

GREEN BUILDING PRACTICES



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Green Design Principles

Minimize or design away the extraneous.

In 1946 the average house was 1100 sq. ft. and the average family was about 5 people. In 1996 the average house was 2200 sq. ft. and the average family was 2.6 people. We now have 4 times the area per person - what are we doing with it? What are we filling it up with?

Integrate design aspects for multiplicity of function.

How many modern construction materials or systems effectively serve more than one pragmatic function or purpose?

Design for all aspects of climate at all levels.

If the "glass box" office building is appropriate for Phoenix, is it equally appropriate for Anchorage? We design them in both climates. How can architects honestly say this with integrity?

Design for durability and longevity.

Even if a material contains 2-3 times the embodied energy of its alternative, it lasts 5-10 times longer. We should consider it better. Think about the unintended consequences of maintenance and renewal!

Select materials that use their base resource most efficiently.

How do we squeeze the most out of a material, meeting principle #1 above at the micro-scale. Make the opportunity to find ways around the "40,000 lbs. laptop."

Design to use only local and regional resources.

Find out what is "sustainable" in your back yard - it may surprise you! Consider the use of the concept of Pliny Fisk's Regional Resource Mapping essential - if only on an intuitive level.

Use products with recyclable materials & recycled content.

First seek out reused materials to conserve the most embodied energy, then find recyclable materials, because it is much more important to know what will be done with it after than to feel good about where it was coming from before. Remember, though, recycling may not be all it's cracked up to be - again, unintended consequences that may make very large loops.

Look for least toxic materials and manufacturing processes.

After everything in the design has been made minimal, doubled, durable, efficient, local and recyclable, then find ways to involve the least toxins in manufacturing, installation and use - but make this also an overriding principle...and set stringent threshold (e.g. McDonough's carcinogen - test).

Prepared by Tom Hahn, RA, Sol Source, former Scottsdale Green Building Advisory member.

For information on Scottsdale's Green Building Program, visit www.scottsdaleaz.gov/greenbuilding



Green Building: A Primer for Builders, Consumers and Realtors

The following is an excerpt from
Building Environmental Science and Technology (B.E.S.T)
PO Box 1107, Edgewater, MD 21037 USA
www.energybuilder.com/greenbld.htm

Green Homes Mean High Environmental Performance

A "green" home is a much better product. Your new or remodeled green home is more comfortable, keeps its resale value, has better indoor health, and is the modern thing to do. When you buy one you take as much as 60% of the "pressure" off the environment compared to the conventional home next door. It's good for your pocketbook through much lower utility bills, good for your community through added jobs, it's good for your employer since healthy homes save on medical bills and sick-leave, and you live with the knowledge that you are helping the earth.

Thousands of these new homes and green remodeling are sweeping into housing markets across the nation. This is not another "craze" -- green homes are for real -- they are available now and here to stay. The designs, materials, techniques and builder skills are available now. And, new standards are being issued by professional societies, the housing industry, and numerous trade groups to help you find products and services that really do help provide a cleaner environment. Buying green products has become enormously popular around the World. Now every day can be an *Earth-Day* when you live in a green -- environmentally high-performance -- home.

Why Buy a Green Home?

There are many questions consumers have about environmental products. Do they really work as promised? Why bother to look for and purchase an environmental product? Can my shopping decisions really make a difference and help the planet? The answer -- especially for our homes and the products they entail -- is a resounding yes.

U. S. consumers utilize greater resources per capita than any other people World-wide. We use about 20,000 pounds (10 tons) per person per year of "active" materials. These include virgin forest products, fuels, steel, glass, cement and plastics. An astounding 90 percent of these of materials becomes "waste" in less than one year according to a 1992 study by the US Office of Technology Assessment (OTA). Residential construction processes are still fairly inefficient compared to other industries according to these OTA reports to Congress.

