

INTRODUCTION

The Earth gave rise to both the hummingbird on my pond and to the humans in this room and I'm hoping that one can learn from the other and that both can be here for a very long time.

—JANINE BENYUS, biomimicry writer,
speaking at the EnvironDesign5 Conference

If the past 20 years have taught us anything, we have learned that green design is not practiced in a vacuum. Superstars and students, practitioners and manufacturers—anyone with an abiding interest in exploring the emerging science of green design—regard each other as resources, from whom each can learn and to whom each can give. It is through this constant sharing of knowledge that green design has evolved. And so the “movement,” as it is so often described, is populated not just with architects, engineers, and interior designers but also with Native American leaders, government policy wonks, NGO activists, biologists, researchers, chemists, and even polar explorers.

Why We Wrote This Book

We wrote this book to bring the issues of sustainability to a greater understanding and relevance. Green design isn't just one thing. It touches all of the aspects of what we have traditionally included in the design vocabulary—function, aesthetics, and costs—and layers on new concerns. It isn't enough to plan a great space if the location of that space infringes on the habitats of critters. It isn't worth our energy to design a spacious interior if the energy that it uses is at the expense of the seventh generation coming. Beautiful materials

quickly lose their appeal if they cause wheezing and sneezing. Stunning woods become less rich when mountaintops in Oregon are clear-cut as a result. Newly constructed schools become harmful when children are forced to breathe the “new school” smell.

This book seeks to offer an introduction and exploration into the vast field of sustainable design as it specifically relates to commercial spaces. It will provide those designers who are still searching for more meaning in what they do a glimpse into the possibilities ahead. It is based on the premise that designers, with their power to create, have responsibilities beyond others, and it will offer them both the philosophical and technical knowledge important to their success.

Our concept evolved from our desire to present holistic thinking to the practitioners of green design. We address commercial interiors, and though we offer practical guidance, we begin with a review of the broad global issues, for without context, the implementation of the design strategies becomes little more than busywork. Green design is a discipline to be learned, just like any other, and it includes many, many facets.

What You'll Find

Chapter 1 will define the issues. To the novice this section will begin to lay the foundation of understanding for the more explicit information to follow. The more experienced green designer will find it useful for defining context as well as establishing the vocabulary to be used throughout the book. By examining strategies to overcome the obstacles to sustainability, as well as identifying the benefits of the integrated design pro-

cess, the design charrette, and commissioning, the reader will begin to understand the significant differences between standard interior design practice and designing for sustainability.

In chapter 2 it will become apparent that the core of the book is organized in a way that is similar to the LEED Green Building Rating System (LEED) by sorting the design process into five categories: sites and location, water efficiency, energy issues, materials, and indoor environmental quality. This is deliberate because of LEED's recognition by the building design and construction industry as the commonly accepted standard. We believe that by choosing this organizational model, the book will be more valuable to the practitioner. The chapter will look at the five categories through the filter of "why" followed by the "how" in chapters 3, 4, and 5. By fostering an understanding of the scope of the issues and the consequences of ignoring them, the designer is more likely to be open to new strategies. We believe this to be an important point. Interior design is often product-oriented, and successful green design requires a more wide-ranging approach that seeks to alter ingrained paradigms.

One further note about LEED. At the end of chapters 1, 2, 3, 4, and 5 are sidebars entitled "What's LEED Got to Do with It?" in which we present a truncated version of the LEED for Commercial Interiors v4 credits and requirements. These are included for convenience only and should not be considered a substitute for the actual rating system or the reference guide. Both of those are information-rich documents with far too many details to be included here. Clients and designers wishing to use LEED CI—and we hope you will—must use the original documents provided by the U.S. Green Building Council.

Chapter 3 combines site/location, water, and energy issues, acknowledging the limited impact that the interiors project has traditionally had in these areas and then introducing new, outside-the-boundaries thinking. The narrative will focus on tenancy issues and will highlight the commercial interiors project's opportunities to effect change. Many interior designers are neither educated nor experienced in these subjects, and this chapter will attempt to

provide them with the knowledge they need to work effectively with the architects and engineers on their project teams.

Chapter 4 will focus on materials, with a strong emphasis on life cycle thinking. The LCA discipline will be described in detail, followed by product comparisons using life cycle techniques. Other product attributes such as toxicity and "natural versus synthetic" will be discussed. The remainder of the chapter offers an overview of important trends in materials use and a crystal ball look at the direction in which sustainable products is heading.

Indoor environmental quality will be examined in chapter 5, covering the very broad issue of indoor air quality, as well as other factors that contribute to the health and well-being of building occupants: acoustics, thermal comfort, daylighting, and views.

Chapter 6 will list and explain some of the green design tools available to the practitioner, such as standards, certification programs, specifications, green libraries, and other product resources. Making the business case for green design is becoming increasingly important to design firms, and chapter 7 will address the oft-asked economic questions "How much does it cost?" and "How can I justify and diminish the expenses of building green?"

Chapters 8 and 9 bring it all together by highlighting case studies of projects that, in our opinion, exemplify the best of the sustainable commercial interior. Chapter 8 examines how the U.S. Green Building Council and five design firms have "practiced what they preach" when greening their own office spaces. Chapter 9 explores the design of other diverse commercial spaces that have incorporated the issues presented throughout our book with exceptional insights, care, and beauty. Finally, a glossary and a listing of important books, publications, and websites are included in the back of the book.

A unique and important feature of the book is the contributing authors whose work we present as essays. Each is a recognized expert in his or her field, and their submissions are a powerful addition to the body of knowledge the book seeks to embody. We are immensely grateful to Marilyn Black, Gina Bocra,

Bill Browning, Nancy Clanton, Jay Enck, Jean Hansen, Judy Heerwagen, Wanda Lau, Nadav Malin, Bill Reed, Marcus Sheffer, Ross Spiegel, and Ken Wilson for sharing their amazing intellects with us and with our readers.

Our Hopes for the Future

Buildings are the physical embodiment of shelter, and as we enter them we are grateful for the protections they offer. Yet they are more than simply roof and walls; in the context of day-to-day comfort, the interiors matter, perhaps more than the building itself. A worker in a landmark office building in Chicago said, “What good

does it do me to work in a Mies van der Rohe building if I can’t open my file cabinet and close my office door at the same time?” Integrating the additional attributes of sustainable thinking, which focuses on the people inside those buildings, with the traditional standards of good design will save other employees from similar frustrations.

Thoughtful consideration of the indoor environment coupled with a protective commitment to the world beyond the walls is what we have brought to this book. However, no matter how strong our convictions, a reality check tells us that it isn’t possible to accomplish all that we would like or even all that we are able, but we must try if we want to realize our dream of a world reimagined.

