

CHAPTER 1

why be sustainable?



Figure 1.1
Photo courtesy of Allegria Spa.
Interior design by Annette
Stelmack and Donna Barta-
Winfield, Associates III.

There is no greater potential for personal expression than building one's own shelter. For this reason alone, home construction should be sustainable for generations to come. And to be truly sustainable, it is not enough to minimize damage to the environment; the construction must have a net positive impact on it.

—DENNIS WEDLICK, AIA

The answer to the question why, as residential designers, our work should be sustainable is simple: There is only one planet Earth, and if we destroy its ability to sustain life, our planet will become uninhabitable. Numerous speeches have been made and publications written by credible sources who, over the past decades, have been leading the market transformation in the building industry. This book will share knowledge and provide motivation from another perspective—that of the residential interior design community.

Through our experiences and the information that we have gathered and organized, we will demonstrate to residential design professionals that it is possible to build a home that is beautiful, pleasing, functional, healthy, safe, affordable, and life-sustaining. The time is now to ‘BE’ the catalyst for change within the residential design community and to integrate sustainable residential design into our work.

Interior designers are resourceful beings; they are information-gathering, solution-seeking, innovative creatures, and these are ideal characteristics for promoting healthy, high-performing, sustainable design. Our profession is a natural for revolutionizing the industry by transforming environments. It is, after all, what we do. By focusing our creative energy and implementing sustainable design, we become instruments of beneficial change. If we are resolute in our belief that each positive action makes a difference, our contribution to a healthy planet is guaranteed.

Before us lies a remarkable opportunity to connect where we are with where we have been to inform where we need to be going. Creating healthy, life-enhancing design is an invigorating prospect. Is it challenging? Absolutely! It’s challenging, doable, exciting—and, of course, the right thing to do.

Let’s begin by asking why everything considered good for us is termed “alternative”—alternative health care, alternative medicine, alternative food. Indeed, sustainable design should no longer be considered an alternative; it is, simply, the responsible way to conduct good business. In fact, states and municipalities have passed legislation mandating high-performing and healthy building standards. It benefits us all to work together toward better solutions that “respect all of the children of all of the species, for all times,” to quote renowned architect William McDonough, principal and founder of William McDonough + Partners and MBDC.

Sustainability is transforming the building industry, and expertise in sustainable design is now highly regarded and regularly sought after. Clients, architects, and contractors value the knowledge and skills that we bring to the table as part of the professional services team; as designers, we can offer numerous possibilities for creating eco-friendly homes. The finishes in a home can exemplify environmental responsibility, support our clients’ health, and be beautiful as well. By combining materials in a unique and environmentally responsible way, we have a rich opportunity to make a difference.

As interior designers and architects, we have the power—and the responsibility—to create environments that sustain life on the planet. The methods that we employ, often beyond the realm of other professions, compel us to practice sustainable design. By doing so, we are, as defined nearly three decades ago by the Brundtland Commission in 1987, “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

Designers have much to teach the world. Of all people, we understand that there is never only one right way to design anything. Searching for new solutions, creatively adapting what we know to what we need, and solving problems is what designers do. Perhaps, then, we as designers need to expand our vision to include sustainability and start showing ordinary people how to look at the world from a green design point of view.

—FROM DANIEL QUINN,
ISHMAEL: AN ADVENTURE
OF THE MIND AND SPIRIT
(BANTAM, 1995)

There are countless opportunities for design professionals and those we work with to make a significant difference. Green building practices and strategies, coupled with constantly emerging technologies, are transforming our industry and, subsequently, the buildings that we live and work in. By applying principles, strategies, and practices that sustain our natural resources, we can ensure a healthier life on our planet for future generations.

As we all were taught, for every action there is an equal reaction; similarly, for every choice we make there is a consequence. By practicing sustainable design, we catalyze change in our industry by gathering information, learning new strategies, attending conferences, questioning the status quo, sharing information, and aligning with like-minded individuals, project teams, and clients.

Market transformation begins with individuals who integrate sustainability into the core of their interior design process—one step at a time, one material at a time, one project at a time, and one question at a time. We can and do make a difference. (See the sidebar on Ray Anderson, page 50.)

What Are Green Buildings?

The U.S. Environmental Protection Agency (EPA) describes green building as the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life cycle, from siting to design, construction, operation, maintenance, renovation, and deconstruction.¹ Green buildings, including residences, exhibit a high level of environmental, economic, and engineering performance, including:

- Energy efficiency and conservation
- Indoor environmental quality
- Resource and materials efficiency
- Occupant health, safety, welfare, and productivity
- Transportation efficiency
- Improved environmental quality including air, water, land, limited resources, and ecosystems

The U.S. Green Building Council (USGBC) states that the built environment is expected to double by 2050. Buildings have a major impact on the environment as a whole in that they account for:

- 39 percent of total energy use and percent of electricity consumption
- 30 percent of greenhouse gas emissions
- 30 percent of raw materials use

¹www.epa.gov/greenbuilding/pubs/about.html

Energy consumption in homes by end uses
quadrillion Btu and percent

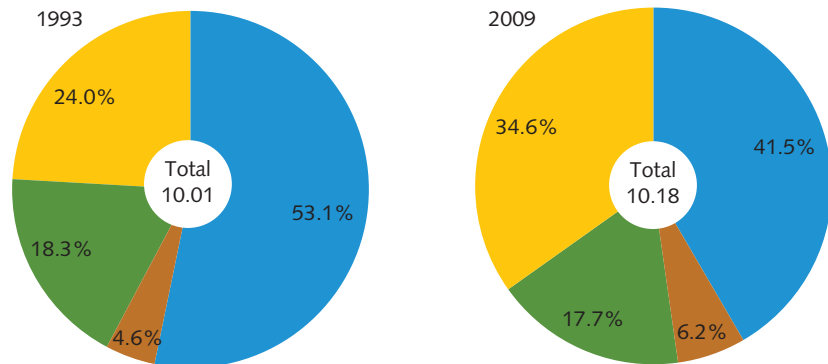


Figure 1.2 ■ space heating ■ air conditioning ■ water heating ■ appliances, electronics, and lighting

- 30 percent of waste output (136 million tons annually)
- 12 percent of potable water consumption

Various other resources note that:

- Nearly 40 percent of total U.S. energy consumption in 2012 was consumed in residential and commercial buildings, or about 40 quadrillion British thermal units (Btus).
- 50 percent of all global energy is used to cool, light, and ventilate buildings.
- More than 50 percent of all resources are used in construction.

The EPA notes that if every American home replaced their five most frequently used light fixtures or the bulbs in them with Energy Star–qualified lighting, we would save close to \$8 billion each year in energy costs, and together we'd prevent the greenhouse gases equivalent to the emissions from nearly ten million cars.

In addition, statistics show that the United States, though it comprises less than 5 percent of the world's population, consumes nearly 20 percent of the world's energy—and as of 2012 generates 16 percent of the world's global emissions. Our ecological footprint is enormous compared with that of other countries. If everyone in the world enjoyed the American standard of living, we would need four to five Earths to sustain us.

Buildings account for around half of the global output of the greenhouse gas carbon dioxide as well as half of the output of sulfur dioxide and nitrogen oxide, both components of acid rain. The building industry therefore shares responsibility for environmental disasters related to energy production: oil spills, nuclear waste, the destruction of rivers by hydroelectric dams, the runoff from coal mining, the mercury emissions from burning coal—the list goes on and on.

