe in a 4- to 6-inch layer of large gravel under the foundation slab. Connect this to a solid pipe running to the attic and through the roof. Attach a fan to this pipe for discharging the radon.

### Benefit:

Installing a radon mitigation system will significantly reduce the occupants' levels of radon exposure.

## BUILDING BASICS

### Building Basics: Foundation Drainage System

Without proper rain and groundwater dispersion elements (as well as crawl space sealing techniques), unwanted moisture can easily migrate into the home, basement or crawl space. Once inside, moisture can cause decay of building materials and mold growth, and potentially lead to structural failure and indoor air quality problems.

A properly installed foundation drainage system includes the following:

- Soil grade sloped away from the home.
- Gutter system with downspouts directing away from the foundation.
- Foundation wall drainage panel.
- Footing perimeter drainage system.

Effective water management systems are important elements in maintaining the structural integrity of the home's foundation and reducing opportunities for mold growth within the home. Consult your local jurisdiction to ensure compatibility with stormwater management requirements.

# D. Structural Frame and Building Envelope

## 1. Apply Optimal Value Engineering (Advanced Framing)

### Description:

Optimal Value Engineering (OVE) is a set of framing techniques that reduce the amount of lumber used to build a home, while maintaining structural integrity and meeting the building code.

### Application:

Implement any number of common OVE techniques including framing on 24-inch centers instead of 16-inch, using right-sized headers, and avoiding unnecessary lumber for sills and excess jack and cripple studs around doors and windows.

### Benefit:

Using OVE techniques saves wood and construction costs without a significant reduction in structural strength, while allowing for more of the wall to be better insulated.

## 2. Use Engineered Lumber

### Description:

Solid-sawn lumber in sizes 2x10 and greater typically comes from old-growth forests. Engineered lumber products, on the other hand, come from small-diameter, fast-growing plantation trees. These products include glued laminated timber (glulam), laminated veneer lumber (LVL), laminated strand lumber (LSL), parallel strand lumber (PSL), wood I-joists, wood floor trusses, oriented strand board (OSB), and finger-jointed studs.

### Application:

Substitute solid-sawn lumber with engineered lumber wherever applicable.

### A. Beams and Headers

Engineered beams and headers can easily replace any solid-sawn member of similar size or even larger. In addition, solid-sawn lumber is often used for headers and beams when smaller dimension lumber would suffice.

### B. Insulated Engineered Headers

Engineered headers with pre-installed insulation are lighter than solid wood headers, do not shrink (reducing cracks in drywall), and are sometimes less expensive than solid wood.

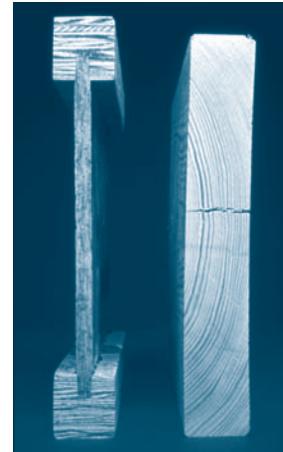
### C. Wood I-Joists for Floors and Ceilings

The typical 2x10 and larger solid lumber used for floor and ceiling joists, can be replaced with engineered lumber in most applications.

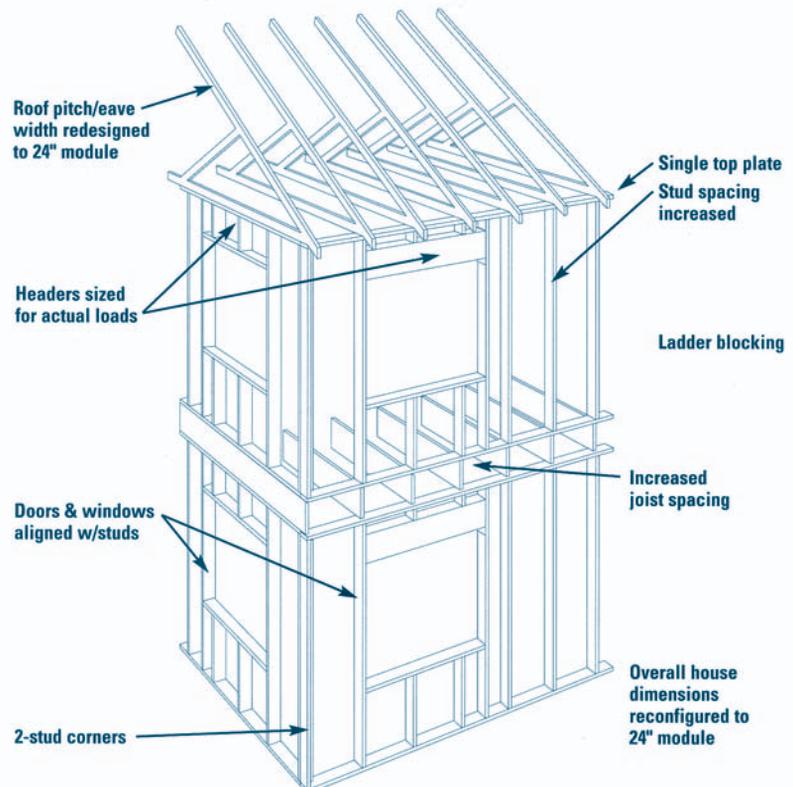
### D. Floor Web Trusses

For long-span floor joists use floor web trusses instead of solid-sawn lumber. Not only are web trusses stronger than solid beams, they are lighter, and allow for easy passage of

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



Optimal Value Engineering Techniques.



Adapted from Building Science Corporation

ducts, pipes and wires through them, resulting in quicker installation.

### E. Engineered or Finger-Jointed Studs

Use engineered or finger-jointed studs wherever conventional studs are typically used. Finger-jointed studs use short pieces of 2x4 or 2x6 material glued together to form standard stud lengths, while engineered lumber is typically veneers, strands or flakes of wood glued to form studs. These studs are all dimensionally straight and save on labor and material costs associated with culling crooked lumber and shimming and straightening crooked walls.

#### 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. Most engineered wood

products are straighter and stronger than solid-sawn equivalents, eliminating crooked walls and squeaky floors, and reducing material waste.

### 3. Use FSC-Certified Wood for Framing

#### Description:

Forest Stewardship Council (FSC) certification assures that the forest from which the wood was harvested is managed in an environmentally, economically and socially responsible manner. FSC is the only lumber verification rating that maintains chain-of-custody certification throughout the cutting, milling and final delivery of products, thus ensuring that wood labeled as FSC actually came from a certified sustainably managed forest.

#### Application:

Use FSC wood where wood framing is required. Certified solid framing and plywood are available from some suppliers.

#### Benefit:

FSC certification assures that forests are managed in a way that protects the long-term availability of wood resources and the health of old-growth forests.

### 4. Design Energy Heels on Trusses

#### Description:

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

#### Application:

Install where conventional trusses are used. The increased height may require modifications to exterior soffit and trim details.

#### Benefit:

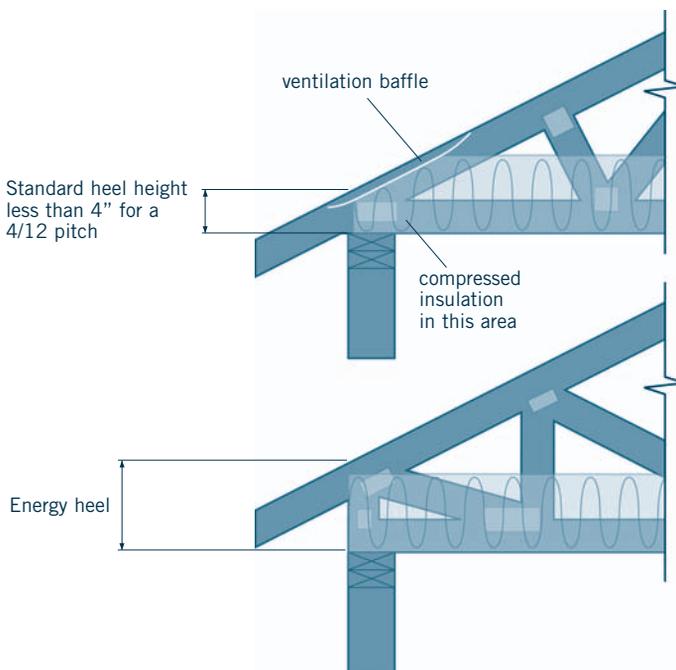
The perimeter intersection between walls and roof framing is often an area of increased heat loss since conventional trusses reduce insulation to less than 6 inches. Raising the heels allows for full insulation around the house, saving energy and money.