1

SUSTAINABLE DESIGN: PAST, PRESENT, AND FUTURE

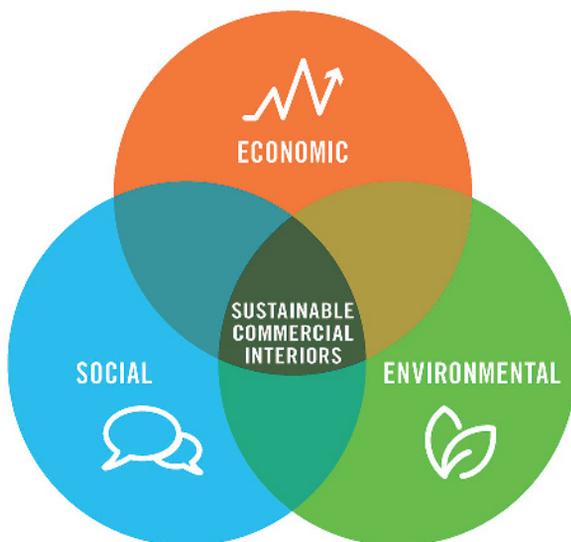
Help Wanted

Seeking commercial interior designer with a desire to eradicate the causes of sick buildings, nurture the health and well-being of the occupants of interior spaces as well as increase the retention and productivity of said occupants (thus improving a client's return on the building investment), and assist in halting the rapid depletion of precious natural resources. Candidates must possess the talent to interpret sometimes complex and complicated standards, as well as the knack to separate fact from fiction. Only those interested in constant learning and able to demonstrate a willingness to challenge conventional thinking need apply.



Chances are you probably won't find this classified ad posted on LinkedIn or CareerBuilder.com anytime soon, yet it represents some of the big-picture responsibilities facing an interior designer who chooses to pursue a practice that is grounded in the tenets of sustainable design. It is a career that can be as challenging as it is satisfying, filled with unlimited possibilities largely because the delineation between green design and great design is gradually blurring. Someday, all great design will be green design. When that happens, environmental design solutions will be de rigueur. Codes will be in place to guide design professionals toward the right decisions. Accepted standards will provide benchmarks against which to measure new products and procedures. Those with experience—the veterans who have participated in the development of this new approach to design—will be ahead of the curve and well positioned to capitalize on its potential.

For now, however, interior designers and architects continue to strive to understand the issues while learning to separate valid information from phony claims. Current efforts focus on translating the outcomes of early anecdotal success stories and initial research studies while undertaking further investigation to help solidify the case for green building from ecological, economical, and sociological standpoints (fig. 1-1).



Interpreting data, though, can be frustrating and difficult and often comes down to understanding the significant elements involved with ecology and sustainability. It also requires an understanding of developing—and diverse—mind-sets in order to best extrapolate these principles and practices into mainstream thinking.

Sustainability Defined and Refined

The word sustain comes from the Latin word *sustine-re*, which means “to hold up from below” (*sus-*, “from below,” and *tenere*, “to hold”). Throughout the centuries, the use of the word has evolved, and today it is cloaked in many subtle variations: to give support or relief, to provide nourishment or the necessities of life, to buoy up, to make something continue to exist, to maintain through time. The term first appeared in the environmental vernacular a few hundred years ago when the Germans invented a new form of forestry practice that was designed to ensure that their forests were not run down—it was called in the English-speaking world “sustainable-yield forestry.”¹ One of the term’s first appearances in the business arena occurred in an article entitled “The Blueprint for Survival,” published in *The Ecologist* magazine in January 1972, in which the authors wrote of the need for “sustainable development” and for “ecological and economic stability that is sustainable far into the future.”²

Figure 1-1 Anecdotal evidence and early research studies demonstrate that sustainable design practices can positively impact business from three distinct yet overlapping perspectives: economic, environmental, and social. The task at hand is to strengthen the case with a wealth of solid empirical data.

Our vision is of a life-sustaining Earth. We are committed to the achievement of a dignified, peaceful, and equitable existence. A sustainable United States will have a growing economy that provides equitable opportunities for satisfying livelihoods and a safe, healthy, high quality of life for current and future generations. Our nation will protect its environment, its natural resource base, and the functions and viability of natural systems on which all life depends.

—The President’s Council on Sustainable Development, “Towards a Sustainable America,” May 1999

Also in 1972, the relationship between economic development and environmental degradation earned global attention at the United Nations (UN) Conference on the Human Environment, held in Stockholm, Sweden. Not long after, the United Nations Environment Programme (UNEP) was formed to “act as a global catalyst for action to protect the environment.” Despite UNEP’s efforts, however, environmental degradation continued at an accelerating rate, so much so that in 1983 the UN established the World Commission on Environment and Development, which served to “emphasize that environmental degradation, long seen as a side effect of industrial wealth with only a limited impact, was in fact a matter of survival for developing nations.” Led by Gro Harlem Brundtland of Norway, the commission put forward the concept of sustainable development as “a necessary alternative approach versus one simply based on economic growth.” The Brundtland Commission, as it came to be known, defined sustainability as that “which meets the needs of the present without compromising the ability of future generations to meet their own needs.” A critical factor in achieving this objective, notes the report, is the ability to “overcome environmental degradation without forgoing the needs of economic development as well as social equity and justice.” Sustainability, then, requires that human activity, at a minimum, uses nature’s resources only to the point where these resources can

be replenished naturally so that they can continue to sustain—in other words, to support, nourish, and maintain—human populations.

It wasn’t until nearly a decade later, however, at the UN’s Earth Summit in Rio de Janeiro, Brazil, in 1992, that widespread international support for UNEP’s efforts was fully realized. The summit, which was attended by representatives of 112 countries and more than 2,400 nongovernmental organizations (NGOs), was organized by the United Nations in an effort to “help governments rethink economic development and find ways to halt the destruction of irreplaceable natural resources and pollution of the planet.” As the UN describes, “Hundreds of thousands of people from all walks of life were drawn into the Rio process. They persuaded their leaders to go to Rio and join other nations in making the difficult decisions needed to ensure a healthy planet for generations to come.”³

At the end of the summit, participating nations adopted a set of 27 principles, the Rio Declaration on Environment and Development, to guide future sustainable development. Included in these principles was the precept that “human beings are at the center of concerns for sustainable development” and are “entitled to a healthy and productive life in harmony with nature.” The declaration also acknowledged that “in order to achieve sustainable development, environmental protection must constitute an integral part of the development process and cannot be considered in isolation from it,” and it noted that “the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.” Finally, the declaration noted that to “achieve sustainable development and a higher quality of life for all people, states should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.”