This is motivation enough to rethink the way that we practice design. By designing and adapting the places where we live in an ecologically responsive style, we can contribute to the well-being of our clients as well as our planet and its limited natural resources. To encourage, inform, and assist you in navigating all this, we have assembled some of the most compelling reasons for sustainable design in the key areas where residential interior designers can actively improve the current state of the industry and the planet—before it is too late and the damage to the planet and its ecosystems become irremediable. They include:

- Environmental stewardship and the improved environmental quality of the planet, including air, water, and land, and protecting limited resources and ecosystems
- Good design supported by the Council for Interior Design Accreditation (CIDA) and the American Institute of Architects (AIA)
- Natural resource and materials conservation that minimizes the use of nonrenewable natural resources, and building with low-impact materials
- Improved indoor air and environmental quality
- Energy efficiency, lower energy consumption, and the promotion of renewable energy sources
- Water efficiency and conservation
- Waste reduction and management
- Optimized operational and maintenance practices
- A healthy planet for future generations

ENVIRONMENTAL STEWARDSHIP

For the children and the flowers are my sisters and my brothers, come and stand beside me, we can find a better way.

—JOHN DENVER, COFOUNDER, WINDSTAR

Nature is the precious source of life. As such, living in and engaging with nature should be treated as a privilege. All Earth's citizens must develop a broader perspective and become stewards of our planet. If we do not, the results promise to be disastrous. There is long-established evidence, for example, that we are headed for the dire consequences of global climate change. We would be foolish to wait for a calamity such as a dramatic rise in sea levels—predicted to be nearly five feet within a few generations—before we take action.

How Did the Ecology Movement Begin?

Over one hundred years ago, John Muir wrote to the editor of *Century* magazine, "Let us do something to make the mountains glad." Together, John Muir, Theodore Roosevelt, and David R. Bower founded the Sierra Club, the first major organization in the world dedicated to preserving nature, and the modern ecology movement was born.

Throughout his life, Muir was concerned with the protection of nature both for the spiritual advancement of humans and, as he said so often, for nature itself. These two concerns still inform the ecology movement and continue to inspire millions to think of themselves as a part of nature. Though the arguments in favor of ecological thinking are often couched in scientific terms, the basic impetus remains as Muir stated it: “When we try to pick out anything by itself, we find it hitched to everything in the universe.”²

How Did the Environmental Movement Begin?

When, in 1962, Rachael Carson wrote the book *Silent Spring*, it made the public aware of nature’s vulnerability to human intervention. In it, she made a radical proposal: that at times, technological progress is so fundamentally at odds with natural processes that it must be curtailed. Prior to the book’s publication, there had never been broad public interest in conservation, for until then few people had worried about the disappearing wilderness. But the threats Carson outlined—the contamination of the food chain, cancer, genetic damage, the extinction of entire species—were too frightening to ignore. For the first time, the need to regulate industry in order to protect the environment became widely accepted, and environmentalism emerged.

Carson was well aware of the larger implications of her work. Appearing in a CBS documentary about *Silent Spring* shortly before her death from breast cancer in 1964, she remarked:

Man’s attitude toward nature is today critically important simply because we have now acquired a fateful power to alter and destroy nature. But man is a part of nature, and his war against nature is inevitably a war against himself....[We are] challenged as mankind has never been challenged before to prove our maturity and our mastery, not of nature, but of ourselves.

The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for destruction.

—RACHEL CARSON, © 1954
REPRINTED WITH PERMISSION
FROM THE NATURAL RESOURCES
DEFENSE COUNCIL

The message of *Silent Spring*, one of the landmark books of the twentieth century, continues to resonate loudly more than four decades after its publication. Equally inspiring is the example of Rachel Carson herself. Against overwhelming difficulties and adversity, and motivated by her unabashed love of nature, she rose like a gladiator to its defense.

Environmental Stewardship

What is environmental stewardship, and how does it relate to sustainable design? Sustainability is a concept with definitions that vary across national borders and over time, but most agree that at its core is societal advancement balanced by the social, economic, and environmental needs of current and future generations. Here are two examples:

- The Environmental Protection Agency bases sustainability on a simple principle: Everything that we need for our survival and well-being depends, either

²www.ecotopia.org/ecology-hall-of-fame/john-muir/biography/

directly or indirectly, on our natural environment. Sustainability creates and maintains the conditions under which humans and nature can exist in productive harmony and that permit fulfilling the social, economic and other requirements of present and future generations. Sustainability helps ensure that we have and will continue to have the water, materials, and resources to protect human health and our environment.³

- The Energy Alternative defines environmental stewardship as the “wisest use of both finite and reusable energy resources to produce the most work guided by a principle of causing the least known harm to the environment and driven by a desire to aid in the restoration of a healthier environment.”⁴

PERSONAL RESPONSIBILITY

Never doubt that a small group of thoughtful, committed people can change the world; indeed, it's the only thing that ever has!

—MARGARET MEAD

As interior designers, we must make a commitment to become environmental champions; it is, after all, men and women who make things happen and get things done who will ‘BE’ the significant difference in the world.

Change occurs by the actions we take and the choices we make. We can be change agents who set an example by demonstrating environmental responsibility through our work and business practices. We, collectively, have the power to drive change within our industry. By specifying interior finishes that are timeless, healthy, and include recycled content; selecting woods that are responsibly harvested; and ensuring that the materials we specify do not contribute to outgassing and exacerbate human health problems, we can reshape our industry's traditions while we accelerate acceptance and implementation of environmental principles and practices. As environmental champions, we can welcome the challenge to be innovative risk-takers and push beyond the status quo. We may experience an occasional setback, but if we continue to challenge the industry we can help raise it to the next level of environmental performance.

By seeking reliable information and surrounding ourselves with like-minded people, we nurture our environmental aspirations. But first we need to recognize how directly our actions affect the environment, both positively and negatively. Then we must acquire the skills we need to further develop our personal commitment to improving the environment, safety, health, and well-being of our clients.

On a personal level, identify what inspires you to take on environmental issues and to make change happen. Then proactively, respectfully, enthusiastically, and tenaciously pursue your goal of sustaining the environment. Influence others through your involvement with professional organizations such as the American Society of

³www.epa.gov/sustainability/basicinfo.html

⁴www.theenergyalternative.com/glossary.html

Environmental Champion: Ray Anderson

Ray Anderson's personal commitment to the environment changed the floor-covering industry. In 1994, as CEO of Interface, the world's largest commercial floor-coverings producer, Anderson was invited to give the keynote address to Interface's newly formed environmental task force. He was reluctant to accept because his environmental vision ended with obeying the law. Then he received Paul Hawken's *The Ecology of Commerce* (1994). Anderson recalled, "I read it, and it changed my life. It hit me right between the eyes. It was an epiphany. I wasn't halfway through it before I had the vision I was looking for. . . and a powerful sense of urgency to do something." After this chance introduction to environmental issues, Anderson embarked on a mission to make Interface a sustainable corporation by leading a worldwide war on waste and by pioneering the processes of sustainable development within his company and beyond.

Interior Designers (ASID), the International Interior Design Association (IIDA), the American Institute of Architects (AIA), the AIA Committee on the Environment (AIA COTE), Architects/Designers/Planners for Social Responsibility (ADPSR), and the U.S. Green Building Council (USGBC). As part of the larger movement, you can integrate environmental consciousness at all levels, both personally and professionally. Make the very personal decision to take moral responsibility for what you do as a designer of the built environment, and then put that commitment into action on all projects.

GOOD DESIGN

Good design and sustainable design are one and the same—synonymous with each other. Integrating sustainable design principles and practices is creative and rewarding and opens doors to vast possibilities for personal expression and personal growth for the designer, the client, and the project team.