### 5. Design Trusses to Accommodate Ductwork

#### Description:

One way to include HVAC ducts in conditioned space (see Section I.7.A) is to design trusses with a raised center section that accommodates the ducts. This may add only slightly to the cost of the trusses.

Energy Heels on Trusses Allow More Insulation.



**Application:**

Coordinate with the HVAC contractor and structural engineer before ordering trusses to identify opportunities for including all ducts in conditioned space. If feasible, order trusses with a plenum space between the bottom truss chord and the ceiling; insulate the plenum and seal it with drywall or another air barrier.

**Benefit:**

Designing trusses to accommodate ducts can reduce the cost of the duct installation. It also reduces duct heat loss/gain and air leakage to outdoors.

## 6. 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:**

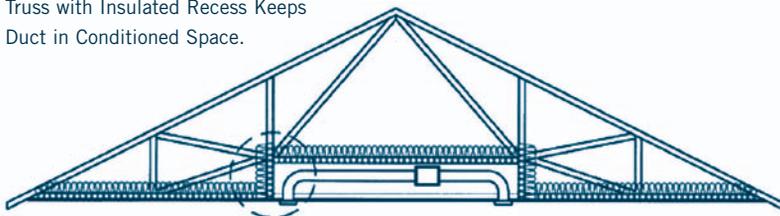
OSB is as strong as traditional plywood sheet materials and is less expensive. OSB reduces the need for large-diameter old-growth trees required for plywood. Some OSB uses lower formaldehyde content adhesives that contribute to healthier indoor air quality.

## 7. Use Recycled-Content Steel Studs for Interior Framing

**Description:**

Steel studs can be either stand-alone or contain wood pieces within the

Truss with Insulated Recess Keeps Duct in Conditioned Space.



Steven Winter Associates

“C” channel. Steel studs may or may not be load-bearing, depending on their rating.

**Application:**

Use in non-insulated interior walls.

**Benefit:**

In addition to its recycled content, steel provides strength, light weight, exacting specifications, fire- and pest-resistance, and fewer of the twisting, warping and other defects that can plague wood framing.

## 8. Use Solid Wall Systems

**Description:**

Solid wall systems include structural insulated panels (SIPs), insulated pre-cast concrete, insulated concrete forms (ICFs), aerated autoclaved concrete (AAC), rammed earth and similar systems.

**Application:**

Each of these systems entails its own specialized installation techniques. Always follow manufacturer specifications.

**Benefit:**

These walls replace wood stud construction by including structure, sheathing and insulation in a single durable, energy-efficient system.

## 9. Provide Thermally Massive Walls

**Description:**

Use wall materials that improve thermal mass.

**Application:**

Low cost strategies for thermal mass walls include using 5/8” drywall on all interior surfaces. Less conventional approaches

Construction using SIPs.



include using pre-cast insulated concrete walls or insulated concrete forms (ICFs).

**Benefit:**

Increasing thermal mass will reduce heating and cooling energy use and will moderate indoor temperature swings, keeping the home more comfortable.

## 10. Design and Build Structural Pest Controls

**Description:**

Pests are attracted to water, food and rotting wood. Permanent, structural pest controls can stop pests along their typical pathways of entering the home.

**Application:**

### a. Install Termite Shields and Separate All Exterior Wood-to-Concrete Connections by Metal or Plastic Fasteners or Dividers

Install a continuous, durable termite shield around all foundation slab penetrations (such as pipes), at the junction of the foundation or piers and the wall framing, and wherever slab perimeter insulation is installed.

When structural wood elements (such as posts, stairs and decks) are in constant contact with concrete or soil, they remain moist for prolonged periods. Create a separation to allow water to drain and wood to easily dry out.

### b. Locate All New Plants At Least 36 in. from Foundation

Maintaining this minimum distance keeps roots away from the foundation, reduces the chance of pests traveling from nearby branches onto the home, and allows the homeowner to more easily inspect

for termite tunnels around the home's foundation wall.

**Benefit:**

Physical pest controls are permanent controls that reduce the need to use unsafe chemicals. They also increase durability of the home's structural elements, reducing the time and money needed for repairs.

## 11. Reduce Pollution Entering the Home from the Garage

**Description:**

According to the U.S. Environmental Protection Agency (EPA), an attached garage is the single most significant contributor to poor indoor air quality in a home. Car exhaust contains many known carcinogens and can migrate into living spaces through doors and cracks in walls and ceilings adjacent to the garage. Other pollutants commonly found in garages include benzene from lawn mowers and power tools, pesticides for gardens, toxic cleaning agents, and chemicals in paints and adhesives.

**Application:**

### a. Tightly Seal the Air Barrier between Garage and Living Area

Use foams, weatherstripping and caulking to completely seal garage walls and ceilings adjacent to the interior. Doors should have full weatherstripping and sealed thresholds. Spray-applied foam insulation that creates a complete air barrier is recommended.

### b. Install Separate Garage Exhaust Fan

Install an 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 after door has been opened or closed.

**Benefit:**

Properly designed garages keep polluted air out of the home.

## 12. Install Minimum 16-in. Overhangs with Gutters

**Description:**

Overhangs increase a home's durability by protecting it from the elements and helping regulate the amount of rain striking walls. Overhangs also provide shading for windows. Gutters provide a pathway for water to exit the roof without entering walls and splashing back onto the foundation and siding.

**Application:**

Design at least a 16-inch overhang with gutters around the building's entire roof. Consider adding deeper overhangs where needed to shade walls and windows to provide cooling during summer. Drain gutters at least 24 inches from the home and into a rainwater cistern or toward adjacent landscaped areas that are graded to receive the excess water so as to recharge groundwater, filter pollutants, and water vegetation.

**Benefit:**

Overhangs and gutters protect siding, windows and doors from water intrusion, thereby reducing the likelihood of rot and mold issues. Overhangs also provide protection from the sun's harsh UV rays, which can degrade building materials and furnishings.

# E. Exterior Finish

## 1. Use Sustainable Decking Materials

### Description:

A home's deck takes more abuse than just about any other building material. Besides being exposed to all the elements, the deck often gets heavy foot traffic.

### Application:

#### a. Use Recycled-Content Decking (Avoid Virgin Plastic)

Use recycled-content decking in all nonstructural deck applications. Recycled plastic lumber contains only recycled plastic, while composite lumber is made by combining recycled wood fiber and recycled plastic. Both can be used in place of old-growth redwood, cedar and pressure-treated lumber. These products accept screws and nails, and cut like wood. Follow manufacturer recommendations closely regarding installation techniques.

#### b. Use FSC-Certified Wood Decking

FSC-certified lumber comes from forests managed in an environmentally and socially responsible manner. Use FSC-certified lumber for all exterior decking applications or as structural deck members in conjunction with recycled-content decking.

### Benefit:

Recycled-content plastic and composite decking is more durable than wood. It doesn't rot, crack or splinter, doesn't require staining, and isn't treated with potentially toxic chemicals. Using recycled-content decking also reduces pressure to harvest old-growth forests. FSC certification guarantees that forests are managed in a way that will assure the long-term availability of wood resources and the health of old-growth forests.

## 2. Install a Drainage Plane (Rain Screen Wall System)

### Description:

A drainage plane or rain screen wall system is an effective envelope solution to external moisture penetration. It allows for an air space between the siding and wall structure, protecting it from damaging rain intrusion.

### Application:

Install siding with an air space between it and the wall. Flash all wall openings correctly and create vent strips at the top and bottom of the wall.

### Benefit:

This system will significantly help

protect a home from rain intrusion and the associated problems with rot and mold in the wall structure.

## 3. Use Durable and Noncombustible Siding Materials

### Description:

Sidings made of metal, stone, brick, stucco and fiber-cement offer a durable and non-combustible home exterior.

### Application:

Use in place of conventional wood siding.

### Benefit:

Using these siding materials can reduce repainting and other maintenance needs, protect the home from fire, and possibly lower the homeowner's insurance rates, especially in fire-prone areas.

## 4. Select Durable and Noncombustible Roofing Materials

### Description:

Forty- to fifty-year asphalt shingles, tile, slate, fiber-cement, recycled plastic and metal are examples of durable roofing materials. A Class A fire rating offers a home the highest in fire protection.

### Application:

Applicable anytime roofing materials are specified. The Class A fire rating is achieved through the roofing material itself or through the roof assembly as a whole.

### Benefit:

Short-lived roofing materials result in more waste going to landfills and more money spent on roof replacement. In extreme cases, early failure of a roofing material can allow for water damage and require costly repairs.

## BUILDING BASICS | Avoid Moisture Intrusion

Most major building failures and construction defect lawsuits are related to water intrusion into the building's walls, ceilings and floors due to incorrectly installed flashing. Water intrusion leads to rot, mold and mildew, and may eventually result in structural and health problems.