Fast-forward through subsequent decades, and today you can stumble across as many definitions and interpretations of “sustainability” or “sustainable development” as there are experts willing to offer one. Each definition is characterized by the perspective from which it is being viewed. As a result, arriving

at a general consensus of what sustainability means is perhaps an unachievable task, as stakeholders emphasize their own particular interests. And while such conflicting viewpoints may seem incongruous, they have expanded the base of parties advocating for sustainability, with each group assuming ownership of the concept in some way—an essential condition to the continued advancement of any emerging policy or practice.

In fact, Sandra Mendler, during her tenure as leader of HOK's sustainable design initiatives, suggested that the reason the sustainable design movement is more successful than the energy-efficiency movement of the 1970s is because the underlying goals and purpose are larger and the constituencies that are attracted to the cause are broader and more diverse. "Under a single umbrella of sustainability are the individual causes of energy efficiency, recycling, indoor air quality and building health, waste management, healthy buildings, native plants, backyard habitat, dark sky initiatives, etc. Each of these has passionate advocates, and many people are motivated to action because they see the synergies. By endorsing sustainable design, one can accomplish all of this," she notes.⁴

Environmentalism is much more than a hodge-podge of pleas and campaigns to save the Everglades, the tundra, or the snowy egret. Mountains, forests, streams, clear skies, and wildlife are parts of environmentalism because they are essential parts of man's well-being. But environmentalism is also a vital element in dealing with problems of health, economic prosperity, social development, education, justice—indeed, with the full range of human aspirations. It is the basic undertaking if we are to attain the objectives this country subscribed to 200 years ago: life, liberty, and the pursuit of happiness.

—William D. Ruckelshaus, first administrator, U.S. Environmental Protection Agency, 1973

■ Defining “Green”

During the early decades that the concept of sustainability was being debated on an international platform, environmental problems at the local level weren't going unnoticed. The 1962 release of Rachel Carson's book *Silent Spring* brought overwhelming attention to the impact of pesticides on human and environmental health; people were horrified to learn how DDT and other chemicals being used to enhance agricultural productivity were actually poisoning our lakes, rivers, oceans, and bodies. Eight years later, the first Earth Day was instigated by Wisconsin senator Gaylord Nelson and patterned after the teach-ins staged at many U.S. university campuses protesting civil rights violations and the Vietnam War. Nelson hoped that by holding the first nationwide environmental protest, it would “shake up the political establishment and force the environmental issue onto the national agenda.”⁵

That first Earth Day saw 20 million Americans take to the streets, parks, and auditoriums in what an October 1993 article in *American Heritage* magazine called “one of the most remarkable happenings in the history of democracy.” Some credit the environmental consciousness raised by Earth Day as the impetus behind the passage of the Clean Air, Clean Water, and Endangered Species acts. It provided a mobilizing force, a formal way for ordinary citizens to protest against the medical waste washing up on shorelines, the increasing numbers of toxic waste dumps dotting the landscape, and oil spills that were despoiling the beauty of our country's coasts and threatening the sea life that inhabited them (fig. 1-2). That same year, the U.S. Environmental Protection Agency (EPA) was formed and the Natural Resources Defense Council (NRDC) was established. In 1990, Earth Day went global, mobilizing 200 million people in 141 countries and lifting the status of environmental issues onto the world stage. As the millennium approached, Earth Day began focusing on global warming and a push for clean energy. By the time April 22, 2000 rolled around, the Internet had helped bring 5,000 environmental groups worldwide onboard, reaching out to hundreds of millions of people. Earth Day is now the

most celebrated secular holiday in the world with over one billion people in approximately 192 countries taking action to protect the environment.

After that first Earth Day, a generation of committed citizens emerged, a group who recognized the importance of environmental health and its related causes. And while most chose to concentrate their activities on local initiatives conducted with little publicity, the more radical activists took on the biggest environmental offenders, chaining themselves to smokestacks, living in trees, or even commandeering oil tankers.

Much of that radical element no longer exists today (baby boomers have, after all, gotten considerably older and tamer and are now aligned with respected, though still passionate, nonprofits); instead we have reached a juncture where much of the global debate on sustainability has merged with industry-specific efforts. Some in the electronics industry, for example, have made sweeping product design changes and instituted take-back programs to keep their products out of landfills, where they can leach dangerous chemicals into the groundwater. In fact, it seems that the tenor of the agenda has changed: where before our voices cried out against the wrongdoers, we now understand the value of rallying for those who are cleaning up their act and doing things right. We celebrate the fact that the Cuyahoga River in Cleveland, Ohio, no longer burns, and the Hudson River, known 30 years ago as the “Dead River” filled with industrial scum, today supports fish, harbor seals, and porpoise populations as well as many recreational areas.

Today, our consciousness is raised and our access to information is unparalleled. So why, then, do we still wonder what’s green and what’s not?

Like the debate on sustainability, the determination of whether something is green or not green usually depends on who’s asking and in what context. (It’s ironic that the word *green* represents the holy grail of sorts for two often contentious interests, economics and environment, leaving one to wonder if perhaps this might be symbolic that the two can, in fact, be mutually beneficial.) For example, a subdivision developer might think being green is as simple as leaving as many trees as possible around the new homes he