Home building needs to undergo a process of technological substitution and rethinking to become more environmentally sensitive and sustainable. In a green housing project, many inefficiencies are addressed and overcome, so your home becomes part of the solution. The building industry is acting to incorporate the growing knowledge of green buildings into housing products and services, but consumer demand plays an important role in getting these better products to market.

As a Nation we consume over 2 billion tons of non-durable resources each year. Add to this quantity: non-hazardous industrial waste equaling 11 billion tons per year (OTA said 6.5 billion tons could be reduced by design decisions and enhanced recycling), 1.9 billion tons per year of pollution from automobiles and light trucks, 700 million tons of hazardous waste, about 600 million tons of building related air-pollution, and 180 million tons of municipal solid waste (sewage sludge, etc.). From the graphic below on annual environmental pollution from major sources in the US, you begin to get the picture. Our productive economy produces these by-products of our affluent life-style, which are threatening our environment.

Luckily, our homes can become a powerful tool that empowers us to help protect the environment. When we live in a green home we encourage reducing waste, implementing recycling, using renewable materials and energy sources, and implementing a better way of producing housing. These are the Four-R's: *Reduce, Recycle, Renewable and Rethinking*. When our homes are built or remodeled with these important tools in mind, each one becomes an "engine" pulling to help the environment.

Basics of Green Homes and Communities

Selecting an environmentally superior "green" home does not necessarily cost more. But, a green home will directly benefit you by its energy efficiency, ease on our natural resources, high level of comfort, and better value when you sell. Yes, homes can be built and remodeled using inexpensive currently available designs, materials and techniques to greatly reduce their environmental impact. One day, green homes may even help to heal previous environmental damage as more is learned.

Any home or multi-family building can be designed, constructed, remodeled, or renovated - even demolished -- in ways that have much less impact on the Earth's environment. There are several key things to look for in a new home, or to do now to make your current home better for the environment. You the buyer -- working with your Real Estate Professional -- need also to evaluate how the home fits into its development, and in turn how the development fits with the surrounding community. Even if you demolish an older structure, there are ways to minimize environmental impacts and reuse or recycle the old building components and materials wisely. Green building techniques concern the whole life-cycle of a building, and are simple but very systematic in application.



Small is Beautiful: 14 Ways to Optimize Space

1. Provide an open plan for the kitchen/dining and living areas. Family members often prefer to spend time in the kitchen, so provide for that in the design. In many cases it also makes sense to extend this open layout to the living area, so that one space serves all three.
2. Avoid single-use hallways. Design houses so that circulation areas serve additional functions – circulation through the living/dining area, or hallways that also serve other functions – library space, for example, or (with adequate separation) laundry.
3. Combine functions in other spaces. By combining functions in certain rooms, space can be optimized. For example, combine a guest bedroom with a home office.
4. Provide built-in furnishings and storage to areas to better utilize space. For example: storage cabinets and drawers built into the triangular space beneath stairways; bench seats built into deep windowsills; library shelves along stairway or hallway walls; and display cases built into wall cavities. Small windows in walk-in closets can make those spaces more inviting and better used.
5. Make use of attic space. A tremendous volume in most houses is lost to uncooled/unheated attic space. Instead, insulate the roof and turn attic spaces into living area – making use of light tubes and dormers to bring in light and extend the space. Having some rooms extend right up to the ceiling often makes sense, because variations in ceiling height make the room feel larger. If a standard uninsulated attic can't be avoided, at least design easy access and provide convenient storage areas so that the space can be used.
6. Don't turn bedrooms into living rooms. These are actually primarily used for sleeping and dressing. Keep them relatively small to avoid wasted space.
7. Provide acoustic separation between rooms. A small house will be more acceptable if there are no common walls between bedrooms. Closets can help provide this separation. Also consider insulating interior walls and providing staggered wall studs for acoustic isolation.