Offer detail drawings on plans that show how moisture drains away from building elements. Show proper shingle-flashing of all penetrations and joints such as chimneys, pipes, roofs, windows, doors, vents and decks. It is a highly recommended practice to provide on-site training for workers.

# F. Plumbing

## 1. Distribute Domestic Hot Water Efficiently

### Description:

Much of the energy used to heat water for domestic purposes is lost in long piping runs to remote fixtures. Locating the domestic hot water (DHW) source close to usage points reduces heat loss, speeds the rate of hot water delivery to the user, and reduces water waste. Larger houses may require hot water recirculation systems to reduce waiting time, but continuous or timed pump operation wastes an excessive amount of energy. For larger houses that require hot water circulation, an on-demand hot water circulation pump control will reduce this energy use.

### Application:

#### a. Insulate Hot Water Pipes from Water Heater to Kitchen

Follow Title 24 pipe insulation standards; in addition, insulate the length of the hot water pipe from the water heater to the kitchen. A no-cost option for insulating piping run through attics is to bury them in ceiling insulation.

#### b. Insulate All Hot Water Pipes, or Insulate Pipes to Kitchen and Install On-Demand Hot Water Circulation System

Reduce heat loss by insulating all hot water pipes in the home. If that is not feasible, insulate the hot water pipes from the water heater to the kitchen, and install an on-demand hot water circulation system to shorten hot water delivery times. These systems consist of a recirculation loop and a pump with on-demand controls (pushbutton or motion sensor activated). Only one

pump is needed to supply hot water to all fixtures.

#### c. Locate the Water Heater within 25 feet of All Fixtures

Locate the water heater tank close to bathrooms, kitchen and laundry to shorten pipe lengths. This can be accomplished in a spread-out floor plan by creating a central mechanical space which can also house the furnace, by installing a tankless water heater centrally in the attic, or by using more than one tankless water heater.

#### d. Use Engineered Parallel Piping

Often termed "home run" or "manifold" piping, this alternative to typical "branched" piping can save water and energy needed for heating water. Small diameter flexible pipes are run from a manifold located near the water heater directly to the fixtures, thereby decreasing the volume of water in the piping and reducing friction loss imposed by elbows and other fittings.

Parallel piping can be implemented using either soft copper or PEX (cross-linked polyethylene). The latter should be used where codes permit because it has a lower heat conduction rate and it costs less. With low-flow fixtures, 3/8" diameter piping may be adequate for sinks; 1/2" piping should be used for other fixtures. To ensure that pipe lengths are kept to a minimum and that sufficient flow will be provided, an "engineered" piping plan should be prepared to show the location and diameter of hot water pipes.

### Benefit:

Efficient design and distribution of domestic hot water saves energy, conserves water, uses less piping, and speeds hot water delivery.

## 2. Install High Efficiency Toilets

### Description:

Toilets that use less than 1.3 gallons per flush (gpf) are called High-Efficiency Toilets (HETs). This category of fixture includes dual-flush toilets, 1.0-gpf pressure-assist toilets, and conventional gravity-fed toilets.

### Application:

Install HETs qualified as meeting the rigorous performance requirements of North American water agencies. These fixtures are identified as meeting or exceeding a 250 gram waste removal threshold as defined in the Maximum Performance (MaP) testing report. A complete listing of HETs and the MaP report can be downloaded from the product webpage of the California Urban Water Conservation Council: [www.cuwcc.org/products\\_tech.lasso](http://www.cuwcc.org/products_tech.lasso)

### Benefit:

HETs perform well and allow residents to further reduce their water and sewer costs. Water providers benefit by reducing demand upon their water supplies. Municipalities and wastewater agencies benefit from less wastewater to treat. Check with the local water provider for possible rebates.

Tankless Water Heater. See page 45 for details.



# G. Appliances

## 1. Install ENERGY STAR® Dishwasher

### Description:

High efficiency dishwashers use less water and energy than conventional dishwashers. They save at least 25% over the federal minimum standards. Some dishwashers are more water-efficient than others, even among ENERGY STAR®-qualified models. The most water-efficient models use 6.5 gallons or less per cycle.

### Application:

Select ENERGY STAR®-qualified dishwashers. They use an internal water heater to boost temperatures inside the dishwasher. This means that household water heaters can be turned down to 120°F, saving water heating costs.

### Benefit:

Water-efficient dishwashers reduce water and energy use.

## 2. Install ENERGY STAR® Clothes Washing Machine

### Description:

ENERGY STAR® clothes washing machines use 50% less energy and 45 to 60% less water while performing as well as a standard washer. To maximize water efficiency, choose models with a water factor rating of 6.0 or less.

### Application:

Most ENERGY STAR® washing machines save energy and water through a front-loading design (horizontal axis) that tumbles clothes in a small amount of water. Most models also include a high-speed final spin cycle that extracts more moisture than standard

washers. Less moisture means less drying time, saving additional energy from the drying operation.

### Benefit:

ENERGY STAR®-qualified washing machines use substantially less water and energy than conventional washers.



Horizontal Axis Washing Machines.

## 3. Install ENERGY STAR® Refrigerator

### Description:

Refrigerators and freezers are among the largest users of electricity in most homes. They can account for up to 25% of household energy use. ENERGY STAR® refrigerators save at least 15% over the federal minimum standards. Refrigerators that qualify for the Consortium for Energy Efficiency's



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](http://www.energystar.gov).

Super-Efficient Home Appliances (SEHA) Tier 2 designation save at least 20% over minimum federal standards.

### Application:

A. Select ENERGY STAR®-qualified refrigerators. For information, go to [www.energystar.gov](http://www.energystar.gov).

B. Select SEHA Tier 2 refrigerators. For information, go to [www.cee1.org/resid/seha/refrig/refrig-main.php3](http://www.cee1.org/resid/seha/refrig/refrig-main.php3)

### Benefit:

ENERGY STAR® refrigerators can reduce the total annual electricity bill by more than 10%.

## 4. Install Built-In Recycling Center

### Description:

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

### Application:

Recycling and trash bins should be built into kitchen cabinets.

### Benefit:

A built-in recycling center provides convenience by locating a recycling bin right next to a trash bin, keeping materials separated and free from contamination.



Built-In Recycling Center.

# H. Insulation

## 1. Install Recycled-Content Insulation

### Description:

Nearly all building insulation contains some recycled content. Fiberglass insulation typically contains 30% recycled glass, with a combination of post-industrial and post-consumer content. Materials such as recycled cotton or newspaper insulation contain up to 80% post-consumer recycled materials.

### Application:

Choose products with the highest recycled content possible. Give preference to materials with a high level of post-consumer recycled materials. Post-consumer waste is recovered after a product's useful life has ended and the product is ready to be discarded.

Damp-Blown Spray Cellulose Wall Insulation.



### Benefit:

Buying products with high post-consumer recycled content reduces reliance on virgin raw materials, closes the loop in the curbside recycling process, and reduces landfill deposits.

## 2. Install Insulation That Is Low Emitting for Formaldehyde and Volatile Organic Compounds (Certified Section 01350)

### Description:

Many insulation products emit formaldehyde and other volatile organic compounds (VOCs). Look for products that have been tested for low emissions by a reputable third-party organization or government agency.

Recycled-Content Batt Insulation.



### Application:

Select a product that has been tested for low emissions according to the California "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers." (For information, go to [www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350](http://www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350).)

### Benefit:

Minimizing formaldehyde and VOCs in the home improves indoor air quality.

## 3. Quality Installation of Insulation

### Description:

Studies have shown that poorly installed insulation severely decreases the material's insulating value. Ensure quality installation of insulation in walls, floors and ceilings. Consider installing above Title 24 minimum levels.

### Application:

Pay proper attention to detail and quality assurance. Install insulation with no gaps or voids. Size insulation correctly to fill the cavity side-to-side, top-to-bottom and front-to-back. Cut or fill to fit around wiring and plumbing without compression. Insulate hard to access cavities.

### Benefit:

Effectively installed insulation creates a more comfortable home and reduces the owner's utility costs. Lower energy demand reduces pollution and improves public health.

# I. Heating, Ventilation and Air Conditioning

## 1. Design and Install HVAC System to ACCA Recommendations

### Description:

The Air Conditioning Contractors of America (ACCA) has developed a set of calculation manuals—Manuals J, D and S—to determine the appropriate size and design of a home's heating, ventilation and air conditioning (HVAC) system.

### Application:

Design and install the HVAC system according to results obtained from Manual J (the home's heat load calculation), Manual D (ductwork design and sizing) and Manual S (equipment selection and sizing).

### Benefit:

Doing these calculations correctly and installing the system indicated by the calculations will result in an efficient and effective HVAC system that will deliver comfort and energy savings.

