

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.

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.