8. Provide connections to the outdoors, especially from the master bedroom. This will create a more pleasant house and make a compact house feel significantly larger. Careful placement of windows and glazed patio doors, as well as tall windows that extend down close to the floor help extend spaces to the outdoors.
9. Provide daylighting and carefully placed artificial lighting. Try to provide natural light on at least two sides of every room to provide a feeling of spaciousness and an opportunity for natural cross-ventilation. Incorporate some natural and artificial lighting where the light source is not readily visible to make compact spaces feel larger. Uplighting onto ceilings also makes a space feel larger.
10. Provide visual, spatial, and textural contrasts. Contrasting colors, orientations, degrees of privacy, ceiling heights, light intensities, detailing and surface textures can be an important design strategy for creating spaces that feel larger than they really are.
11. Use light colors for large areas. Most walls and ceilings should be light in color to make spaces feel larger. Use dark colors only for contrast and accent.
12. Keep some structural elements exposed. Structural beams, posts, and timber joists can be left exposed, creating visual focal points and texture. Be careful not to let these elements overwhelm the space; too many exposed timbers can make a space feel smaller.
13. Design spaces for visual flow. Careful building design can make small spaces feel larger by causing the eye to wander through a space. A continuous molding line that extends throughout a house somewhat below the ceiling can assist with this visual flow. Continuity of flooring and wall coverings can also tie spaces together visually. With very small spaces, provide diagonal sight lines that maximize the distance and feeling of scale.
14. Provide quality detailing and finishes. By limiting the overall square footage of a house, more budget can be allocated to green building materials and products that cost more (natural granite countertops, linoleum, certified wood flooring, top-efficiency appliances, etc.).

Source: Alex Wilson, "Small is Beautiful: House Size, Resource Use, and the Environment," *Environmental Building News*, January, 1999, p. 11.

For more information, please visit Scottsdale's Green Building website
www.scottsdaleaz.gov/greenbuilding

Eighteen Design Principles to Make Square Feet Work Harder

Robert Gay, Tucson Architect

BEFORE YOU BEGIN designing, do this four-part exercise in self-knowledge.

1. Study your lifestyle very carefully.
2. Think as freely as possible about the qualities of the spaces and places you have most loved and hated.
3. Fight to minimize your clutter and accumulations.
4. Free yourself up from advertising, media imagery, and pressures to consume, since if you don't, the urge to buy will terrorize you.

Then when you begin designing or working with a designer, use as many of the following principles as possible.

1. Minimize circulation space by reducing or eliminating hallways and paths to and from the doors. Excessive circulation space is one of the biggest drawbacks of many floor plans.
2. If you do have to have a hallway, enrich the pass-through experience with bookcases, niches, photos, mirrors, art objects, skylights, or textures.
3. Avoid circulation paths that cut diagonally through a space. This almost always chops something up that would otherwise be a whole with its own integrity. (An exception is that sometimes a large space can successfully be cut into two groupings of furniture.)
4. Don't close rooms off from each other unless you have to. It's easy to see how this helps minimize interior walls.
5. Consider partial separations between rooms to create an ambiguity of connectedness: arches, interior windows, half-walls, curtained spaces, freestanding headboards (for beds), interior columns, and similar features. Often there are reasons for partially separating one space from another, without needing to devote a separate room to each.
6. Let interior walls be as thin as possible. (this contrasts to the many compelling reasons for having thick exterior walls.) Something thinner than an inch (2.5 centimeters) can often serve as a wall, as with Japanese *shoji* doors.
7. Organize the floor plan around activities, such as eating dinner, doing a craft or hobby, or greeting visitors, rather than around preconceived rooms. Look for the centers of action, movement, and attention; then shape spaces around them.
8. Minimize the number of doors, after considering your real need for privacy.
9. If a door swing seems to take up too much space or unavoidably conflicts with something else, consider a sliding 'pocket' door.
10. Relate carefully to the different views in different directions; include connections with the heavens above, via roof windows, skylights, or porch roofs high enough to let you see some sky from inside the house. Look also for ways to appreciate or enhance the smaller views, since intimate, small-scale views can be just as enjoyable as sweeping, dramatic ones. The perceptual effect of a view is to expand the space from which you see it.