## 2. Install Sealed Combustion (Direct Vent) Furnaces and Water Heaters

### Description:

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

### Application:

Install in place of conventional atmospherically vented furnaces or water heaters.

### Benefit:

Some gas appliances such as gas dryers and fireplaces require indoor air for combustion and exhaust conditioned air. When a house is negatively pressurized by exhaust fans, dryers or leaky ducts, carbon monoxide can be pulled into the house from the combustion chamber. Sealed furnaces and water heaters eliminate that condition, thereby improving indoor air quality and reducing the danger of carbon monoxide contamination. Sealed combustion furnaces can also be installed (by code) in conditioned indoor spaces in tightly sealed houses, thus reducing heat loss to outdoors.

## 3. Install Efficient Gas Fireplaces

### Description:

Gas fireplaces are installed in a large percentage of new homes mostly for decorative use. Many have very low efficiency (as low as 13%), yet homeowners depend on them to meet some percentage of the heating load. Though there are no U.S. or state standards regulating their efficiency, efficiency listings are required in Canada and are available for many models sold in the U.S.

### Application:

Do not install gas fireplaces unless their listed efficiency (from Natural Resources Canada) exceeds 60%.

### Benefit:

Efficient gas fireplaces consume less gas and reduce winter heating costs.

## 4. Install ENERGY STAR® Ceiling Fans with CFLs

### Description:

Ceiling fans improve interior comfort by circulating air. Most ENERGY STAR®-qualified models can be adjusted to either draw warm air upward during the summer or push it downward during the winter.

### Application:

Preferable locations are areas where occupants tend to spend more time, such as bedrooms and family rooms. Anchor ceiling fans to ceiling joists. To increase efficiency, select models that include ENERGY STAR®-qualified light fixtures.

### Benefit:

Ceiling fans can make residents feel more comfortable, thereby reducing the need for air conditioning and heating. Compact fluorescent lighting (CFL) lasts longer and saves money.

## 5. Install Ventilation System for Nighttime Cooling

### Description:

Even when windows are ideally placed to provide natural ventilation, passive air circulation may be inadequate to keep the home cool. Mechanical ventilation cooling systems use nighttime air to cool the home's thermal mass, reducing or eliminating the need for air conditioning.

One type of system—a whole house fan—can provide nighttime cooling if used properly. However, they require open windows to

admit air, and they do not filter the air. Integrated ventilation cooling systems, on the other hand, integrate with heating and cooling equipment, are automatically controlled, do not require the use of windows, and deliver filtered outdoor air.

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**Application:**

Ventilation cooling systems should be sized for four to six air changes per hour, and should have at least two speeds. Integrated ventilation cooling systems that combine with variable speed furnaces or air handlers use less fan energy and offset more air conditioning energy.

Whole house fans should have insulated, tight-sealing shutters and should be installed in a hallway ceiling. To prevent backdrafting, never use a whole house fan with water heaters, furnaces, or fireplaces that rely on indoor air as a source of combustion air. Integrated ventilation cooling systems pressurize (rather than depressurize) the house, so backdrafting is not an issue.

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**Benefit:**

A properly applied ventilation cooling system can reduce total cooling energy consumption by an average of 35% in inland climates and can eliminate the need for air conditioning in coastal climates.

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## 6. Install Air Conditioning with Non-HCFC Refrigerants

**Description:**

R-22 is a hydrochlorofluorocarbon (HCFC) refrigerant used in residential heating and cooling systems. R-22 contains chlorine, an ozone-destroying chemical. In 2010, under the Clean Air Act, HVAC

manufacturers can no longer produce new air conditioners using R-22.

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**Application:**

Install AC units that don't use HCFC refrigerants. Some new AC units already use an alternative to R-22 refrigerant, R-410A. Make sure that refrigerants are handled properly; always select a reputable dealer that employs service technicians who have achieved EPA certification to handle refrigerants.

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**Benefit:**

If the refrigerant leaks during replacement, a non-HCFC refrigerant will not damage the ozone layer.

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## 7. Design and Install Effective Ductwork

**Description:**

Poorly designed and installed ductwork lowers heating and cooling system efficiency and capacity, and can contribute to poor indoor air quality and comfort problems.

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**Application:**

### a. Install HVAC Unit and Ductwork within Conditioned Space

Install HVAC unit and all heating and cooling ductwork inside the insulated envelope of the home. The unit and duct runs may be installed in closets, chases, and soffits purposefully designed to accommodate them, or they may be installed in an attic that is insulated at the roof deck (non-vented attic).

### b. Use Duct Mastic on All Duct Joints and Seams

Leaks in the joints between ductwork have been shown to allow, on average, 20 to 30% of conditioned air to leak out. Leaky air ducts can cause negative pressure in the

house, which can draw many outdoor and indoor contaminants into the home, including carbon monoxide from gas water heaters and furnaces. Don't use duct tape; it loses its effectiveness in a few years. Mastic maintains a tight seal for decades. Install mastic at every duct joint and seam.

### c. Install Ductwork under Attic Insulation ("Buried Ducts")

As a low cost alternative to installing ductwork in conditioned space to improve HVAC system efficiency, the insulation value of ductwork can be significantly improved by burying ducts in loose-fill ceiling insulation. To maximize the effectiveness of this approach, duct connections must be tightly sealed.

Instead of suspending ducts from rafters or trusses, allow ducts to lay over ceiling joists or the bottom chord of trusses and blow insulation over them. To achieve moderate coverage, insulate to at least R-38. Using supply boots with side instead of top connections keeps ducts low and aids burial.

Title 24 credit may be taken for this measure if markers are placed to indicate duct locations and if inspected by a HERS rater.

### d. Pressure Balance the Ductwork System

When a bedroom door is closed, it reduces or cuts off the return airflow path. In larger rooms, this restricts air movement, leading to comfort problems and a pressure imbalance, with the bedroom overpressurized and the rest of the house depressurized. This may cause infiltration of contaminated air from the attic or crawlspace, or backdrafting of

combustion appliances. At a minimum, install an additional return duct in the master bedroom and other large rooms that can be closed off with a door. Or install a transfer duct to join grilles between the hall or main living area and these rooms. Make the transfer duct long enough to minimize sound transmission.

#### e. Protect Ducts during Construction and Clean All Ducts before Occupancy

Debris and dust from construction can lodge in HVAC units and the ductwork, potentially causing occupants to have allergic reactions and reducing the effectiveness of the blower fan and heating/cooling elements. During construction, completely seal off each duct register and the HVAC unit to block out any construction dust. Use methods and materials that will stay in place under the abuse of a typical construction site. After construction is completely finished, vacuum the blower unit and ductwork as necessary.

##### Benefit:

Effective ductwork practices significantly reduce energy loss, minimize indoor air quality problems and improve occupant comfort.

### 8. Install High Efficiency HVAC Filter

##### Description:

MERV, or Minimum Efficiency Reporting Value, is a metric used to measure an air filter's efficiency. The MERV scale ranges from 1 to 20. The higher the MERV number, the more efficient the filter is at removing particles.

##### Application:

Filters of MERV 6 to 10 are recommended for cleaner air without compromising the performance of standard mechanical systems. Filters with MERV ratings of 10 or more create resistance to airflow, because the filter media becomes denser as efficiency increases. Only use a filter with a MERV of 10 or higher if the HVAC system is specifically designed for it.

##### Benefit:

The EPA has identified micro-particulates as a leading cause of respiratory discomfort. By reducing these particles in the indoor air, a high efficiency filter protects the HVAC equipment elements and makes the living space healthier.

### 9. Install Zoned, Hydronic Radiant Heating with Slab Edge Insulation

##### Description:

Hydronic heating systems circulate hot water through radiant floor panels, wall radiators, or baseboard convectors located in different areas or zones of the house. Hydronic heating is most practical when installed with radiant heating distribution in slab-on-grade foundations

Radiant Floor Heating.



in one-story houses located where cooling is not needed. They can utilize efficient boilers or water heaters that provide hot water for both domestic use and space heating. Install slab edge insulation with a minimum of R-5.

##### Application:

Use hydronic radiant heating instead of forced air heating where cooling is not needed, or where comfort requirements are rigorous. The system should be designed in accordance with Radiant Panel Association guidelines by an RPA-certified installer.

##### Benefit:

Hydronic heating systems are more comfortable than forced air heating, save energy by reducing thermal stratification and eliminating duct heat loss, and are easily zoned.

### 10. Install Mechanical Ventilation System

##### Description:

Mechanical ventilation systems are used to deliver fresh air in tightly sealed homes. There are several types of mechanical ventilation systems that can be grouped into categories of exhaust fans, systems that integrate with furnaces, and stand-alone balanced ventilation systems.