—ADAPTED FROM DENNIS WEDLICK, AIA, DENNIS WEDLICK ARCHITECT, LLC

Designers are trained to become habitually conscientious creatures, and we accept responsibility for creative design solutions for every interior. Our professional organizations provide codes of ethics that specify our responsibilities as designers regarding function, safety, codes, and aesthetics. We are required to find solutions to design questions and to prepare drawings and specifications that illustrate how we intend to implement these solutions. And the subject of sustainability is now being included in the education of interior designers.

On January 1, 2006, the board of directors for the Council for Interior Design Accreditation (CIDA, formerly the Foundation for Interior Design Education Research, or FIDER) adopted revisions to its professional standards. This set in motion the addition of sustainability to the curricula for interior education programs and launched the sustainable initiative that all interior design programs must include to be accredited. (These standards were updated in 2011 and again in 2014.) CIDA's vision and leadership continue to have far-reaching effects for interior design education and professional practice.

These revisions strengthened the expectations for student learning in sustainability and communication. The new standards maintain that every student who graduates from a CIDA-accredited school must demonstrate his or her understanding of the concepts, principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants.

These standards are also supported by the AIA, whose board of directors also adopted position statements to promote sustainable design and resource conservation. In order to achieve a 70 percent reduction of the current consumption level of fossil fuels used to construct and operate buildings by 2015, and an 80 percent reduction by 2020, the AIA will collaborate with other national and international organizations as well as scientists and public health officials. As part of this initiative, the AIA will also develop and promote the integration of sustainability into the curricula for the education of architects and architecture students so this core principle becomes a guide for current and future architects.⁵

AIA Public Policy Position Statement

Architects are Environmentally Responsible

The creation and operation of the built environment requires an investment in the Earth's resources. Architects must be environmentally responsible and advocate for the sustainable use of those resources.

Supporting Position Statements

1. Energy and the Built Environment

The AIA supports governmental policies, programs, and incentives to encourage energy conservation as it relates to the built environment as well as aggressive development and harvesting of energy from renewable sources. Architects are encouraged to promote energy efficiency and waste reduction in the built environment,

⁵www.aia.org

encourage energy-conscious design and technology, plus support a national program for more efficient use and recycling of nonrenewable resources and carbon-neutral design strategies.

2. Sustainable Built Environment

The AIA supports governmental and private-sector policy programs and incentives to encourage a built environment that embodies the advantages of sustainable architecture.

3. Sustainable Architectural Practice

The AIA recognizes a growing body of evidence that demonstrates current planning, design, construction, and real estate practices contribute to patterns of resource consumption that will inhibit the sustainable future of the Earth. Architects, as the leaders in design of the built environment, are responsible to act as stewards of the Earth. Consequently, we encourage communities to join with us to take the leadership to change the course of the planet's future and support legislative and regulatory strategies that implement sustainable design practices to advance the goal of achieving carbon-neutral buildings by the year 2030.

4. Sustainable Building Codes, Standards, and Rating Systems

The AIA supports the development, evaluation, and use of codes, standards and evidence-based rating systems that promote the design, preservation, and construction of sustainable communities and high-performance buildings

Source: American Institute of Architects

Additionally the AIA Committee on the Environment (COTE) works to advance, disseminate, and advocate—to the profession, the building industry, the academy, and the public—design practices that integrate built and natural systems and enhance both the design quality and environmental performance of the built environment. COTE is the voice of AIA architects regarding sustainable design, building science, and performance.

COTE reflects the profession's commitment to provide healthy and safe environments for people and is dedicated to preserving the Earth's capability of sustaining a shared high-quality of life. The committee's mission is to lead and coordinate the profession's involvement in environmental and energy-related issues and to promote the role of the architect as a leader in preserving and protecting the planet and its living systems.

What Is Next for Sustainable Design?

Authentic experiences are grounded in what is real, what is enduring, and what we can experience directly. As such, experiential design is less focused on buildings as objects and interior architecture as abstract composition, instead prioritizing direct, sensual experience and the narrative of place. In addition to engaging traditional sustainability measures such as energy efficiency, daylighting, and the use of healthy materials, the following are key to a holistic and experientially based sustainable design approach:

- *Focus on experiential qualities.* Experiential design is sensual, tactile, and revealed over time as spaces respond to the dynamics of the seasons and the time of day.
- *Connect with cultural history.* Design can keep stories about the past alive by preserving and/or reusing artifacts or by leaving traces of the past through the use of architectural palimpsests.
- *Engage the natural world.* In a natural setting, this may mean organizing space to capture views or finding opportunities to open up to the outdoors. In urban settings, this may mean creating a bit of nature indoors with living walls, roof terraces, and pocket parks.
- *Seek out diversity.* Rather than seeking beauty in uniformity and a tightly controlled palette, seek out materials, colors, and textures that create beauty through diversity.
- *Demonstrate interconnectedness.* Develop building systems that are multifunctional and interconnected, like systems in the natural world.
- *Cultivate resilience.* Be aware that efficiency has its limits, and the use of redundant systems can be beneficial in the long run to increase longevity.
- *Use local materials.* Explore the use of locally sourced natural materials, reused materials, and unique or artisanal materials that have meaning to building occupants.

Source: Sandy Mendler, AIA, in *Contract* magazine. <http://www.contractdesign.com/contract/design/What-Is-Next-for-Sus-7749.shtml>

COTE provides the AIA with knowledge about environmental issues and advises the Institute on environmental policy matters affecting the practice of architecture. The committee supports cooperation with educators and institutions of learning, manufacturers, government agencies, environmental organizations, and industry groups to advance environmentally sound design processes and standards as well as environmentally innovative materials and integrated systems.

All of this is great news for the entire built community. Through ingenuity, drive, and commitment, we can make sustainability and design ideal partners. Coupled with the support of the higher educational system, the accelerated implementation of a healthy, high-performing built environment and interior design is a certainty.

LOW-IMPACT BUILDING MATERIALS

Mountain men left no physical trace of their lives upon the Western landscape—they moved so lightly upon the world that only the land and the river remain a witness to those shining times.

—1838 RENDEZVOUS ASSOCIATION

The AIA requires the reduced use of nonrenewable natural resources through the reuse of existing structures and materials, reductions in construction waste, promotion of recycled content materials, and use of materials independently certified as from sustainable sources. This strong stance will change how every building is created going forward and, because we work so closely with architects, it will likewise change our approach to projects.

Conventional building practices consume large quantities of wood, stone, metal, and other natural resources that lead unnecessarily to their depletion. Wood, for example, one of the most frequently used building materials, is often inefficiently utilized. Reports indicate that we have already harvested 95 percent of this nation's old-growth forests. Plainly, this practice cannot continue.

According to the Worldwatch Institute, the USGBC, and the United Nations Environment Programme, buildings have a significant measurable impact on the environment.

- Buildings use about 40 percent of global energy, 25 percent of global water, and 40 percent of global resources.
- The building sector is the largest contributor to global greenhouse gas emissions, emitting approximately one-third of all greenhouse gas emissions.
- As much as 10 percent of the global economy is dedicated to buildings: their construction, operation, and the equipping of these homes and offices.
- Buildings account for 40 percent of the materials entering the global economy each year. Three billion tons of raw materials are turned into foundations, walls, pipes, and building finishes.

- Buildings consume enormous resources: one-quarter of the world's wood harvest and two-fifths of the world's material and energy flows.
- Residential and commercial buildings consume approximately 60 percent of the world's electricity.
- Existing buildings represent significant energy-saving opportunities because their performance level is frequently far below current efficiency potentials.
- In developing countries, new green construction yields enormous opportunities. Population growth, prosperity, and increasing urbanization fuel building and construction activities, which represent up to 40 percent of GDP.
- In the United States, nearly 650,000 new housing units are built each year, approximately 80 percent of which are single-family homes.
- A typical 1,700-square-foot wood-frame home requires the equivalent of clear cutting one acre of forest in the United States.