11. Have easy connections between inside and outside spaces, such as patios, decks, and outdoor showers, designing them as outdoor rooms with their own definition and sense of partial enclosure. Because of seasonal variations in your climate, you may need different outdoor spaces for winter and summer use.
12. Consider creating other planetary connections: a compass in the floor, a Stonehenge-like shaft of light at the equinoxes or solstices, a sundial or shadow-casting play place, or prisms in a window that send rainbows flying around. These connections help make a house feel part of a much larger whole.
13. Avoid right angles as much as is permitted by your budget, your building system, and your skill in building. Where you do have them, consider softening them by sculpting your wall material by using trim, ornament, or a built-in feature like a fireplace or display cabinet.
14. Vary ceiling height by generally giving smaller spaces lower ceilings. This will dramatize the perceived size of the larger spaces by increasing the contrast between spaces. Floor levels can also be varied—even a few inches of difference adds to the diversity and apparent size of a space. (This, of course, is at odds with the desire for maximum accessibility for potential wheelchair-bound or otherwise infirm users of a house.)
15. Avoid flat ceilings; instead, use open trusses, curved vaults, or cornices. A shape that rises will pull your feelings up with it.
16. Have a diversity of windows. A single glass block or 1-square-foot (.09-square-meter) window can energize a large blank wall, and 'zen views' can make much of a smaller window.
17. Plan lighting to create pools of light, rather than uniform illumination everywhere.
18. To extend rooms and create diversity, use 'non-room' spaces, such as window seats, sleeping alcoves, niches, built-in benches, and recessed shelves. Thick-walled building systems like straw bale and rammed earth naturally allow these kinds of spaces, but thin-wall methods can also incorporate them. One result on the outside might be 'bumpouts.'

Of course these guidelines aren't absolute, and sometimes the exceptions are as intriguing as the rules! Nevertheless, I believe that in well-crafted houses that embody most of these principles, small spaces can be intensified to become richer and more enjoyable. A vibrant level of complexity will automatically unfold. And it might just be that houses made in this way will be understood to be a contribution to the well-being of the planet.

Robert Gay, an architect in private practice in Tucson, centers his largely residential practice on human needs and sustainable building practices, with a specialty in straw bale design. He's also done university teaching, a college master plan, general contracting, furniture making, stonework, and small playful art projects. He lives near the Catalina Mountains with his wife, two small boys, and many other creatures, some domesticated.