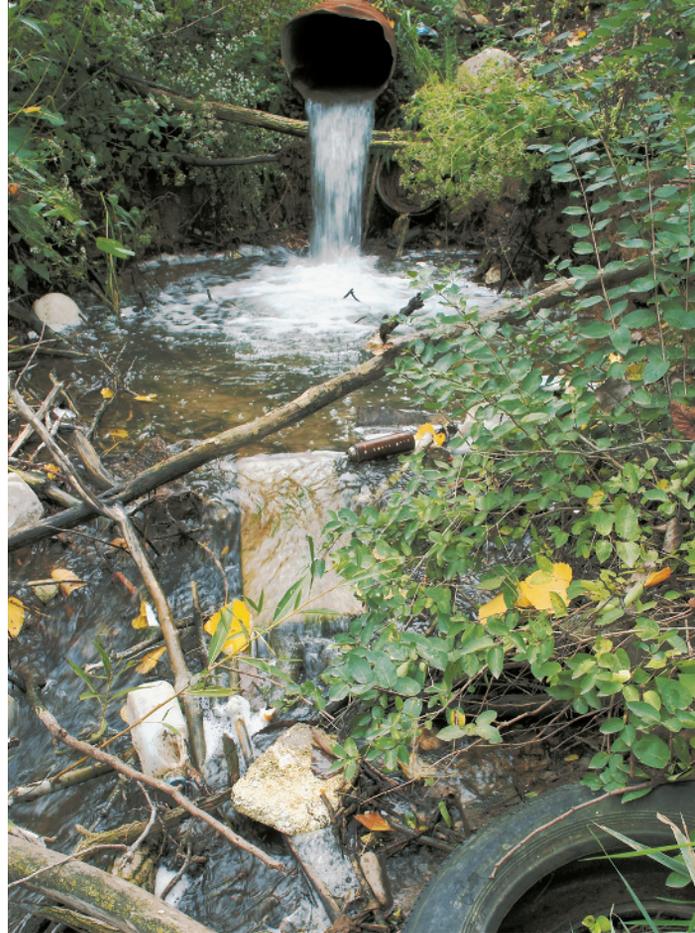


Figure 1-2 The first Earth Day in 1970 provided ordinary citizens with the opportunity to formally protest the environmental degradation occurring in their own backyards, from toxic wastes washing up on shorelines to rivers filled with industrial scum to oil spills threatening the sea life along our nation’s coasts. © *Photographer: James Jurica*

builds or may take a more sophisticated view and plan an entire community with a number of ecofriendly amenities. Consider the Prairie Crossing conservation community located about one hour northwest of Chicago. Named one of *Mother Nature* magazine’s top 10 eco-friendly planned communities, it features more than 10 miles of trails (which lead to two colleges, the local high school, train station, and local stores and restaurants), a stable, a large lake, an organic farm, and three community buildings, including a historic barn that serves as a community center (fig. 1-3). Rail service runs to both Chicago and O’Hare Airport, and a wind turbine provides power to the farm.



Figure 1-3 Conservation communities, such as Prairie Crossing in Illinois, provide a way of life that respects the environment and enables residents to experience a strong connection between community and the land. Prairie Home developers have sold all 359 planned new construction single family homes, and are now selling 36 condominiums. Source: Site plan courtesy of Prairie Crossing © Liberty Prairie Foundation

A home builder, on the other hand, takes a different approach and markets “green” as above-standard insulation, highly efficient windows, or a money-saving heating and cooling system. The more environmentally astute builder will throw in passive solar energy and cisterns to collect rainwater. A typical home owner probably believes that she’s green because she separates out glass, plastic, and metals before throwing them in the trash (fig. 1-4). More-enlightened consumers shop for energy-efficient appliances and have retrofitted their lamps and fixtures with compact fluorescent and LED bulbs. A business office goes green when its printers are set to default to two-sided printing and motion detectors are installed to control lighting usage and cut utility bills. Small efforts, such as reusing the backside of paper for notepads, using washable ceramic coffee cups instead of Styrofoam and paper, and recycling toner and ink cartridges, also may qualify.

Politicians who propose a “green” agenda usually translate their efforts into environmental regulation. The Clean Water Act and the Clean Air Act are examples of government actions that worked. And while many hope that official legislative action on global warming

will be enacted in the future, contentious partisanship currently is preventing this. As a result, regulations designed to reduce greenhouse gas (GHG) emissions and mitigate climate change are increasing at the state and regional levels, and the U.S. EPA is taking action under the Clean Air Act regarding motor vehicle fuel efficiency and emissions from power plants and WaterSense labeling of water-efficient products and services.

Ecologists today think green globally and act to protect our earth and its biodiversity. They worry that nature’s fragile balance is in constant peril and that every ecosystem is in an accelerating and perhaps irreversible decline. Ecologists can cite hundreds of frightening examples of species extinction and rain forest endangerment. In January 2013, the U.S. Fish and Wildlife Services reported 2,054 species worldwide that are endangered or threatened, 1,436 of which exist in the U.S. alone. The planet’s largest rain forest—the Amazon—lost more than 17 percent of its forest cover in the last century due to human activity. The fact that before it closed, the towering pile of garbage at the infamous Fresh Kills, the Staten Island landfill, measured higher than New York City landmarks, or that its mass was considered larger than the Great Wall of China, speaks volumes about the

Figure 1-4 Some consumers take heart in separating out glass, plastic, and metals for curbside recycling pickup. Though considered a small green action on the part of an individual, the U.S. EPA estimates that Americans generated about 250 million tons of trash in 2010 and as a collective effort recycled and composted over 85 million tons of this material, which is equivalent to a 34.1 percent recycling rate. On average, we recycled and composted 1.51 pounds of our individual waste generation of 4.43 pounds per person per day. © *Photographer: James Jurica*



Conspicuous Conservation

In 2002, a study entitled “Vital Signs” first reported that well-informed consumers were emerging as a new force in the global struggle to create an environmentally sustainable world. Aided by labeling programs, standards, and an expanding group of social and environmental certification organizations, the study, produced by the Worldwatch Institute with support of the UNEP and the W. Alton Jones Foundation, noted that “the world’s consumers are voting with their wallets for products and services that promote sustainable development.”

One significant aspect of this movement is being fueled by those consumers who want to be seen being environmentally friendly. Called “conspicuous conservation,” this concept is similar to the better-known spectacle of conspicuous consumption and espouses the same belief that “you are what you own.” However, it exalts virtue over tawdry materialism. The idea really isn’t new, says Edwin Stafford, marketing professor at Utah State University/Logan. “A counterculture lifestyle without cars, refrigerators, or electricity from the grid has been around since the 1960s. It’s been conspicuous, but hardly alluring. Today’s new conspicuous conservation, however, carries a smarter, high-tech appeal,” he explains.

Wordspy.com defines “conspicuous conservation” as “using technology to live more frugally and to conserve resources,” and it reflects the increasing popularity of state-of-the-art wares and technologies designed elegantly to protect the planet. Energy Star appliances, compact fluorescent lights, photovoltaic solar panels, high-performance homes, and wind turbines atop skyscrapers all embody smart frugality with

superior performance and style. In the wake of soaring oil prices, environmentalists’ advocacy for energy conservation has taken on added resonance. High-tech prudence simply makes sense. As the SUV fades as the icon of the good life, Toyota’s hybrid, the Prius, now symbolizes the socially better life.

In “Conspicuous Conservation: The Prius Halo and Willingness to Pay for Environmental Bona Fides,” authors Steven E. Sexton and Alison L. Sexton reinforce this argument. The report, issued in 2012, analyzes how much consumers are willing to pay to demonstrate that they are environmentally conscious. Using vehicle ownership as a symbol of social status, and the design of the Toyota Prius as distinctive from other hybrid cars, the authors examined the market for Prius hybrid vehicles to estimate the value of this green symbol. By comparing consumers’ willingness to pay for Priuses compared to hybrid Honda Civics in communities across Colorado and Washington, the authors find that consumers are willing to pay between \$430 and \$4,200 to signal that they are green. The authors emphasize that the Prius premium is not the result of differences in vehicle quality, but rather the difference in design. The Prius is designed to be instantly recognizable as an environmentally friendly purchase, compared with other hybrid competitors.