Products specified for the design and construction of homes consume resources and energy and produce air and water pollution and solid waste during manufacturing. Finite raw materials such as granite and marble are in decline and, therefore, prices for such products are rising faster than inflation. Following installation, these products and materials also require maintenance and periodic replacement, and when the building is demolished they are usually disposed of in landfills.

Resource efficiency must therefore become common practice. Durable, reusable building materials that minimize the use of natural resources are key to sustainable building practices. Consider the following overarching criteria when researching, specifying, and selecting materials.

Sustainable Management Practices

Companies that adopt sustainable management practices are becoming easier to find; look to organizations that pursue certification programs and standards like the International Standards Organization's ISO 14000 category, which addresses a variety of environmental management characteristics. ISO 1400 provides practical tools for companies and organizations that want to control their environmental impact and constantly improve their environmental performance through life-cycle analysis, communication, and auditing.

Look for manufacturers whose policies responsibly address the triple bottom line: people, profit, and planet. Do they prominently display their sustainable practices in their website and literature? Qualify the strategies they employ, such as source, waste water and energy reduction, voluntary testing programs, improved corporate image, and waste management.

Resource Efficiency

A fundamental strategy for resource-efficient building is to build less square footage, use smaller quantities of materials, and design the smallest footprint possible

while still meeting the customer's needs. The most cost-effective conservation strategy is to buy fewer products and to use those products more resourcefully.

Source Reduction

The EPA defines source reduction as the design, manufacture, purchase, or use of materials (such as products and packaging) that reduce the amount or toxicity of garbage generated. Source reduction reduces waste-disposal and handling charges because the costs of recycling, municipal composting, landfilling, and combustion are diminished. Source reduction conserves resources and reduces pollution.

Reused Materials

Reused material is an element, product, or material that has been reprocessed or repurposed from another location or for a different purpose. Many durable products such as doors, cabinets, and other easily removed millwork, as well as some architectural metals and glass, can be readily salvaged and reused. This practice has typically been limited to restoration work, but deconstruction for building and renovation projects is now common practice in many parts of the country. Salvaging requires a plan to cost-effectively reclaim quality materials such as old-growth hardwood flooring. Labor costs are often partially or even entirely offset by savings on new materials, transportation, and landfill tipping fees.

Recycled Content

The Leadership in Energy and Environmental Design (LEED) rating system categorizes recycled materials:

- *Postconsumer material* is the percentage of a product's material made from waste generated by end users (such as households or commercial, industrial, and institutional facilities) and can no longer be used for its originally intended purpose. It has been recycled into raw material for a new product.
- *Preconsumer/postindustrial content* is the percentage of a product's material that has been diverted from the waste stream during a manufacturing process. Excluded from this category are materials such as scrap that were generated during a certain process and can be reclaimed during that same process.
- *Internal manufacturing reclamation* refers to materials such as rework, regrind, or scrap that can be reused in the same process during which they were generated.

Using products made with recycled content keeps materials out of the waste stream. There are many building products with a high percentage of recycled materials on the market.

Rapidly Renewable

Rapidly renewable materials must have a harvest cycle of ten years or less. Wood, plant fibers, wool, bamboo, agrifibers, cork, linoleum, soy, cotton, and corn-based products are examples of rapidly renewable materials. When these materials come from animals, like wool, they need to do no harm to the animal.

Climate-Specific

Certain types of construction and materials are more appropriate for certain climates. For example, utilizing thermal mass in building design has important energy and comfort benefits in the Southwest, where daily temperature swings can be extreme. In a hot, humid climate like that of the Southeast, lightweight construction and high ceilings may be more beneficial.

Regional Products

Specifying products made with local materials and labor can mean lower embodied energy consumption and reduce or even eliminate transportation costs. Regional products and materials should be extracted, harvested, and manufactured within a set distance of your project; LEED requires materials to come from within a 500-mile radius of the site.

Durable and Timeless

Good design and green design are synonymous and translate into a home that is the most durable and high-performing possible. The building envelope and assemblies, systems, interior finishes, and furnishings need to work together seamlessly to make a home healthy, efficient, safe, durable, and timeless. Durability is a strategy that should be adopted at the onset of the design, carried through material research and selection, and implemented throughout construction; it yields aesthetics and serviceability that lasts and adds to the value of the home. By integrating energy efficiency, indoor air quality, moisture management, and materials selection, the home will be inherently timeless and durable.

Multi-Attributes

Multi-attribute products carry numerous certifications that take into account a broad assessment of environmental, health, and even social measures. Some may include a full life-cycle evaluation. Others may simply use life-cycle philosophy to inform the priorities within a certification.

Manufacturer Transparency

Product transparency informs project teams about their products' health, environmental, and social impacts. Asking for a comprehensive report on a product's health effects, material sourcing, chemical makeup, sustainability, life cycle, and societal

impact is a human right. This detailed level of transparency about a products ingredients will continue to move the industry in the right direction. Look for more on this subject in chapter 8, “Certifications and Standards.”

Life-Cycle Cost

Over the useful life of a building, which can be one hundred years or more, most materials will require maintenance and be replaced more than once. When the costs over a building's entire life cycle are considered, a material's higher initial cost may be justified if the product compares favorably with others' durability.

Resource Recovery and Recycling

Beyond a material's initial use, it has the potential to be recovered, repurposed, and recycled:

- Metals are recyclable if they can be separated by type. Steel and aluminum building elements are easily recyclable. Approximately 50 to 70 percent of the pollution from and energy used in steel production can be eliminated through recycling; as much as 85 percent of the energy used in and pollution from aluminum manufacturing can be eliminated by re-melting it.
- Most plastics are technically recyclable, but the wide variety of plastics in use makes them difficult to separate; additives, coatings, and colorants impede recycling as well. Some plastics, such as pure polyvinyl chloride (PVC), would be recycled from buildings more often if they were designed for easy removal.
- Glass products are recyclable if separated and uncontaminated; however, few glass building products are currently recycled. Recycled glass products are made with consumer container glass salvaged from the waste stream. Although re-melting glass offers only marginal energy and pollution reduction, it reduces the use of virgin materials.
- Heavy timber is recyclable by salvaging and re-sawing it. Engineered structural wood products, wood panels, and millwork are candidates for salvage and reuse, particularly if they are fastened in such a way that they can be easily removed.
- Concrete, clay, ceramics, and other masonry products are difficult to salvage and reuse. They are sometimes recycled by crushing them for use as granular fill in road and sidewalk bases.
- Furniture, area rugs, and artwork can be recovered and repurposed. Most quality casework pieces, although they can be expensive, become future collectibles.

Ecologically minded design requires that we consider a product's environmental impact. By conserving natural resources, we will begin the rebuilding and restoration of our natural capital—the natural resources and ecological systems that provide vital life-support services to our planet.

INDOOR AIR QUALITY

A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people.

—FRANKLIN ROOSEVELT

Healthy interiors are organic by nature. They feel good, live well, look great, and are sustaining for all. We are all part of the integrated system called nature, and more than any other species, what we do affects the health and longevity of life on the planet.

Why Does Indoor Air Quality Matter?

The air quality of our indoor environments affects our health and often contributes to structural degradation and building failures.

According to the American Lung Association of Minnesota, elements within our home and workplaces have been increasingly recognized as threats to our respiratory health. The most common pollutants are radon, combustion products, biologicals (molds, pet dander, pollen), volatile organic compounds (VOCs), lead dust, and asbestos.