GREEN BUILDING RESOURCES

Green Label & Rating Resources

City of Scottsdale Green Building Program

Energy Efficiency	Energy Star Backed by the U.S. Environmental Protection Agency and Department of Energy, Energy Star promotes energy efficiency in over 40 product categories, including appliances, home electronics, and lighting. Most Energy Star-qualified products use 10 to 50 percent less energy than standard products. www.energystar.gov NFRC Label The National Fenestration Rating Council (NFRC) administers a testing and labeling program for windows, glass doors, and skylights. www.nfrc.org Cool Roof Rating Council Cool roofing materials reflect a high percentage of solar radiation away from the roof and readily shed absorbed heat, trimming air-conditioning bills and keeping the neighborhood cooler in summer. The Cool Roof Rating Council verifies and publishes data about cool roof products. www.coolroofs.org EnergyGuide The U.S. Federal Trade Commission requires manufactures to affix and EnergyGuide label to major appliances, including refrigerators, dishwashers, and air conditioners. The label shows the unit's estimated yearly operating cost and compares its energy use with similar models. www.ftc.gov
Indoor Environmental Quality	Green Seal Green Seal Certifies environmental performance in a variety of product categories, including indoor air quality. Interior paints bearing the Green Seal logo have zero or very low levels of volatile organic compounds (VOCs) and other problematic chemicals. www.greenseal.org Greenguard This voluntary program tests and certifies products that emit low or zero levels of potentially harmful chemicals. Though mostly oriented toward commercial interiors, Greenguard certifies some residential products, including paint, insulation, and flooring. www.greenguard.org Green Label Plus Carpets bearing the Carpet and Rug Institute's Green Label Plus logo have been tested and verified to meet California's Collaborative for High Performance School's stringent criteria for low-emitting products. www.carpet-rug.org
Environmentally Preferable Products	Scientific Certification Systems (SCS) Manufacturers seeking to gain consumers' confidence pay SCS to certify their claims for recycled or recovered content, biodegradability, and more. Look for the SCS "Green Cross" logo on cleaning products, paint, carpet, particleboard, and flooring. www.scs-certified.com Cradle to Cradle Certification The consulting firm MBDC has a rating program based on the principles in William McDonough and Michael Braungart's book, <i>Cradle to Cradle</i>. Unlike programs that address a single environmental attribute, Cradle to Cradle assesses a product's impacts throughout it's life cycle. www.c2ccertified.com

Lumber	Forest Stewardship Council (FSC) FSC's certification program sets voluntary international standards for responsible forest management. Look for the FSC logo stamped on lumber and printed on the packaging of wood and paper products. www.fsc.org Sustainable Forestry Initiative (SFI) Administered by the American Forest & Paper Association, SFI sets voluntary industry standards for responsible forest management. Look for the SFI logo stamped on lumber and printed on the packaging of wood and paper products. www.afandpa.org Rediscovered Wood Administered by Rainforest Alliance's SmartWood program, the Rediscovered Wood certification is awarded to forest-products operations that use reclaimed, recycled, or salvaged wood. www.rainforest-alliance.com
Whole House Design	Energy Star-Qualified Homes Homes built or remodeled to meet energy-efficiency guidelines set by the EPA can qualify as Energy Star homes. Benefits include lower utility bills, increased comfort, and the potential to qualify for an Energy Efficient Mortgage. www.energystar.gov LEED for Homes Currently in its pilot phase, LEED (Leadership in Energy and Environmental Design) for Homes expands on the U.S. Green Building Council's successful Green Building Rating System for commercial buildings. Look for new homes with the LEED rating beginning in 2007. www.usgbc.org Local Green Home Rating Programs A number of municipal agencies and regional homebuilders' associations have established programs to certify eco-friendly home remodeling and new construction. The LEED for Homes page at www.usgbc.org lists many of these programs. For the City of Scottsdale Green Building Program visit www.scottsdaleaz.gov/greenbuilding
Local Green Retail Outlets	aka Green aka Green is an Eco-Friendly Building Supply Center located in downtown Scottsdale. It serves as a resource center for eco-friendly labeled building materials and products including sustainable flooring, non-toxic paints/finishes, energy and water saving products, and renewable energy technologies. Located at 8100 E. Indian School Road (480-946-9600). www.akagreen.com EcoClean EcoClean is a Healthy Home Product Center located in downtown Scottsdale. It carries labeled materials and products for healthy indoor living including flooring, paints and finishes, cleaning products, and air purification systems. Located at 3511 N. 70th Street (480-947-5286). www.ecoclean-az.com

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Green Building Resources

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Sonoran Desert Ecosystem

Desert Naturalist – www.arizonensis.org/sonoran/index.html

Sonoran Desert - www.desertusa.com/du_sonoran.html

Energy

Alliance to Save Energy - www.ase.org

APS Energy Survey - www.aps.com/aps_services/energysurvey/Default_BUSRES.html?type=r