Sources: “Choosing A Better Future: Consumers Pressure Business to Go Green,” Worldwatch Institute, www.worldwatch.org; “Conspicuous Conservation,” by Edwin Stafford, green@work magazine, Winter 2004, www.greenatworkmag.com; and “Conspicuous Conservation: The Prius Halo and Willingness to Pay for Environmental Bona Fides,” by Steven E. Sexton and Alison L. Sexton, October 5, 2012, www.ncsu.edu/cenrep/workshops/TREE/documents/ConspicuousConservation-TREE.pdf.

harm that humans are inflicting on the earth (fig. 1-5). Ecologists also speak of the devastating consequences that come from natural disasters: The year 2012 was the hottest year on record in the United States, the Mississippi River experienced near record-low levels, more than half the country experienced drought conditions, and wildfires spread throughout the West. Poor development choices, from deforestation and river engineering to poor siting of cities and buildings, have made us more vulnerable to disaster than ever.

In the design fields, architects and designers are using a number of strategies to increasingly introduce the concept of green building into their projects. Techniques such as daylighting, light shelves, and light sensors flood spaces with natural light. To prevent “sick” buildings, professionals work hard to develop innovative strategies for heating and cooling air and keeping it clean. Separate exhausts for print/copy rooms, monitors for noxious chemicals, and operable windows help to keep a building—and its occupants—healthy. So do safe building materials such as paints, adhesives, and floor coverings that emit few or no volatile organic compounds. Some of the most forward-thinking product developers and manufacturers conceive of being green as an opportunity to differentiate themselves from the competition. Some producers of modular carpet tiles recognize that their product doesn’t wear out, it “uglies out,” and they’ve developed a process of renewal and reuse, keeping the carpet out of landfills and saving their customers money in the process.

Furniture manufacturers are going green by placing a greater emphasis on the three Rs: reduce, reuse, and recycle. Chairs, for example, are now being designed with fewer materials, and their components are clearly identified for easier separation and recycling. Some manufacturers even print the recycling instructions on the bottom of their chairs in several languages, thus increasing the odds for their desired disposal and reuse.

What all these examples illustrate is that there are varying shades of green, from pale green to dark green—but the fact is, some green is better than none. Of course, there’s always the practice of greenwashing to cloud the issue. Best described as “the deliberate dissemination of misleading information or the im-

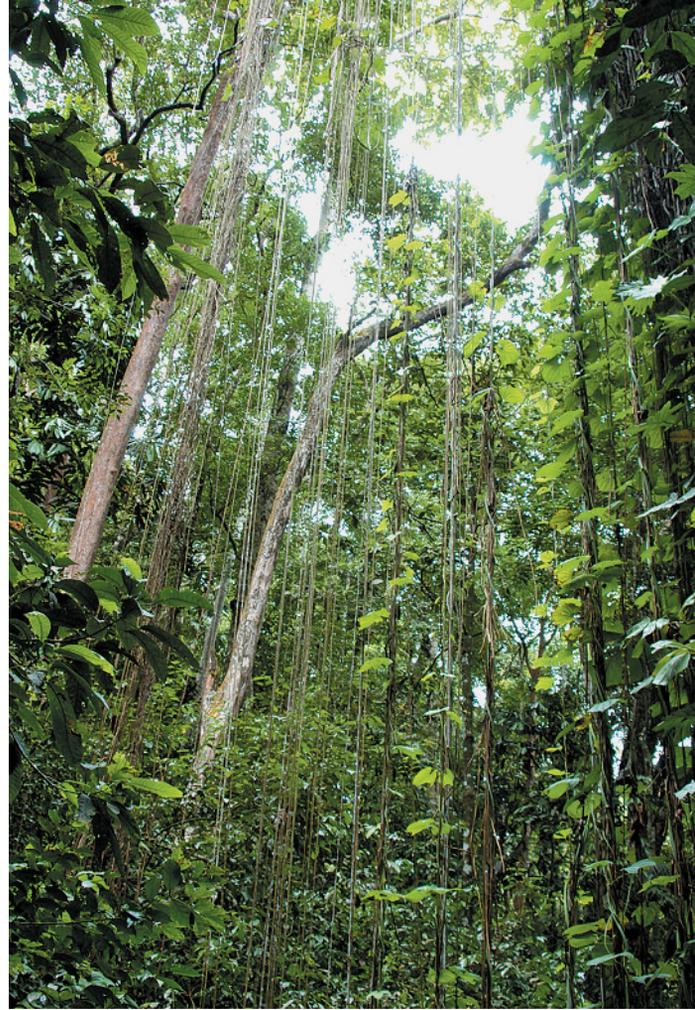


Figure 1-5 From species extinction to widespread rain forest endangerment, ecologists warn of the devastating consequences for global ecosystems as a result of human activity. © *Photographer: Lim Seang Kar*

plementation of token eco-friendly initiatives in an effort to conceal a larger abuse of the environment and present a positive public image,” greenwashing takes its roots from the term whitewash, thus emphasizing the cover-up part of the equation. Some argue that greenwashing plays a big role in the public’s confusion about green versus not-so-green by introducing a third choice: not green at all but convincingly faking it. For example, consumers were intrigued with Madison Avenue’s wholesome images that promote cotton as “the fabric of our lives.” Yet cotton needs more chemicals to grow than almost any other crop in the world. Cotton production uses 8 to 10 percent of all of the agricultur-

Truth in Marketing

The Federal Trade Commission offers a series of green marketing guidelines—the Green Guides—that hold companies to truthful standards in marketing their products. First introduced in 1998 and updated in 2012, the guides are intended to limit the number of deceptive claims made by product manufacturers and suppliers. They are also designed to help reduce “greenwashing,” in which a company promotes a single green aspect of the product but doesn’t give the full picture of other ingredients.

In general, the FTC warns against broad, unqualified general environmental benefit claims like “green” or “eco-friendly.” Broad claims are difficult, if not impossible, to substantiate. Instead, the FTC says that qualifications for any claim should be clear, prominent, and specific. When a marketer qualifies a general claim with a specific benefit, consumers understand the benefit to be significant. As a result, marketers shouldn’t highlight small or unimportant benefits. If a qualified general claim conveys that a product has an overall environmental benefit because of a specific attribute, marketers should analyze the trade-offs resulting from the attribute to prove the claim.