The Environmental Protection Agency lists poor indoor air quality as the fourth-largest environmental threat to our country.

There are an estimated 40 million individuals in the United States affected by allergies, so knowing how to reduce a home's allergen levels is important. People who suffer from asthma or have other respiratory illness can be at a greater risk for health complications associated with poor air quality in their home.

The prevalence rate of pediatric asthma has increased from 40.1 to 69.1 percent—a 72.3 percent increase. Asthma is the sixth-ranking chronic condition in the United States and the leading serious chronic illness in children.

In the house itself, poor indoor air quality can result in structural rot from excess moisture within the walls and attic and around window framing. And common pollutants can enter our houses through air leaks in the structure. Typical problems or failures include musty odors and mold growth, window condensation, structural rot, peeling paint, back-drafting appliances, damp basements, ice dams and ice buildup on the edge of a roof, and high utility costs.

Source: American Lung Association, <http://www.lung.org/associations/charters/mid-atlantic/air-quality/indoor-air-quality.html>

In our efforts to build energy-efficient homes, we have inadvertently created indoor air problems due to poor ventilation and the use of toxic materials and finishes. Poor indoor air quality is caused by the off-gassing of chemicals found in many building materials as well as mold and mildew that build up in poorly designed and maintained heating and cooling systems. Statistics indicate that we spend 90 percent or more of our time indoors, further heightening the effects of indoor air quality (IAQ). The consequence of polluted indoor environments is an overall deterioration in health and well-being. The EPA reports that the air in new homes can be 2 to 5 times more polluted than outdoor air and occasionally 100 times worse than outdoor air. The World Health Organization (WHO) reports that as many as 30 percent of our buildings exhibit signs of what is referred to as sick building syndrome (SBS).

According to the *New England Journal of Medicine*, 40 percent of children will develop respiratory disease due in part to the chemicals in their homes. Children breathe more rapidly and inhale more air per breath than adults, and because they are more physically active than adults when outdoors, they are exposed to more outdoor air pollution. Because their breathing zone is lower than adults, they are more exposed to vehicle exhausts and heavier pollutants that concentrate at lower levels in the air. Children also spend up to 80 percent of their time indoors and are therefore also exposed to high amounts of indoor air contaminants.

The choices we make in designing homes and the materials we select have long-term consequences on the indoor environment. Interior designers can therefore contribute positively to creating a safer, healthier environment, and good indoor air quality must be an important consideration throughout the design process.

Fortunately, IAQ becomes a priority for clients once they understand that it is possible to build a home that provides a healthy environment for their family. Delivering an indoor environment that celebrates health, productivity, and happiness; aims to not cause headaches, watery eyes, or raspy throats; and ensures that children with allergies and asthma can breathe more easily is paramount to good design. By choosing wisely the strategies, systems, and products that we specify, we can produce a healthy environment that supports healthier air quality.

INDOOR ENVIRONMENTAL QUALITY

We must also consider indoor environmental quality (IEQ), which has a significant impact on the health, comfort, and productivity of a home's inhabitants as well. A sustainable building should therefore maximize daylighting and a connection to nature, provide appropriate ventilation and moisture control to minimize the opportunity for microbial growth, utilize the least toxic and lowest emitting materials, provide an adequate fresh air supply, and utilize ergonomic tactics.

Common Factors That Affect IAQ

- People (exhalation, body odors, diseases)
- Human activities that use cleaning products, correction fluids, carbonless paper, pest control products,
- Personal activities such as wearing fragrances and smoking
- Technology (photocopiers and laser printers)
- Furnishings (furniture, draperies, floor coverings)
- Finishes (paint, varnish, vinyl wall coverings)
- Building materials (caulking compounds, adhesives, wood laminates)
- Outdoor air quality
- Inadequate or contaminated air-handling units
- Inadequate cleaning practices

Source: Carpet & Rug Institute, www.carpet-rug.org

One of the most common indoor pollutants is formaldehyde, a volatile organic compound (VOC) and a known human carcinogen. When combined with urea, an organic compound, it can emit toxic VOCs at room temperature. Common culprits include kitchen cabinets, countertops, shelving, and furniture, all typically constructed from particleboard held together by formaldehyde-based adhesives. The formaldehyde continues to be released into the home for years after these products have been installed, and its emissions have an adverse effect on human health. These emissions are also easily absorbed by soft materials, including carpets and fabrics, that reemit VOCs at a later time, thereby prolonging residents' exposure.

Paints, finishes, solvents, and adhesives also contain unhealthy VOCs. What is commonly called a "new house smell" is caused by the off-gassing of these compounds and is a good indication that harmful chemicals are present. Children are at a greater risk than adults, as their bodies and brains are still developing, hence more susceptible to damage from these chemicals.

Potentially harmful substances come from every room in the home. Indoor air quality is affected by:

- The building assembly
- Interior finishes and furnishings
- Volatile organic compounds

- Existing hazards such as lead, mold, and asbestos
- Cooking and cooking appliances
- People and occupant behavior
- Pets
- Toiletries
- Cleaning supplies
- Environmental tobacco smoke
- Pollen and dust
- Back drafts
- Moisture and mold
- VOCs from paints and finishes
- Formaldehyde emissions from cabinets
- HVAC and filtration systems
- Petroleum and pesticides tracked in from outside
- IAQ of adjacent rooms like a garage or shed

Thanks in large part to green building rating systems, the building products industry has risen to the challenge of improving indoor air pollution by developing adhesives, paints, and finishes with lower levels of VOCs and emissions. The next step is to eliminate toxic content and harmful chemicals.

We designers must practice the precautionary principle when specifying interior finishes and furnishings. The Science and Environmental Health Network best defines the precautionary principle: “When an activity raises threats of harm to the environment or human health, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”⁶ Ultimately, if the effects of a product, strategy, practice, or process are disputed or unknown, it should be avoided.

Many finishes and furnishings contain potentially hazardous chemicals that range from somewhat to extremely unhealthy, and when combined they can create a veritable chemical soup. It is far easier—and less costly—to prevent indoor contamination from the outset. This means including strategies for good IAQ within the design and construction process. This will reduce the need for mitigation cleanup and lower the risk of potential liability issues. (See “Understanding IAQ,” page 21.)

By designing responsibly—following a set of guidelines for good indoor air quality and using low-emission materials and pollutant source control—we can deliver healthy, clean, nontoxic homes.

⁶www.sehn.org/Volume_3-1.html

CONSERVATION OF ENERGY AND WATER

Energy

I believe that the average guy in the street will give up a great deal if he really understands the cost of not giving it up. In fact, we may find that while we're drastically cutting our energy consumption, we're actually raising our standard of living.

—DAVID R. BROWER

Understanding IAQ

Indoor Air Quality Sources
The quality of indoor air depends on the interaction and impact of many complex factors. With potentially hundreds of different contaminants present in indoor air, identifying indoor air quality problems and developing solutions is difficult. The ways in which these factors contribute to IAQ are summarized below.
<i>Construction Materials, Furnishings, and Equipment</i>
<p>These items may emit odors, particles, toxic content, and total volatile organic compounds (TVOCs), absorbing and releasing VOCs known as semi-VOCs (suspended particles that are airborne). Individual VOCs from a specific material may combine with VOCs from other materials to form new chemicals. VOCs and particulates can cause health problems for occupants that are exposed to them. In the presence of adequate heat and moisture, some materials produce nutrients that support the growth of molds and bacteria, which produce microbial volatile organic compounds (MVOCs).</p> <p>These organisms can affect occupants adversely if fungal spores containing mycotoxins and allergens or the MVOCs themselves are inhaled. Much research remains to be done to identify individual metabolic gases, their odors, the microbes that produce them, and the human response to molds and fungi.</p>
<i>Building Envelope</i>
The envelope makes up the outer shell of the building and provides protection from the exterior elements. The design of building components that separate conditioned living areas from unconditioned spaces must consider climate, ventilation, and energy consumption. Through the design and specification of HVAC systems, doors, windows, and insulation, the envelope provides thermal comfort by regulating temperature, air speed, and humidity; controls the infiltration of outside air, moisture control, and humidity levels; and regulates air pressure changes.
<i>Ventilation Systems</i>
Filtration and acoustical materials in HVAC systems may contribute to indoor air pollution in the same way as construction materials. Ventilation systems also control the distribution, quantity, temperature, and humidity of air.