##### Application:

California Title 24 standards require mechanical ventilation when "tight" construction is used for compliance (specific leakage area, or SLA, is less than 3). Design the mechanical ventilation systems to meet established ventilation standards such as in

ASHRAE Standard 62.2. Provide the homeowner with clear information about such systems, so that they can operate and maintain them properly.

When used for whole-house ventilation, exhaust fans should operate continuously and include provisions for filtered makeup air. Integrated systems use the furnace fan to bring in outside air through a dampered duct, and should be equipped with controls to regulate volume of air. Stand-alone systems include heat recovery ventilators (HRV's) and energy recovery ventilators (ERV's) that employ heat exchangers to recover heat and/or moisture. HRV's and ERV's are appropriate for colder climates; their high fan energy use may not justify their use in most California climate zones.

Exhaust all bathroom ventilation fans to the outdoors, not to the attic. Bathroom fans should be controlled by a timer or humidistat to ensure proper run-time to adequately remove moisture from the room. Timers that are triggered when the lights are turned on, and then run for a set time (usually 15 to 30 minutes) work well. Humidistat controllers are even better, as they automatically switch on when moisture in the air reaches a threshold level, and shut down when the moisture level subsides. Look for bathroom fans with 1.5 sones or less for quieter operation.

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**Benefit:**

Mechanical ventilation systems provide today's tighter homes with fresh outdoor air. Whole house ventilation systems improve indoor air quality by diluting pollutants. Properly ventilating bathrooms will reduce the possibility of rot, mold and other moisture problems. ENERGY STAR®-qualified ventilation fans use 65% less energy, on average, than standard models. They also provide better efficiency and comfort with less noise, and use high performance motors that last longer.

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### 11. Use Low-Sone Range Hood Vented to the Outside

**Description:**

Kitchens produce a lot of moisture that can cause mold growth if not properly ventilated. Gas ovens and cooktops produce carbon monoxide, nitrogen dioxide and other pollutants. Additionally, cooking food produces odors and particulates.

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**Application:**

Exhaust kitchen hoods to the outside, not the attic. Use range hoods that are quiet (less than 4 to 5 sones), so that home occupants will be more likely to use them. Make sure to purchase hoods that are not overpowered and can cause backdrafting of fireplaces.

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**Benefit:**

Excessive moisture resulting from poor ventilation is one of the main causes of mold in buildings. Venting range hoods to the exterior reduces the amount of moisture inside the home, and helps prevent adverse health effects from combustion gases and cooking emissions.

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### 12. Install Carbon Monoxide Alarms

**Description:**

Carbon monoxide (CO) is emitted from combustion appliances such as stoves, cooktops, water heaters, furnaces and fireplaces, as well as from cars and some landscape equipment. If a home's ductwork is leaking in a tightly built home, it can depressurize the home and reverse the flow of exhaust vent pipes. This can introduce carbon monoxide from these appliances back into the home, a process known as backdrafting.

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**Application:**

Install a carbon monoxide alarm per manufacturer's instructions. Alarms must comply with both UL 2034 and CSA 6.19 standards. Alarms must be replaced every three to five years, as they lose their sensitivity over time.

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**Benefit:**

A carbon monoxide alarm provides an added level of home safety.

## BUILDING BASICS

### Design Energy-Efficient Homes

In October 2005, revisions to California's Building Energy Efficiency Standards (Title 24) went into effect.

Consider the following energy efficiency strategies to achieve and exceed Title 24 standards.

#### **a. Improve Insulation**

Insulation in exterior walls and ceilings can reduce demand for air conditioning and heating and make homes more comfortable. However, if the insulation is not properly installed, the insulation's stated value will not be achieved. Ensure quality installation of insulation. California's Building Energy Efficiency Standards (Title 24) now allows a credit for "quality installation" whereby a certified professional verifies in the field that insulation has been installed well, and with minimal gaps and voids.

#### **b. Install Radiant Barrier Roof Sheathing in Warm Inland Climates**

Radiant barrier sheathing is a roof sheathing material with a reflective layer (film or foil) applied to the underside. Use in place of, and install in the same manner as, conventional roof sheathing. Radiant barrier sheathing can reduce attic temperatures by as much as 30 degrees on hot days.

#### **c. Install Energy Efficient Windows**

When selecting windows, look for low-e models that have an NFRC

label listing a U-value of 0.4 or less and an SHGC of 0.4 or less. The cost premium for low-e glass is minimal and typically pays for itself very quickly. There are two types of low-e glazing: heat rejecting (soft coat) and heat receiving (hard coat). The soft coat low-e is more commonly available, and it is effective as a cooling strategy. However, the hard coat low-e is recommended for south glazing in passive solar buildings. Wood, vinyl and fiberglass frames generally insulate much better than aluminum frames.

#### **d. Install Tankless Water Heaters**

The new generation of tankless water heaters can meet the hot water needs of most houses, have no standing pilot, and can reduce water heating gas use by 50% or more. Instead of storing hot water they heat water as needed, thus reducing standby energy use. Install the tankless water heater as close to the points of use as possible, and adjacent to an exterior wall or roof to reduce the cost of venting (stainless steel venting is required). A control that allows the hot water temperature to be varied is recommended. See picture on page 38.

#### **e. Install Water Heater with Energy Factor >0.62**

Water heaters with high energy factors use more of the energy for

heating the water rather than losing it out of the flue. This also saves money on fuel costs.

#### **f. Install High Efficiency Furnace (AFUE 90 % or higher)**

Install a furnace with 90% AFUE (annual fuel utilization efficiency) or greater. A properly sized, high efficiency furnace costs less to operate and reduces air emissions. Furnaces with variable speed fans also use less electrical energy. Check with your local utility company for rebate information.

#### **g. Install High Efficiency Air Conditioner (SEER >13) with a Thermostatic Expansion Valve (TXV)**

Air conditioning is the greatest contributor to residential peak loads in California. There are two efficiency ratings, SEER (seasonal energy efficiency ratio), which reflects energy use at 82°F outdoor temperature, and EER, which is measured at 95°F outdoor temperature. The higher the SEER and EER numbers, the less electricity is required to provide comfort. Both values should be considered, since most of California's air conditioning occurs at temperatures above 82°F. TXV is a refrigerant regulation device that can help ensure that the air conditioning system operates at maximum efficiency over a wide range of conditions, and can compensate for incorrect refrigerant charge.

## 1. Design and Build ENERGY STAR® High Performance Homes

### Description:

A home that is designed and built with energy efficiency improvements beyond Title 24 may be eligible for ENERGY STAR® designation.

### Application:

To be ENERGY STAR®-qualified, a home must exceed Title 24 by 15% and pass a home performance test conducted by a certified Home Energy Rating System (HERS) technician. Incentives may be available to help offset the cost of the home performance testing.

### Benefit:

People living in a high performance home will benefit from increased comfort, lower energy costs, and higher quality construction.



## 2. Meet ENERGY STAR®'s Indoor Air Quality Package Requirements

### Description:

ENERGY STAR®'s Indoor Air Quality Package goes beyond energy

efficiency and requires that duct leakage be controlled, the thermal envelope tightened, air pressures balanced, fresh air introduced, pest control measures installed, indoor contaminants reduced, and all major moisture issues managed.

### Application:

Fulfill the requirements of the ENERGY STAR® Indoor Air Quality Package, apply for and receive qualification. Fulfilling ENERGY STAR®'s energy-efficiency requirements is a prerequisite for the Indoor Air Quality Package.

### Benefit:

These requirements go very far in effectively managing building comfort, health and durability.

## 3. Third-Party Plan Review and Inspection

### Description:

Early review of project plans can help maximize a home's energy efficiency and green building benefits. Homes designed to be very energy efficient may still perform poorly. Diagnostic evaluations and inspections can help uncover errors and fix potential problems.

### Application:

Have an experienced and certified green building professional review the home's design for maximum efficiency and interaction of the

building elements. The plan reviewer can identify additional green building opportunities for the project and ensure proper installation.

Later, have the home performance tested for thermal envelope and HVAC effectiveness. Inspection and diagnostic evaluations should include the following measures: Use a certified Home Energy Rating System (HERS) technician to test duct system air delivery (CFM); results should be within 10% of design flow calculations. Pressurize ducts and verify that leakage is under 6%. Use a blower door test to estimate the interior air changes per hour (ACH); results should be close to 0.35 ACH. Perform a combustion safety test if needed to ensure carbon monoxide is not backdrafting into the home.

### Benefit:

Third-party plan review can lead to additional green building benefits for the project. Third-party home performance testing is vital for ensuring that homes will perform as intended.

# K. Renewable Energy

## 1. Pre-Plumb for Solar Water Heating

### Description:

Preparing for the installation of solar water heating will substantially reduce the cost of future installation, and adds little cost during the time of construction.