The Green Guides provide suggestions on best practices for marketing products with the following claims:

- ◆ Carbon offsets
- ◆ Certifications and seals of approvals
- ◆ Compostable
- ◆ Degradable
- ◆ Free-of
- ◆ Non-toxic
- ◆ Ozone-safe and ozone-friendly
- ◆ Recyclable
- ◆ Recycled content
- ◆ Refillable
- ◆ Made with renewable energy
- ◆ Made with renewable materials
- ◆ Source reduction

The Green Guides are not rules or regulations but general principles that describe the types of environmental claims the agency may find deceptive. The FTC has imposed fines and taken other actions in recent years involving deceptive recyclability, biodegradable and environmental certification claims.

Source: Federal Trade Commission, www.ftc.gov

al pesticides in the world and 23 to 25 percent of the total insecticides.⁶ In addition, the bleaching, dyeing, and finishing of cotton fabric use industrial chemicals such as chlorine, chromium, and formaldehyde that the EPA has identified as hazardous substances. Hotels will advertise that they’re green simply because they offer guests the opportunity to reuse towels and bedding instead of having these items changed each day—yet energy-guzzling and heat-producing fixtures light and warm empty rooms for hours on end, unhealthy chemicals are used for cleaning, hundreds of pounds of dis-

posable cups, plates, and silverware are thrown away each day, and a guest can’t find an operable window anywhere in the building. (See chapter 4 for a larger discussion of identifying and preventing greenwashing.)

When the final scorecard is tallied, shame on us if it’s not a field of green.

—Clay Johnson III, deputy director for management, U.S. Office of Management and Budget

What Is Green Design?

So what's a designer to do? If it's difficult to determine what's green and what's not, how does a designer even begin to start unfolding the complicated layers surrounding the core principles of sustainable design?

Working within the constraints of available technology and processes, today's green design and building professionals concentrate on achieving the most practical solutions to environmental concerns. The ideal green facility would have no negative impact on the environment, would use only sustainable or renewable resources, and all material components would be returnable to their manufacturer after the end of their useful life to be used as food for another material. In addition, this facility would be nurturing and restorative, aid productivity, and produce a sense of well-being for its occupants. Sound impossible? Actually, says architect William A. McDonough, FAIA, one of the very first sustainable design gurus, this facility does exist: it's called a Bedouin tent, and it's used by nomads wandering the desert, where temperatures often exceed 120 degrees and there's virtually no shade and no air movement (fig. 1-6). To survive in this

hostile environment, the nomad relies on a black tent that produces a deep shade that brings the temperature down to 95 degrees. Its coarse weave creates an interior beautifully illuminated with millions of specks of light, beneath which air rises and is drawn through the membrane, creating a breeze and lowering the temperature even further. Even rain, when it occurs, isn't a problem, as the moisture causes the fibers to swell and create a tight enclosure. Finally, the Bedouin tent is completely portable.⁷

For most climates and cultures, however, the Bedouin tent won't do. Do modern building types exist that meet our totally green criteria? Are we able to produce interior spaces well suited to our lifestyle needs without negative environmental impacts? Can we buy or specify products capable of complying with evolving protocols? The answer is yes ... and no. Nature provides us with everything we need to be sustainable and healthy with minimum impact on the environment: natural materials that if used correctly can be returned to the earth to be used again, an unlimited supply of energy from the sun, and the biodiversity necessary for our complex human requirements. Couple all this with the best of intentions and designing green should be attainable.

Figure 1-6 The Bedouin tent is an example of a perfect green building, suggests William McDonough, in that it produces no negative impact on the environment, it uses only sustainable or renewable resources, and all material components can be returned to the manufacturer at the end of their useful life to be used as food for another material. In addition, it is nurturing, restorative, and produces a sense of well-being for its occupants. © *Photographer: Steven Tilston*



The Hannover Principles

1. Insist on rights of humanity and nature to co-exist in a healthy, supportive, diverse and sustainable condition.
2. Recognize interdependence. The elements of human design interact with and depend upon the natural world, with broad and diverse implications at every scale. Expand design considerations to recognizing even distant effects.
3. Respect relationships between spirit and matter. Consider all aspects of human settlement including community, dwelling, industry and trade in terms of existing and evolving connections between spiritual and material consciousness.
4. Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems and their right to co-exist.
5. Create safe objects of long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creation of products, processes or standards.
6. Eliminate the concept of waste. Evaluate and optimize the full life cycle of products and processes, to approach the state of natural systems, in which there is no waste.
7. Rely on natural energy flows. Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.
8. Understand the limitations of design. No human creation lasts forever and design does not solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not as an inconvenience to be evaded or controlled.
9. Seek constant improvement by the sharing of knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long-term sustainable considerations with ethical responsibility, and re-establish the integral relationship between natural processes and human activity.

The Hannover Principles should be seen as a living document committed to the transformation and growth in the understanding of our interdependence with nature, so that they may adapt as our knowledge of the world evolves.

© 1992, William McDonough Architects. Reprinted with permission.

How, then, do we do it?

In *The Hannover Principles: Design for Sustainability*, McDonough sought to provide “a platform upon which designers can consider how to adapt their work toward sustainable ends (designers being all who change the environment with the inspiration of human creativity).”

Designing for sustainability, he said, “requires awareness of the full short- and long-term consequences of any transformation of the environment.”⁸

If we must be aware of the consequences of our design decisions, as McDonough suggests, we necessarily need to explore all the issues and elements that those decisions have the potential to affect. Figure 1-7 categorizes the issues according to three primary areas of concern—economic, environmental, and social—as well as identifies those issues where more than one factor comes into play. A brief explanation of the relationship between sustainable design principles and each impact area is included.



Figure 1-7 Three primary areas of concern—economic, environmental, and social—overlap in a number of areas; a diverse set of results/reductions/improvements result in each area and from their integration.

Clearly, the consequences of sustainable design strategies are intertwined with many vital aspects of a company's operations and its culture. While subsequent chapters address all of these issues (and their related green design strategies) in depth, even the briefest of examinations illustrates how the sustainable design process—from conception to completion—provides vast opportunities to support, nourish, and maintain all segments of corporate America.

Sustainability is an evolving discipline. As our knowledge of and experience with sustainable design expands, most likely the issue parameters will change accordingly.