(Continued)

Understanding IAQ (Continued)

<i>Maintenance</i>
Lack of maintenance allows dirt, dust, mold, odors, and particles to accumulate. The use of high-VOC cleaning agents pollutes the air.
<i>Occupants</i>
The number of occupants and the amount of equipment contribute to indoor air pollution. People and pets are major sources of microorganisms and airborne allergens in indoor environments. Occupant activities also can pollute the air.
<i>Electric and Magnetic Fields</i>
Electric and magnetic fields (EMFs) are invisible areas of energy, often referred to as radiation, associated with the use of electrical power and various forms of natural and man-made equipment as well as lighting. Electromagnetic hypersensitivity (ES) is a physiological disorder caused by exposure to electromagnetic fields, also known as electro-pollution. It produces neurological and allergic-type symptoms. Symptoms may include headache, eye irritation, dizziness, nausea, skin rash, facial swelling, weakness, fatigue, joint and muscle pain, tinnitus, numbness, abdominal pressure and pain, difficulty breathing, and irregular heartbeat. Exposure to electronics, fluorescent lights, dimmers, or a new home or work environment can elicit symptoms.
Health and Indoor Air Quality Issues
Poor indoor air quality can cause short- and long-term illness; symptoms range from minor irritations to life-threatening diseases. They are classified as follows:
<i>Sick Building Syndrome</i>
Sick building syndrome is a collection of usually short-term symptoms experienced by occupants that may disappear after they leave the building. The most common symptoms are sore throat, fatigue, lethargy, dizziness, difficulty concentrating, respiratory irritation, headaches, eye irritation, sinus congestion, dryness of the skin, and other cold-, influenza-, and allergy-type symptoms.
<i>Building-Related Illnesses</i>
Building-related illnesses are clinically verifiable diseases attributable to a specific source or pollutant within a building. Examples include cancer and Legionnaires' disease.
<i>Multiple Chemical Sensitivities</i>
Multiple chemical sensitivity (MCS) is a medical condition characterized by a heightened sensitivity to chemicals. People who have MCS become ill when exposed to a variety of chemical sources, many of which are commonly part of the environment. Some people have mild chemical sensitivities, while others have a more severe form of the illness. Substances that can cause symptoms include pesticides, fresh paint, new carpets, countless building materials, solvents, fresh ink, smoke, vehicle exhaust, industrial fumes, many cleaning products, and perfume, cologne, and other scented products such as air fresheners, fragrance-emitting devices, fabric softener, potpourri, incense, essential oils, and most soaps, shampoos, hair products, skin lotions, and laundry detergents.

Understanding IAQ

Symptoms can occur after inhaling, touching, or ingesting these substances. Reactions to scented products can occur even in people who cannot smell them. Because people with MCS react to chemicals at levels that do not ordinarily affect others, chemical sensitivity is similar to an allergy, but the symptoms and mechanism are not the same as those of traditional allergies to pollen, animals, and dust. Many of the above substances can make anyone sick at high concentrations, but chemically sensitive people can be harmed by exposure levels considered safe for the general population. Some of the symptoms reported by people with MCS are similar to known toxic reactions such as those listed on the manufacturer's material safety data sheets (MSDSs), but many chemically sensitive people experience symptoms different from typical toxic reactions. This individual variability and exquisite sensitivity can be so pronounced many scientists and doctors find it hard to accept as real.

Typical Indoor Air Pollutants

Poor indoor air quality is caused by outdoor and indoor sources of gaseous and particulate air pollutants that exceed the capacity of the building's ventilation and filtration equipment to remove or dilute to an acceptable level. Although many pollutants originate outdoors or from occupant activities, equipment, and processes, others are generated by materials.

Indoor air pollutants include:

- VOCs emitted by interior materials and their components
- VOCs emitted by cleaning and maintenance products periodically used with those materials
- Fiber shed from textiles, insulation, and panel products
- Soil, biological materials (e.g., fungi and bacteria), and gases released by biological activity
- Dust and other particulates from spraying, sanding, or finishing

These material-based pollutants may affect the health and productivity of building occupants, maintenance personnel, and construction tradespeople.

Emission Levels

Review emission levels from building products at the following stages of a project:

- *Installation.* To prevent emission exposure to tradespeople and building occupants during construction or renovation, information on potential hazards is documented in MSDSs, which are legally required for any material that may have health risks. However, these sheets typically do not disclose a full list of contents or proprietary blends. Additional information is available from the Occupational Safety and Health Administration (OSHA).
- *Building occupancy.* To prevent exposing building occupants to toxic emissions, gather the emissions data for materials during building use. Obtain product emissions data from manufacturers and coordinate with the mechanical engineer so that ventilation rates will protect building occupants while ensuring the design and performance are feasible.
- *Maintenance and removal.* Review emission levels to prevent exposure of building occupants and tradespeople during maintenance procedures, removal, or demolition. Maintenance and removal risks are reasonably well known for many conventional materials.

(Continued)

Understanding IAQ (Continued)

Consider these additional materials issues and effects:

- *Sink effect.* Rough and porous materials may contain microscopic planes and cavities that can absorb airborne molecules. When these molecules, which may be pollutants, are released—or “desorbed”—from the material after several hours or days, it is known as the “sink effect.” Hard, smooth, and nonporous surfaces typically have a low sink effect.
- *Moisture and temperature.* Moisture and heat in materials increase their rate of deterioration and the emission of pollutants. Moisture also supports microbial growth.
- *Soiling and cleaning.* Improper cleaning practices may disturb dirt and expose tradespeople to chemicals in cleaning products. Soft floor coverings such as carpeting are more susceptible to improper cleaning than nonporous flooring with minimal seams and low-maintenance coatings.
- *Natural materials.* There is a common perception that natural materials are better for the environment and pose fewer health risks than man-made or synthetic materials, but this is not always the case. Toxicity and emissions testing will clarify which are, in fact, safer. However, predicting all potential health effects is not always possible.

Source: U.S. Environmental Protection Agency, www.epa.gov; Greenguard Certification from UL Environment, www.greenguard.org

Building Energy Consumption

Buildings consume more energy than any other sector. According to the U.S. Energy Information Administration (EIA), the building sector consumes nearly half (47.6 percent) of all energy produced in the United States. Nearly three-quarters (74.9 percent) of all the electricity produced in the United States is used just to operate buildings. Globally, these percentages are even greater.

Buildings are the largest contributor to climate change. Because so much blame is heaped on transportation emissions, many people are surprised to learn that the building sector was responsible for nearly half (44.6 percent) of the United States’ CO₂ emissions in 2010. By comparison, transportation accounted for 34.3 percent of CO₂ emissions and industry just 21.1 percent.

The health of the economy is tied to the building sector. The nation’s economy hinges on a healthy building sector. The building sector touches nearly every industry (from steel, insulation, and

The United States, home to only about 4.5 percent of the world's population, consumes about 20 percent of the world's energy and generates 19 percent of global greenhouse gas pollution—six times that of automobiles in the United States. The United States is also the largest contributor to CO₂ emissions and, therefore, to climate change.