### Application:

Installation of insulated copper pipes and sensor wiring between the attic and the water heater location will facilitate future installation of a solar water heater. To accommodate “active” systems, provisions should also be made for a solar storage tank (with pressure relief drain line) and an electrical outlet for a pump. Provide at least an 8 ft. by 8 ft. clear section of south-facing roof for future installation of solar panels.

### Benefit:

Solar hot water pre-plumbing will make it easier and less expensive to install a solar water heater in the future.

## 2. Install Solar Water Heating System

### Description:

Solar water heating systems use solar panels and water storage to collect and store heat from the sun for domestic hot water use. Water preheated by a solar system is typically used to deliver preheated water to a standard water heater. Solar water heating is more cost effective than ever, as a result of new technologies, reliable products, and rising natural gas prices.

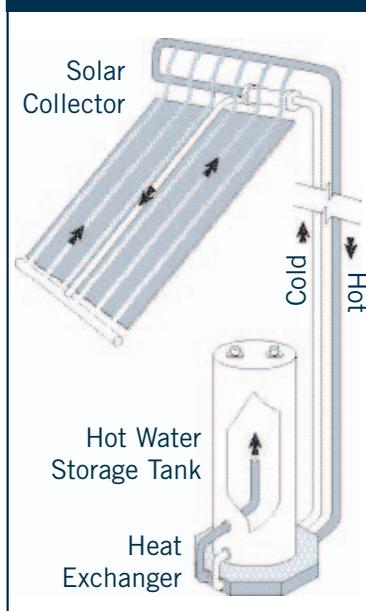
### Application:

Use only solar water heaters that are SRCC (Solar Rating and Certification Corp) certified. Provide sufficient south-facing roof area for collectors, make sure the roof structure can accommodate the weight of the system, and make provisions near the conventional water heater for any additional mechanical equipment (such as storage tanks, pumps, pipes and controllers).

Installing Solar Water System.



## Solar Hot Water and Space Heating System



### Benefit:

Many solar water heating systems can provide all the hot water needed during summer months, and will save more than 50% of the gas normally used for water heating. Solar hot water systems can pay back in as little as ten years and reduce the use of gas or electricity for water heating.

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

### Description:

Making provisions during construction for installing future PV systems can significantly lower the cost when systems are installed later. These provisions include installing conduit from the attic to a location near the electric service entrance/ circuit breaker panel, allowing space for installation of PV modules on south-facing roofs, and ensuring that roof trusses are adequate to accommodate any added roof loads.

### Application:

Maintain a 200-square-foot or larger section of south or west roof area clear of vent pipes and other obstructions to allow for the installation of modules. Install 3/4-inch or larger conduit with pull boxes as needed to run wire from the attic to a junction box near the main panel and meter. Provide the owner with a roof plan with the preferred location for PV modules and the conduit location clearly marked, and provide structural information on what added loads the roof can accommodate. (One type of PV systems, called building-integrated PV modules,

typically weigh less than the roof tiles they replace.)

**Benefit:**

Net metering rules and time-of-use electric rates are improving the economics of photovoltaic systems, which can provide all of the electrical energy needed by a home on a net annual basis. PV-generated electricity produces no air pollution and reduces the need for building new power plants. Photovoltaic panels and systems may drop in price over the next few years, and California incentives may increase.

#### 4. Install Photovoltaic (PV) Panels

**Description:**

PV systems convert solar energy into electricity when sunlight strikes the PV cells. A number of different products are available for residential applications. One type, “building-integrated” PV modules, are designed to attractively interface with tile roofing systems.

**Application:**

For cost and appearance, the best location for PV modules is flush on south or west-facing roofs. More energy is produced annually by south-facing modules, but west-facing modules can take better advantage of time-of-use rates that are available from some utilities, and help reduce the system peak load. For tile roofs, building-

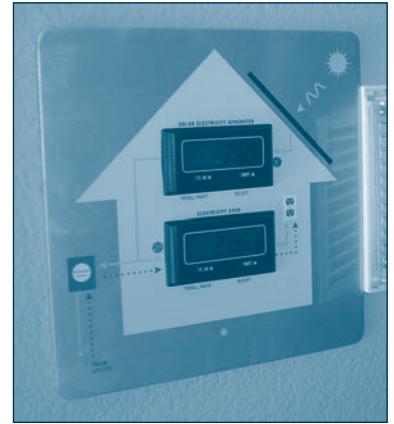
integrated modules are usually easier to install and more attractive. For other roof types, specially designed racks are available for mounting the PV panels.

Current incentives include a California Energy Commission “buy-down” and a federal tax credit.

**Benefit:**

Benefits include lower utility costs, reduced emissions by fossil fuel—burning power plants, reduced need for the development of new power plants, and improved energy security.

Power meter showing the amount of solar electricity generated and used.



Photovoltaic Panel System, Centex Homes, Livermore.



# L. Finishes

## 1. Provide Permanent Walk-Off Mats and Shoe Storage at Home Entrances

### Description:

Up to two-thirds of dust and particulates in houses is tracked in on shoes. The dust contains everything from soil and pesticides to abrasive sand, mold, road grime and bacteria. Once these particulates are inside the home, they can be difficult to get rid of.

### Application:

Minimize the amount of contaminants tracked inside the home. For entryways, avoid carpet, and specify easily cleaned flooring with a hard surface, such as hardwood, bamboo, ceramic tile or natural linoleum. Provide features near entryways for removal and storage of outerwear and shoes, such as tiled surface and benches for removing shoes, or a mudroom.

### Benefit:

Occupants will have a cleaner home with less outdoor pollution tracked in.

## 2. Use Low-VOC or Zero-VOC Paint

### Description:

Most paint releases volatile organic compounds (VOCs), a major air pollutant, into the home. Once outside, certain VOCs react with other pollutants, producing ground-level ozone (smog) that also affects human health. Low- and zero-VOC paints reduce these sources of pollution.

### Application:

Paint with low- or zero-VOCs is available from most major manufacturers and is applied like conventional paint.

Low-VOC paints contain less than 150 grams per liter (gpl) of VOCs for nonflat finishes, and 50 gpl or less for flat finishes. Paints that contain less than 5 gpl of VOCs are classified as zero-VOC.

### Benefit:

Low- or zero-VOC paint reduces the emissions of VOCs, improving indoor air quality and reducing the formation of smog.

## 3. Use Low-VOC, Water-Based Wood Finishes

### Description:

Conventional oil-based wood finishes can offgas for months and can be harmful to children and chemically sensitive individuals. Offgassing means the solvents are released into the air, contaminating indoor air quality. Low-VOC finishes, such as waterborne urethane and acrylic, are lower in toxic compounds compared to conventional oil-based finishes while providing similar durability.

### Application:

Low-VOC wood finishes (with VOC concentrations of 150 gpl or less) can be used in most applications where oil-based finishes are typically used. If oil-based wood finishes must be used, they should be applied off-site or 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 smog.

## 4. Use Low-VOC Adhesives and Caulks

### Description:

Unlike oil-based adhesives and caulks that offgas toxic compounds for months, low-VOC products reduce toxic gases such as aromatic hydrocarbons or other petroleum solvents that contribute to indoor and outdoor air pollution.

### Application:

Use low-VOC products (70 gpl or less) in place of standard adhesives and caulks for all interior applications such as installation of flooring, countertops, trim, wall coverings, paneling and tub/shower enclosures.

### Benefit:

Low-VOC adhesives and caulks work as well as or better than conventional products, emit fewer pollutants and reduce the potential of harmful health impacts.

Low/No-VOC paint.



## 5. Use Recycled-Content Paint

### Description:

A number of manufacturers have developed high-quality recycled-content latex paint and primers. The recycled portion (20 to 100%) comes from unused consumer or industrial stock, as well as paint recovered from household hazardous waste collection facilities. The paint is checked for quality and then sent to paint manufacturers for recycling and blending with a portion of new paint.

### Application:

Latex paint with recycled content is applied like conventional paint. Due to the blended nature of the paint, it tends to come in a limited range of colors.

### Benefit:

Recycled paint is often less expensive than new paint. It also reduces the need to manufacture new paint and supplies a market for unused paint, rather than putting it into the waste stream.

## 6. Use Environmentally Preferable Materials for Interior Finish

### a. Use FSC-Certified Materials

#### Description:

Forest Stewardship Council (FSC)–certified wood comes from forests managed in accordance with stringent sustainable forestry practices.

#### Application:

Use FSC-certified materials in any application that normally calls for conventional plywood or stain-grade materials, such as cabinets, trim, doors, shelving and window frames.