Sandra Mendler, now a principal in the San Francisco office of Mithun, believes that modern design is evolving in response to a cultural yearning for authenticity. "The quest for authenticity is part of a much larger social transformation that many describe as a new paradigm, as we leave the industrial age and the information age behind to enter the 'ecological' age," Mendler writes in the article "What Is Next for Sustainable Design," published in the September 2012 issue of *Contract* magazine (and reprinted here with permission). "These broad ideas underlie a shift in perspective from one based on the domination of nature, to one that views man and nature as fundamentally interconnected and interdependent. This shift is gradually percolating throughout societies and ultimately influencing consumer demand as society seeks out authentic places and experiences that reveal our connection with the natural world."⁹

Mendler advocates for experiential design, which is less focused on buildings as objects and interior architecture as abstract composition, and more focused on direct, sensual experience and engaging the narrative of place. This new approach¹⁰ will include the following:

- 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 use of redundant systems can be beneficial in the long run to increase longevity

Historic Buildings: A “Nonrenewable” Resource

Perhaps the most responsible form of green design is the kind that occurs in the renovation of our existing building stock. However, Americans’ love affair with new construction means that approximately 1 billion square feet of buildings are demolished each year. The Brookings Institution estimates that as much as a quarter of all of our building stock could be turned over by 2030.

There are signs, however, that this tide is turning, bolstered in part by evidence showing the significant benefits to renovation, including the potential advantages that sustainable design principles can bring to these projects.

The Greenest Building: Quantifying the Environmental Value of Building Reuse, a 2011 study by Preservation Green Lab, an office of the National Trust for Historic Preservation, explores the environmental impacts associated with the decision to demolish and replace existing buildings—and especially the carbon dioxide savings that might be offered by reusing and retrofitting these places instead of demolishing them.

Using a life cycle assessment, this study compares the reuse of existing buildings to demolition and new construction. Six different building types are examined: single family, multi-family, commercial office, mixed-use (main street style), elementary school, and warehouses converted to multi-family and commercial buildings. Important study findings include:¹¹

- ◆ Building reuse typically yields fewer environmental impacts than new construction when comparing buildings of similar size, functionality, and energy efficiency. This result was found to be true irrespective of climate, though differences in climate can affect the extent of savings.
- ◆ The absolute carbon-related impact reductions can be substantial when these results are

scaled across the building stock of a city. In Portland, Oregon, for example, retrofitting just 1 percent of the city’s office buildings and single family homes over the next 10 years would help to meet 15 percent of the entire county’s total CO₂ reduction targets.

- ◆ It can take 10 to 80 years for a new energy-efficient building to compensate, through efficient operations, for the climate change impacts created by its construction. The majority of building types in different climates will take between 20 and 30 years to overcome the initial carbon impacts from construction.
- ◆ The design of buildings matters. Those buildings that use the fewest materials will have the most significant environmental savings, and, in fact, renovation projects that require many new materials can reduce or even negate the benefits of reuse.

The renovation of historic buildings is of special significance to the sustainable design paradigm because it contributes to the preservation of an intangible symbol of our culture, contributes to a sense of place, and forms a physical connection to our heritage that, once gone, can never be replaced. The National Park Services (NPS), in its “Guiding Principles of Sustainable Design,” refers to historically significant buildings as “a nonrenewable resource” that should be “protected, conserved, interpreted and left unimpaired for future generations.”

According to the U.S. Department of Energy’s database of standing buildings, the historic building segment is increasing by 10 million buildings a year. The U.S. General Services Administration (GSA), the nation’s biggest real estate player, reports that more than one-fourth of its 1,600 owned buildings are listed in or eligible for the National Register of Historic Places.

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“Cultural resource preservation intrinsically is a form of sustainable conservation. The built environment represents the embodied energy of past civilizations.”

—National Park Service, “Guiding Principles of Sustainable Design”

When applying sustainable design principles to historic projects, NPS requires that “all site and facility designs incorporate methods for protecting and preserving significant cultural resources over the long term.” The architectural style, landscape design, and construction materials of new developments should also “reflect the cultural heritage of the locality or region.” Additionally, whenever possible, cultural resources should be “interpreted to include lessons about the environmental exploitations or sustainable environmental successes of the past.”

Designers who work with historic structures often find that these projects are ideally suited to sustainable design parameters: they often involve urban redevelopment, are in close proximity to mass transit, have operable windows, and are filled with old-growth timber and locally quarried stone—elements that more often than not could never be replaced. That’s not to say that greening historic buildings is not without obstacles: designers may uncover toxic materials, such as lead-based paint and asbestos, which must be removed and properly disposed of; systems often must be brought up to code; close proximity to neighboring buildings may make daylighting strategies difficult to achieve; and older, ill-fitting windows, doors, and other exterior architectural details may impact energy-saving strategies.

Many well-known historic landmarks have successfully undergone green renovations, including the 4.2-million-square-foot Merchandise Mart in Chicago, which was awarded LEED certification in 2009 after a substantial retrofit, and New York City’s famous Empire State Building, which was awarded a LEED Gold certification in 2011 after significant green renovations were completed.

In Houston, designers at Gensler were able to achieve LEED Gold certification for their renovation of the Julia Ideson Building. Located in downtown Houston, the (circa 1926) Spanish Renaissance-style building is named after Houston’s first professional librarian and was designed by noted Boston architect Ralph Adams Cram, who worked with well-known local architects William Ward Watkin and Louis Glover. The project was unique in that it had numerous stakeholders that served as the client. The City of Houston owns and maintains the building. The Houston Public Library system operates the building, and the Julia Ideson Preservation Partnership, a Texas not-for-profit, was formed to raise funds necessary to build a new archival wing for the Houston Metropolitan Research Center (HMRC), located at the Ideson Building since 1976, and enhance and restore the building. To further complicate matters, the 66,000-square-foot building is a recorded Texas Historic Landmark, a City of Houston Protected Landmark, a Texas State Archaeological Landmark, and a site listed in the National Register of Historic Places.

All clients were on board to pursue a green design strategy. Additionally, the City of Houston required a target of LEED Silver certification for new construction, replacement facilities, and major renovations of city-owned buildings.

Figure 1-8 The restoration of the Julia Ideson Building's interiors included restoring and refinishing period architectural details such as elaborately painted ceilings and ornate columns. *Photograph courtesy of Gensler*



Phase one of the project included the addition of a new 21,500-square-foot archival wing for the HMRC. Also included were a new public reading garden and an open-air loggia. Phase two included the restoration of the building's exterior and interiors, replete with period architectural details, including elaborately painted ceilings and ornate columns (fig. 1-8). The original furniture and decorative features were restored and refinished throughout. A new exhibit hall was created and the grand public reading room on the second floor was restored. Other components included staff offices, a book conservation lab, and a reproduction/digitization lab for photos and maps. A graceful new iron fence and gates at the main entrance enclosed a beautifully re-landscaped front plaza.