As members of the construction and design industry, residential interior designers have a responsibility to advocate for the highest efficiency appliances, lighting, and entertainment and office equipment.

Energy efficiency is one of the cornerstones of all high-performing building projects, and for residential designers, high-efficiency appliances, equipment, and lighting are a primary focus. The generation and use of energy are major contributors to air pollution and climate change. With the world's supply of fossil fuel dwindling, concerns for energy security increasing, and the global climatic impact of greenhouse gases growing, it is essential to find ways to reduce loads, increase efficiency, and utilize renewable energy.

We can begin by targeting energy savings when specifying appliances, entertainment and office equipment, ceiling fans, and light fixtures and light bulbs. Aided by the U.S. Department of Energy (DOE) minimum efficiency standards, the federal Energy Star program, and the efforts of the Consortium for Energy Efficiency (CEE), manufacturers have made tremendous strides in increasing the energy efficiency of their products. Energy-efficient choices can save families money on their energy bills while reducing greenhouse gas emissions.

caulking to mechanical and electrical equipment, glass, wood, metals, tile, fabrics, and paint) across all sectors of the economy, from architecture, planning, design, engineering, banking, and development to manufacturing, construction, wholesale, retail, and distribution.

The goal of reducing fossil fuel use by 50 percent was inspired, in part, by recent work by Santa Fe, New Mexico, architect Edward Mazria, AIA, who modified some standard assumptions made in analyzing U.S. energy use by economic sector. By including the energy embodied in building materials and some other adjustments, Mazria found that the share of energy use attributable to buildings grows dramatically, from 27 percent to nearly 50 percent. Mazria argues that to avoid a global catastrophe, global fossil fuel use must immediately be cut by 50 percent and emissions reduced even more than that by 2030. Other actions on the list include collaborating with organizations to integrate sustainability into architecture school curricula, documenting the contributions to humankind and the planet from sustainable design practices, and advocating globally for sustainable design. (See www.architecture2030.org for more information.)

Designers must always specify products that meet or exceed Energy Star requirements. Look for durable, easy-to-maintain products that conserve energy and water, are designed for disassembly, and come with long-term warranties.

One resource that identifies superefficient products is TopTen USA (www.toptenusa.org), which is a member of the TopTen International Group, a global alliance of TopTen organizations dedicated to product efficiency.

It's also important to discuss alternative energy sources with the client and project team. Consider wind, geothermal, and photovoltaic power with a goal of zero energy usage after ensuring that the home has a high-performing envelope.

There are different definitions of zero energy. Here is how the Net-Zero-Energy Home Coalition, a multi-stakeholder group in Canada comprised of corporations and nonprofit organizations, defines it:

A net-zero-energy home at a minimum supplies to the grid an annual output of electricity that is equal to the amount of power purchased from the grid. In many cases the entire energy consumption (heating, cooling, and electrical) of a net-zero-energy home can be provided by renewable energy sources.

Water

For many of us, water simply flows from a faucet, and we think little about it beyond this point of contact. We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports.

—SANDRA POSTEL, *LAST OASIS: FACING WATER SCARCITY* (2003)

We use purified drinking water to flush our toilets and water our lawns. That doesn't make any sense. In an era of scarcity, we won't need to limit whether we have water to boil pasta or take a bath. But we will think differently about a whole portfolio of water. There will be different kinds of waters for different uses. And water itself will get smart.

—CHARLES FISHMAN, *THE BIG THIRST*

How much water is used in a typical home?

- Approximately 400 billion gallons of water are used in the United States per day.
- Americans use about 100 gallons of water per day.
- Americans use more water each day by flushing the toilet than they do by showering or any other activity.
- Fifty to 75 percent of all residential water use occurs in the bathroom.
- Older toilets use between 3.5 and 7 gallons of water per flush. However, toilets with the EPA's "WaterSense" label require 75 to 80 percent less water.
- A leaky toilet can waste about 200 gallons of water every day.
- A bathroom faucet generally runs at 2 gallons of water per minute. By turning off the tap while brushing your teeth or

In many parts of this country and around the globe, freshwater has become a limited resource. Current studies indicate that the building industry consumes one-sixth of the world's freshwater supply, according to the USGBC and Worldwatch Institute. A sustainable building aims to reduce, control, or treat site runoff, use water efficiently, and reuse or recycle water for on-site use.

To protect and conserve water, designers can recommend the following:

- WaterSense flow and flush fixtures
- Low-flow faucets and showerheads
- Flow reducers on faucets and showerheads
- Ultra-low or dual-flush toilets
- Energy Star laundry appliances and dishwashers
- Chlorine filters on showerheads
- Water filtration units on faucets
- Hot water on-demand systems

The convenience of plumbing fixtures has made them the biggest water guzzlers in a typical family home. We must therefore specify water-conserving plumbing fixtures and fittings. In addition, retrofitting most devices in older buildings is a cost-effective way to support water efficiency by reducing water usage and

shaving, a person can save more than 200 gallons of water per month.

- High-efficiency washing machines can conserve large amounts of water. Traditional models use between 27 and 54 gallons of water per load, but new, energy- and water-conserving models (front-loading, top-loading, or those without agitators) use less than 27 gallons per load.
- Washing the dishes with an open tap can use up to 20 gallons of water, but filling the sink or a bowl and turning off the tap saves 10 of those gallons.
- Keeping a pitcher of water in the refrigerator instead of running the tap until it gets cold saves time and water.
- Not rinsing dishes prior to loading the dishwasher can save up to 10 gallons per load.

Source: U.S. Environmental Protection Agency and WaterSense

wastewater; such devices will pay for themselves within one to three years of installation.

In homes, bathrooms offer the greatest opportunity for saving water. Toilets use more water than any other household fixture. Nearly all flushed water in North America starts as clean, drinkable water.⁷ The American Water Works Association Research Foundation examined water use in approximately 1,200 homes in 14 North American cities and found that an average household uses approximately 146,000 gallons of water annually, 42 percent indoors and 58 percent outdoors. In households where water-conserving plumbing fixtures have not been installed, toilets use an average of 20.1 gallons of water per day, or 26.7 percent of total indoor water use. In homes with water-conserving fixtures, toilets use an average of 9.6 gallons per day, or 19.3 percent of the total—though plumbing leaks account for another 10 to 14 percent of water use, and much of that is due to toilets.

Another water-saving device from the world of plumbing is the hot water on-demand system. Running cold water down the drain while waiting for hot water to reach the faucet wastes more than 10,000 gallons each year in an average American household. Hot water on-demand systems rapidly distribute hot water to the faucet while cold water is pumped back to the water heater. A pump attaches easily under the sink, and its heat sensor shuts off the unit after the water gets hot.

Preserving water is paramount, and new products on the market make it easier than ever to do. By reducing gallons per flush (GPF) and gallons per minute (GPM), we can achieve dramatic reductions in water use.

WASTE REDUCTION AND MANAGEMENT

The packaging for a microwavable dinner is programmed for a shelf life of maybe six months, a cook time of two minutes, and a landfill dead-time of centuries.

—DAVID WANN, *BUZZWORM*

Instead of defining success as getting the most materials, we need to move to a new standard: getting the most from them. Recycling 60 percent of U.S. solid waste would save the energy equivalent to 315 million barrels of oil each year.

—WORLDWATCH INSTITUTE

We live in a run away, throw away society that is leaving its mark on the Earth for future generations, who will have to clean up after their predecessors.