Arizona Energy Office - www.azcommerce.com/energy

Arizona Solar Center - www.azsolarcenter.com

Center for Renewable Energy and Sustainable Technology (CREST) - www.crest.org

Energy & Environmental Building Association – www.eeba.org

ENERGYguide – www.energyguide.com

Energy Star Program – www.energystar.gov

Home Energy Checkup - www.ase.org/content/article/detail/971

Home Energy Saver - <http://hes.lbl.gov>

Photovoltaics for Buildings - www.nrel.gov/buildings/pv

National Renewable Energy Laboratory (NREL) - www.nrel.gov

Southwest Energy Efficiency Project (SWEET) - www.swenergy.org

SRP Home Energy Manager - www.srpnet.com/hem

State Incentives for Renewable Energy – www.dsireusa.org

Tucson/Pima County Metropolitan Energy Commission - www.tucsonmec.org

US Department of Energy, Renewable Energy – www.eere.energy.gov

Water Efficiency

Arizona Municipal Water Users Association - www.amwua.org

Desert Botanical Garden - www.dbg.org

Forgotten Rain - www.forgottenrain.com

Landscaping in Arizona – www.gardeninginnevada.com

Rainwater Harvesting for Drylands - www.harvestingrainwater.com

Water CASA, Graywater Guidelines – www.watercasa.org

Water: Use It Wisely - www.wateruseitwisely.com

Xeriscape - www.xeriscape.org/xeriscape.html

Indoor Environmental Quality

American Indoor Air Quality Council – www.iaq-council.org

American Lung Association Health House – www.healthhouse.org/index.asp

Environmental Protection Agency, Indoor Air Quality – www.epa.gov/iaq

The Healthy House Institute – www.hhinst.com

Materials & Components

Center for Resourceful Building Technology - www.crbt.org

Green Building Resources Guide - www.greenguide.com

GreenHomeGuide - www.greenhomeguide.com

Green Spec - www.buildinggreen.com/menus

Greenerbuilding - www.greenerbuilding.org

Oikos: Green Building Source – www.oikos.com

Remodeling and Deconstruction

Alameda County Waste Management Authority - www.stopwaste.org/home/index.asp?page=488

Arizona Resource Exchange – www.azrex.org

Habitat for Humanity Discount Home Improvement Store – www.habitataz.org

Seattle Green Home Remodel Guides - www.seattle.gov/sustainablebuilding/greenhome.htm

The Eco-Logic Foundation- www.eco-logicfoundation.org

Other Resources

Alameda County Green Building - www.stopwaste.org/home/index.asp?page=469

Building Science Corporation - www.buildingscience.com

City of Austin - www.ci.austin.tx.us/greenbuilder

City of Santa Monica – www.greenbuildings.santa-monica.org

City of Scottsdale – www.scottsdaleaz.gov/greenbuilding

City of Seattle - www.seattle.gov/sustainablebuilding

City of Portland - www.green-rated.org

Colorado, Built Green - www.builtgreen.org

Development Center for Appropriate Technology - www.dcat.net

Ecological Home Ideas – www.ecologicalhomeideas.com

Environmental Building News – www.buildinggreen.com

Green Matrix - www.greenmatrix.net

Green Seal - www.greenseal.org

National Association of Home Builders – www.nahbrc.org/greenguidelines

Oasis Design - www.oasisdesign.net

Permaculture – www.attra.ncat.org/attra-pub/perma.html

Public Technology: Green Building Technologies - www.pti.org/greenbuildings

Rocky Mountain Institute – www.rmi.org

Smart Communities Network - www.sustainable.doe.gov

Southface Energy Institute – www.southface.org

Sustainable Architecture, Building and Culture – www.sustainableabc.com

Sustainable Building Industry Council – www.SBICouncil.org

Sustainable Sources – www.greenbuilder.com

The Urban Farm - www.urbanfarm.org

US Green Building Council – www.usgbc.org

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City of Scottsdale - Green Building Program

Environmentally Responsible Building
Green/Healthy/Ecological/Sustainable Design

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