#### Benefit:

FSC certification assures that forests are managed in a way that protects the long-term availability of wood resources and the health of old-growth forests.

### b. Use Reclaimed Lumber for Nonstructural Applications

#### Description:

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

#### Application:

Use reclaimed lumber in place of new material for nonstructural applications, such as mantles, nonstructural beams, casing, trim, cabinets and doors.

#### Benefit:

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

### c. Use Rapidly Renewable Trim Materials

#### Description:

Straw-based MDF and bamboo plywood or laminate are alternatives to wood-based MDF and solid wood for interior trim. Straw is the stalk of any of the common grains such

FSC-Certified cabinets, countertop made from wood fibers harvested from sustainable forests and linoleum flooring.



as wheat, rice, barley, etc. This tough material is an annually renewable waste product. Bamboo is a fast-growing grass that can be harvested in three to five years.

#### Application:

Use these rapidly renewable trim materials in place of conventional solid wood or wood-based MDF.

#### Benefit:

Rapidly renewable materials are attractive, durable, and reduce pressure to harvest forests. Bamboo is as durable as most hardwoods. Straw-based MDF is equally or more durable than wood-based MDF, and is derived from an annually renewable waste product.

### d. Use Recycled-Content Materials

#### Description:

Some recycled-content trim is made from recycled polystyrene or other plastics. Recycled-content countertops include recycled glass tiles, terrazzo-like materials that

blend recycled glass and concrete, and natural fiber composites derived from rapidly renewable or recycled resources.

**Application:**

Use recycled-content trim materials in any application where the trim is to be painted. Use recycled-content products in kitchen and bathroom applications such as countertops, backsplashes, shower walls or vanity tops.

**Benefit:**

Recycled-content products keep valuable resources out of the waste stream. Recycled-content trim materials are often straighter and more stable than conventional clear wood.

### e. Use Finger-Jointed Materials

**Description:**

Finger-jointed trim, studs and fascia are manufactured from short pieces of clear wood glued together to create a finished material.

**Application:**

Use finger-jointed materials in any application where the materials are to be painted.

**Benefit:**

Finger-jointed elements are straighter and more stable than conventional clear wood, and use wood more efficiently.

## 7. Reduce Formaldehyde in Interior Finishes

**Description:**

Formaldehyde is often used as a binder in home-building products. Formaldehyde glues used in composite wood products come

in two forms: urea and phenol. Urea-formaldehyde binders are common in interior-grade products. Phenol-formaldehyde binders are used in exterior applications because they are more water-resistant. The waterproofing quality makes phenolic glues offgas more slowly and in lower quantities than urea glues, reducing some of the harmful effects on indoor air quality.

**Application:**

Whenever possible, use materials that emit little or no formaldehyde. Select a product that has been tested for low emissions according to the California “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers.” (For information, go to [www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350](http://www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350).)

**Benefit:**

Reducing formaldehyde exposure helps protect the health of residents, particularly children, who are most susceptible.

## 8. Test Indoor Air for Low Levels of Formaldehyde

**Description:**

Formaldehyde is a colorless gas that contributes to indoor and outdoor air pollution. The California Air Resources Board (ARB) has classified formaldehyde as a Toxic Air Contaminant, based on its potential to cause cancer and other adverse health effects. Formaldehyde is usually present at higher levels in indoor air than outdoor air, in

part because it is used as a binder and preservative in many common building products. Formaldehyde evaporates from products into the home’s interior, often for many years after the product is installed.

**Application:**

ARB recommends that formaldehyde levels be as low as possible because of formaldehyde’s cancer-causing potential, and no greater than 27 parts per billion. Using products with low formaldehyde emissions, such as those mentioned in these Guidelines, will usually lower formaldehyde to this level.

Test the building after installation of all finishes. Home test kits are available that measure the average indoor concentration of formaldehyde.

**Benefit:**

Reducing formaldehyde can decrease the risks associated with exposure.

Recycled content glass tile and concrete bathroom counters.



# M. Flooring

## 1. Use Environmentally Preferable Flooring

### a. Select Forest Stewardship Council (FSC)–Certified Wood Flooring or Reclaimed Wood

**Description:**

FSC-certified wood flooring comes from forests managed in accordance with stringent sustainable forestry practices. FSC-certified products are available in a wide variety of domestic and exotic species. Reclaimed wood is wood from another building or other use that is salvaged for use in a new application.

**Application:**

Use FSC-certified or reclaimed wood in place of conventional hardwood flooring.

**Benefit:**

FSC certification assures that forests are managed in a way that protects the long-term availability of wood resources, the health of old-growth forests, and the economic sustainability of forestry operations

and workers. Reclaimed flooring rescues wood from a landfill and gives it a second life.



### b. Use Rapidly Renewable Flooring Materials

**Description:**

Bamboo, cork and natural linoleum flooring are alternatives to hardwood flooring. Bamboo is a fast-growing grass that can be harvested in three to five years. Cork is harvested from the outer bark of the cork oak tree; the tree regenerates its bark within about 10 years. Natural linoleum is manufactured primarily from renewable materials such as cork, wood flour and linseed oil.

**Application:**

Use these rapidly renewable flooring materials in place of conventional hardwood, carpet or vinyl flooring.

Cork can also be used as underlayment for hard-surfaced flooring to reduce impact noise between rooms.

**Benefit:**

Rapidly renewable flooring materials are attractive, durable, low-toxic, perform well and reduce pressure to harvest old-growth forests. Bamboo is as durable as most hardwoods; cork and linoleum are naturally fire and moisture resistant as well as sound absorbent.

### c. Use Recycled-Content Ceramic Tiles

**Description:**

Recycled-content ceramic tiles can contain up to 70% recycled glass or other materials.

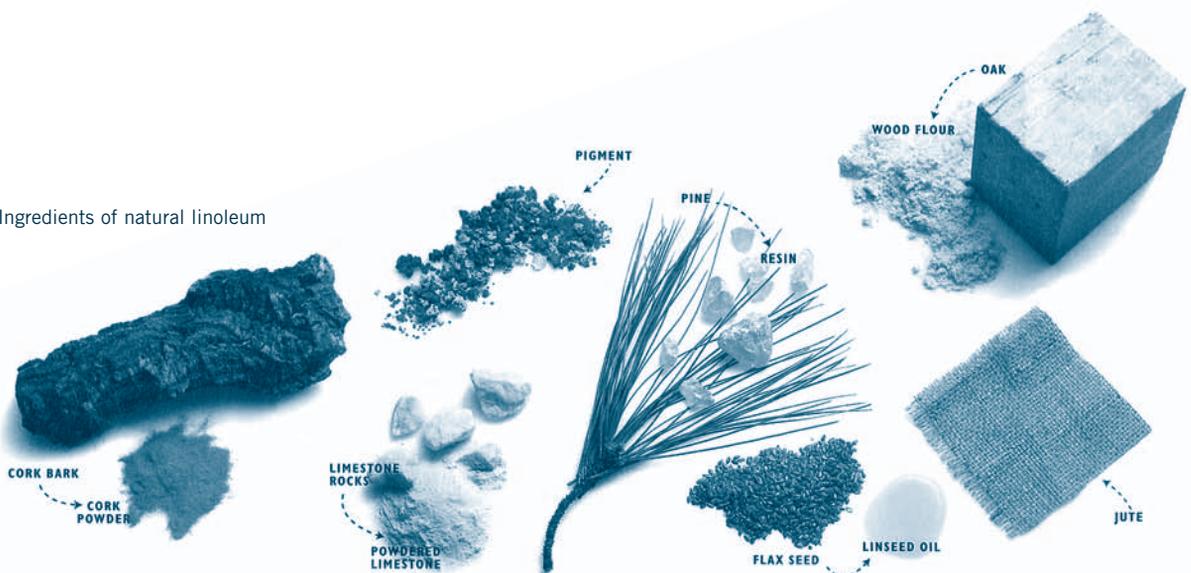
**Application:**

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

Ingredients of natural linoleum



Used with permission from *This Old House*

and stains that are absorbed into the tile, making it more durable and easier to maintain.

#### d. Use Exposed Concrete as Finished Floor

##### Description:

For slab-on-grade construction, the concrete can be polished, scored with joints in various patterns, or stained with pigments to make an attractive finish floor. This approach is especially appropriate for in-floor radiant heating systems and passive solar design.

##### Application:

Use this approach for slab-on-grade construction. The finish must be designed and constructed when slab is being poured.

##### Benefit:

Using the slab as a finish floor eliminates the need to use other flooring materials. It is also durable and easy to clean.

#### e. Install Recycled-Content Carpet

##### Description:

Recycled-content carpet is made from recycled plastic bottles, recycled nylon/wool or recycled cotton. Recycled-content carpet is comparable in appearance, performance and price to conventional synthetic carpet.