A green building includes waste reduction and management techniques from its inception to its completion. The best waste-reduction strategy embraces the three r's: reduce, reuse, and recycle, incorporating a comprehensive green building approach that includes resource conservation, material reuse, construction and demolition debris recovery and the use of recycled content materials. Such a strategy is vital to reducing pressure on landfills, saves money by reducing landfill tipping fees, provides raw materials for future building products, helps the environment, and enhances the bottom line.

⁷Per a report from *Environmental Building News* (EBN), January 2004.

Those in the building industry must be challenged to incorporate waste-reduction and recycling-specification language into their projects. Consider the following facts.

In 2011, Americans generated about 250 million tons of trash:

- Paper and paperboard: 28 percent
- Yard trimmings and food waste: 28 percent
- Plastics: 13 percent
- Metals: 9 percent
- Rubber, leather, and textiles: 8 percent
- Wood: 6 percent
- Glass: 5 percent
- Miscellaneous waste: 3 percent

Fortunately, times have changed. We recycled and composted almost 87 million tons of this material, equivalent to a 34.7 percent recycling rate. On average, we recycled and composted 1.53 pounds of our individual waste generation of 4.40 pounds per person per day. Recycling and composting prevented 86.9 million tons of material from being thrown away in 2011, up from 15 million tons in 1980.

At a minimum, these materials should be addressed by the project's waste management plan. Begin by estimating the types and quantities of the materials to be generated on-site. Target at least 50 percent of the construction and/or demolition debris for recycling. Then contact local haulers and recycling facilities for their terms and conditions.

Many cities have adopted regulations for construction waste management. For example, San Jose, California, requires contractors to recycle 75 percent of construction waste to receive a final certificate of occupancy, thereby reducing the amount of construction and demolition (C&D) waste sent to landfills. Look into your projects' local ordinances to learn what is available and/or required for construction and waste demolition.

Unused materials from the job site can also be donated. Salvaged materials, such as leftover wood, windows, doors, and other uninstalled items, can be donated to organizations such as Habitat for Humanity, local programs like ReSource (www.resourceyard.org), regional art programs, and design or architecture schools.

C&D debris occupies a large percentage of space in our landfills, and the steady growth of building activities is a major reason why landfill volumes have been increasing, despite expanding recycling efforts. In Alameda County, California, for example, where citizens recycle a high percentage of their waste, more than 355,000 tons of construction and demolition materials are nonetheless disposed of in county landfills annually.

Check out the Recycling Certification Institute, which oversees the national certification program that ensures integrity, transparency, accuracy, and reliability in the recovery/recycling reports of participating C&D recycling facilities. It provides a list of certified facilities along with evaluation reports and evaluation statements available on their website. The evaluation reports detail the activities conducted in the evaluation of the certified C&D recycling facility and outline the findings of the evaluators (www.recyclingcertification.org).

Landfills are expensive to build, and no one wants to live near one. The more we reduce waste, the less need we have for building new landfills. Waste reduction on the job site saves money, and hiring source reduction and reuse and/or recycling contractors can reduce expenses. By working with the contractor to develop a waste management plan and developing resources to assist in the diversion of C&D materials, we support environmental stewardship.

OPERATION AND MAINTENANCE

The practice of sustainable design does not end when construction is complete. After the homeowner moves in, the home must operate as it was designed to. Prior planning, recommended cleaning products, and long-term system maintenance guidelines all determine how well a home will perform over its useful life. Incorporating operating and maintenance considerations into the design of a home greatly contributes to healthy and safe living environments, quality of life, and the reduced use of energy and other resources.

To that end, specify materials and systems that are cost-effective and require less water, energy, toxic chemicals, and cleaners to maintain. Providing guidelines that address all aspects of maintaining a home will help a well-designed building function as intended.

Environmental Performance Index Ranks the United States Thirty-third

The 2014 Environmental Performance Index is a joint project between the Yale Center for Environmental Law and Policy (YCELP) and the Center for International Earth Science Information Network (CIESIN) at Columbia University, in collaboration with the World Economic Forum and The Environmental Performance Index (EPI) is calculated from an aggregate of twenty indicators reflecting national-level environmental data. These indicators are combined into nine issue categories, each of which fit under one of two overarching objectives.

The 2014 EPI ranked countries based on nine issues and twenty indicators related to environmental health, air quality, water and sanitation, water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. Switzerland scored first among all countries, earning 87.67 out of 100 possible points. The United States scored 67.52 points, coming in behind most of Western Europe, Canada, Singapore, United Arab Emirates, Japan, Australia, and New Zealand. (The full report is available online at <http://epi.yale.edu/>.)

FOR FUTURE GENERATIONS

We do not inherit the Earth from our ancestors; we borrow it from our children.

—NAVAJO PROVERB

I do not believe that the process of human life on this globe has degenerated to a point of no return. I do believe, however, that we are fast approaching that point and we must redirect and correct our course in life to ensure health and a good life for the seventh generation coming. This legacy is passed down not to ensure the present, but to guarantee the future. Thinking of future generations is an enormous responsibility that requires vision.

—CHIEF OREN LYONS, AUGUST 1997

Protecting the environment and preserving the planet for future generations is without doubt one of the primary benefits of sustainable design. There are many definitions of sustainability:

- The ability to provide for the needs of the world's current population without damaging the ability of future generations to provide for themselves. When a process is sustainable, it can be carried out over and over without negative environmental effects or impossibly high costs to anyone involved (www.sustainabletable.org).
- To keep in existence, maintain; meeting the needs of future generations.... The ability to provide a healthy, satisfying, and just life for all people on Earth, now and for generations to come, while enhancing the health of ecosystems and the ability of other species to survive in their natural environments (www.earthethics.us).
- The Seventh Generation Principle states that we should make decisions about how we live today based on how our decisions will impact the next seven generations. We must be good caretakers of the Earth, not simply for ourselves, but for those who will inherit the Earth and the results of our decisions. This value is found in the Iroquois Great Law of Peace (Haudenosaunee Gayanashagowa) and is common among a number of indigenous peoples in the Americas. It is a sound principle should guides our policies and practices (www.woodbinecenter.org/node/27).

There are common threads to these definitions. Sustainability requires meeting environmental, economic, and community needs simultaneously. All three are essential to ensuring that quality of life continues for living systems and future generations.

What if residential interior designers embraced the message from Catherine Ryan Hyde in her 1999 novel *Pay It Forward*? The book advocates continually passing on good deeds. But does this have to be fiction?

In the book, Reuben St. Clair, the teacher-protagonist, starts a movement with this voluntary, extra-credit assignment: Think of an idea for world change, and put it into action.

Trevor, the twelve-year-old hero, thinks of quite an idea. He describes it to his mother and teacher this way:

“You see, I do something real good for three people. And then when they ask how they can pay it back, I say they have to pay it forward. To three more people. Each. So nine people get helped. Then those people have to do twenty-seven.” He turned on the calculator, punched in a few numbers. “Then it sort of spreads out, see. To 81. Then 243. Then 729. Then 2,187. See how big it gets?”

This concept could become a successful catalyst for healing the planet and creating a change in the marketplace. What if each of us, in our role as designers, implemented three great things for the environment on each of our projects and then asked project team members to “pay it forward”? The positive effects on the environment would grow exponentially....

Conclusion

William McDonough's sustainability design challenge is inspiring:

We need a new design assignment and we need a new design. In order to do this we need to ask new questions. “How do we love all the children, of all species, for all time?” Please notice that I am not just saying *our* children; I am saying *all* of the children. And notice I am not just saying *our* species, I am saying *all* species. And notice I am not just saying *now*, I am saying *for all time*. When we integrate this question into our designs, wonderful and beautiful things begin to happen.

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