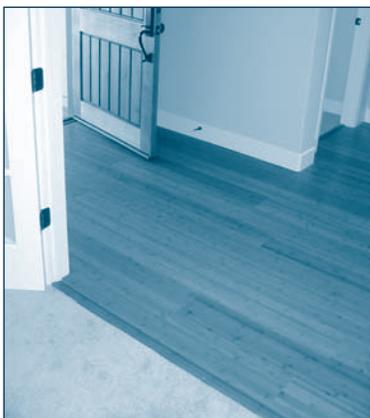
##### Application:

Use recycled-content carpet 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.

Bamboo flooring and recycled-content carpet.



#### 2. Provide Thermally Massive Floors

##### Description:

Use flooring materials that improve thermal mass.

##### Application:

Low-cost thermal mass includes using hard floor coverings such as tile and wood. Wood flooring over a concrete slab also provides reasonably good thermal mass.

##### Benefit:

Increasing thermal mass will reduce heating and cooling energy

use and will moderate indoor temperature swings, keeping the home more comfortable.

#### 3. Use Flooring That Is Low-Emitting (Section 01350 or Green Label Plus)

##### Description:

Flooring products may emit formaldehyde and other volatile organic compounds. Look for products that have been tested for low-emissions by a reputable third-party or government organization.

##### Application:

Choose carpet that meets or exceeds the CRI Green Label Plus requirements or a flooring product that has been tested for low emissions according to the California "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers." (For information, go to [www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350](http://www.ciwmb.ca.gov/GreenBuilding/Specs/Section01350).)

##### Benefit:

Minimizing formaldehyde and volatile organic compounds in the home improves indoor air quality.



# N. Other

## 1. Include Green Points Checklist in Blueprints

### Description:

Attaching the Green Points checklist to the blueprints makes it easier for everyone involved—including the builder, homebuyer and municipality—to see which green features are included in the home.

### Application:

In one of the first few pages of the project blueprints, include the Green Points checklist, with the applicable points checked off. To make it easier to verify the Green Points, note next to each Green Point the blueprint page number that corresponds to that particular point.

### Benefit:

Including the Green Points checklist in the blueprints raises the visibility of green building. This may encourage builders to incorporate more green features. It also provides a quick reference and benchmark for the builder, buyer and municipality.

## 2. Develop a Homeowner Manual of Green Features, Benefits and Operations

### Description:

A green homeowner manual describes all of the home's green features and their benefits. It also gives important information about best practices for maintaining and operating the home.

### Application:

Develop a separate green homeowner manual or include a green section in the standard homeowner manual. A comprehensive manual should include the following information:

- description of the home's green building features
- explanation of importance of maintenance and operations to achieve ongoing green building benefits
- warranty, operation and maintenance instructions for equipment and appliances
- household recycling opportunities
- ways to optimize water and energy use
- clear labeling of safety valves and controls for major house systems
- information about periodically checking crawlspace for termite tubes
- information on organic pest control, fertilizers, and environmental cleaning products
- instructions for keeping gutters clean
- information on proper tree maintenance
- instructions for proper handling and disposal of hazardous chemicals

### Benefit:

Green homeowner manuals instruct homeowners on best practices to

maximize their investment by maintaining their home and its landscaping in a healthy and environmentally responsible manner.

## 3. Community Design Measures and Local Priorities

Community Design measures are not listed individually in the Green Points checklist, but credit can be taken for these measures in line N.3. Municipalities may also identify selected green features that address unique local priorities. These can be listed in section N.3. as well.

## 4. Innovation

The Guidelines' measures are not intended to be an exhaustive list of green elements that can be incorporated into a home, but rather a list of field-tested options that are more likely to be used by custom and production builders. An Innovation Checklist with sample measures is available for download at [www.BuildItGreen.org](http://www.BuildItGreen.org)



Green Building Showroom, Ponderosa Homes.

# Chapter Five: Marketing Green Homes

Every green feature provides your customers with a benefit. Communicating these benefits and conveying the superior value of a green home are key aspects of your marketing effort. Train sales staff to tell the stories behind the features. For example, a buyer is more likely to perk up her ears if you talk about lower utility bills and greater comfort than if you merely tell her that the house is energy efficient.

Depending on which green features you offer, your story may focus on environmental stewardship, greater comfort, lower utility bills, healthier homes and communities, or some combination of these benefits. Remember, the story you tell leaves a lasting impression on all your stakeholders—so take the time to refine your message.

## Market Differentiation

In California's hot real estate market, virtually any home will sell, whether it's green or not. But even in a seller's market where homes are sold before they are finished, building green creates a lasting and positive image among buyers, community leaders, government officials and the media. Here are some of the advantages your company will enjoy as a result of your green-building marketing efforts:

- Enhance your reputation for quality. Buyers are becoming more informed as home improvement television shows and mainstream consumer publications like *Better Homes and Gardens*, *Redbook*, *Family Circle* and *Sunset* regularly showcase green homes and products. As a result, today's buyers are increasingly associating green builders with high-quality construction. What's more, many community leaders and government officials associate green builders with companies that care and that are willing to invest in their community's best interest. A solid reputation for quality and caring will serve your business well over the decades, regardless of market conditions.
- Outshine the competition by offering green amenities. As a green builder, you are not asking your buyers to sacrifice anything. Instead you are offering

them additional value—whether it's lower utility bills, the peace of mind that comes with knowing the home was built with healthier products, or the prestige and “bragging rights” of owning an environmentally responsible home. By providing buyers with these valuable amenities, you engender good will and loyalty, which may translate into referrals and repeat sales down the road.

- Reap the rewards of positive media attention. The news and trade media are hungry for positive stories. Green building is still a fresh concept, making your story attractive to them. Media coverage draws public interest and helps you more effectively engage your potential customers. It's possible this positive media coverage may also serve your business well when you are working to gain approval for new developments.

## Educate Your Sales Staff

Sales are everything. It doesn't matter how well built or how green your projects are if your sales staff doesn't communicate the value of green to your customers. Your salespeople are your greatest advocates, so take the time to effectively train them and get them excited about the green features and benefits you offer. Providing people with quality homes is a rewarding profession, and adding the green factor gives your sales staff even more reason to be proud of what they do. Once you sell them on the idea that green building is good for business, good for people, and good for the community, they will enthusiastically convey this message to potential customers.

## Convey the Benefits

It is important to complement green products and practices with a marketing program that clearly identifies the benefits. Homeowners do not always intuitively grasp how they directly benefit from energy efficiency, improved indoor air quality, or resource conservation. One way to address this in your marketing efforts is to sort the features in terms that are important to the buyer. Use the lists below as a tool to assist you in creating marketing materials and assembling 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:

### **BENEFITS: Higher Quality, Low Maintenance, Good for the Environment**

Most green building products were developed to do something better than their conventional counterparts—they may be stronger, last longer, use resources more efficiently, or manufactured in an environmentally sound manner. Consider offering the following features:

- Durable and noncombustible roofing and siding
- FSC-certified or reclaimed wood
- Engineered wood beams, joists and studs
- Resource-efficient landscaping
- Natural linoleum, cork and bamboo flooring
- Recycled-content ceramic tile
- Recycled-content or composite decking

### **BENEFITS: Greater Comfort and Lower Utility Bills**

Comfort drives high energy use. When it gets hot or cold, we turn on the air conditioning or furnace. By designing the home and its systems properly from the start, you can provide your customers with greater continuous comfort while reducing their utility bills. Emphasize that green doesn't necessarily cost more and will generally save money in the long run.

Consider offering the following:

- Passive solar heating
- ENERGY STAR® appliances
- Efficiently designed/installed ductwork

- Whole house fans
- Photovoltaic panels
- Improved wall and ceiling insulation
- High efficiency toilets
- Efficient landscape irrigation systems

### **BENEFITS: Healthier Products and Practices for Families**

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

Consider offering the following:

- Low and no-VOC paints and adhesives
- Building products with low or no formaldehyde emissions
- Water-based, low-VOC wood finishes
- Exhaust fan in attached garages
- Low-sone range hood vented to outside
- High quality air filters on heating/cooling unit
- Sealed combustion furnace and water heater

### **BENEFITS: Healthy Communities**

Living green should extend beyond the boundary of the individual home to the entire neighborhood. Healthy communities offer residents opportunities to interact with neighbors and watch out for each other, enjoy walks, bike rides and other outdoor recreation, walk to local services, or use mass transit. Consider offering the following:

- Clustered homes for land preservation
- Mixed-use, walkable communities
- Located near a major transit stop
- Pedestrian pathways to open space, parks, and trails
- Home entrances with porches and views of the neighborhood
- Accessible entrances and pathways
- Rental units





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