Because the project is located in the heart of downtown Houston, its site is well-connected to alternative transportation, such as rail, bus, and

bicycle programs. To prevent heat island effect, the site's hardscape was paved with highly reflective materials and planted with new vegetation. Highly reflective roof materials were used on the addition and on the flat portions of the roof that were installed on the historic section.

In the design of the outdoor reading courtyard adjacent to the new wing and in the redesign of the north courtyard, water-efficient landscaping was used. Low-flow plumbing fixtures were used throughout the building to reduce water use by 45.7 percent as calculated from a baseline case.

HVAC was upgraded throughout the building to allow for MERV 13 or better filtration levels throughout public spaces. Finish selection in all spaces avoided volatile organic compounds. Further, special care was taken in archive spaces to provide dry conditions that prevent the growth of mold or other bacteria.

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Designers also upgraded aging, low-power incandescent lighting throughout and were able to achieve 22.9 percent improvement above baseline by using energy-efficient lighting, along with sophisticated dimming systems. Daylighting was provided to 98 percent of regularly occupied, use-appropriate interior spaces, with special care taken to control daylighting where it might affect archived materials. Solar protective film was installed on all exterior windows to help with UV protection, and the film also helped some of the existing (lower performing) windows by reducing solar heat gain.

Because the building is on the register of historic places, material selection for areas in the existing building had to be historically appropriate. The new wing of the building was informed by these classic materials, but it was updated to provide a clean and contemporary addition (fig. 1-9).

Figure 1-9 Materials for the new wing of the building, such as the flooring in the new exhibit hall, were informed by classic influences but were updated to provide a cleaner appearance. *Photograph courtesy of Gensler*



For example, in modern areas, designers chose linoleum and rubber natural products, while the flooring in more formal areas was returned to natural cork to match the original design (fig. 1-10). Over 12 percent of materials by cost were from recycled sources, and over 16 percent of materials were sourced and manufactured within 500 miles of the site. Low VOC paints and coatings were specified, as were composite woods and agrifiber with no added urea-formaldehyde. All carpeting complies with the Carpet & Rug Institute's Green Label Plus program.

Finally, 86 percent of solid waste during construction was diverted from landfills.

The restored building opened to the public in December 2011. The grandeur of the original restored spaces, the modern archival wing, and the intersection between the two make this project extraordinarily special.



Figure 1-10 For the grand public reading room, flooring was returned to natural cork to match the original design, low-VOC paints and coatings were specified, and designers also upgraded aging incandescent lighting. *Photograph courtesy of Gensler*

Overcoming the Obstacles to Sustainability

The exploration of any new and uncharted territory is always a little intimidating; the decision to embrace and actively champion sustainable design strategies can be especially fraught with daily challenges as designers attempt to win over as-yet-unconvinced clients. But perhaps some of the biggest obstacles that designers need to conquer come from within.

Ignorance

“What we don’t know can’t hurt us.” This mind-set is dangerous when it pertains to all matters relating to

sustainability. As humans continue to wreak havoc on the planet’s natural resources, whether through overconsumption or degradation, the call for education and information becomes increasingly urgent. Rain forests the size of New York City are being destroyed every day. The world’s oceans have warmed substantially during the past 40 years as a result of global warming. Human health is being jeopardized by the VOC emissions from common paints, coatings, and adhesives. An hour a week spent visiting the websites of organizations such as the Natural Resource Defense Council, the Worldwatch Institute, Conservation International, the World Resources Institute, or the Earth Policy Institute will deliver a much-needed wake-up call. The antidote to ignorance is knowledge with a caveat: when ignorance ends, negligence begins.

Apathy and Denial

Despite a growing public awareness of some of the most pressing global environmental concerns (the world is getting warmer, potable water is becoming scarce, species are being lost at an alarming rate, and resources are being depleted), some people steadfastly refuse to believe what documented science is reporting. Equally troubling are those who recognize that our planet is in trouble but refuse to take ownership of the problem, preferring instead to assign blame to someone else. Unfortunately, for every designer who is careful to specify only certified wood for his or her project, many others continue to use endangered tropical hardwoods for furniture and flooring in order to satisfy their self-centered personal gratification.

Inconvenience

Time is a precious commodity, and so sometimes it's easy to convince ourselves to take the quicker route: dumping all of our trash into one big can, instead of separating it for recycling; tossing discontinued carpet folders, instead of returning them or donating them to schools; sending damaged furnishings to the landfill, rather than to refinishers; discarding used inkjet and toner cartridges, rather than returning them to the manufacturer or bringing them to a recycler to be refilled. Yet each of these seemingly small actions can, when considered collectively, have significant ecological repercussions.

Lack of Education and Experience

Green design has begun to be taught in design schools, and most design professionals now have at least an awareness of sustainability. Those who are just beginning to learn about its specific principles can be intimidated by its vastness and complexity. Interior designers accurately note that some of the more technical energy issues and those involving the mechanical systems of buildings are beyond the scope of their knowledge base and are the purview of engineers. However, one of the basic tenets of successful green

design insists on the integration of all project participants from the beginning. It is essential, therefore, that designers acquire a fundamental understanding of the principles of sustainability and then a thorough knowledge of the science and technology necessary to provide their clients with valid services and advice. Also, the aspiring green designer must realize that this field requires constant continuing education, for there is always something new to learn. Designers should take advantage of every professional learning opportunity possible, as well as subscribe to one—or all—of the environmental news services (such as *Environmental Building News*, *Environmental News Network*, *Environmental Health News*, *E/The Environmental Magazine*, *Grist*, *Green Biz*, *Green Buzz*, or set up a “green buildings” Google or Yahoo alert) to get a big-picture view of current environmental events and happenings. Those who do so will reap market advantage benefits.

Studies show that the more experience team members have with green design and construction, and the more they understand the corresponding procedures and processes that are required, the more successful the project will be at meeting goals. At the very least, project participants must embrace a collaborative working environment. Authors Peng Wu and Sui Pheng Low report in the article “Project Management and Green Buildings: Lessons from the Rating Systems,” published in the April 2010 issue of the *Journal of Professional Issues in Engineering Education and Practice*, that collaboration is consistently cited as the number one reason for success in green projects.¹²

Reluctance to Change

Humans tend to prefer the comfort associated with familiarity, and so often we find it difficult to deviate from our established practices, especially if there's risk involved. It is safer to write specifications from the boilerplate models we've used for years than it is to experiment with newer ones. We are less anxious about specifying tried and true products and technologies versus testing those that are newer and more ecologically responsible. Reluctance to change is rampant among a number of professionals and in a variety of fields. For example, designers

have oftentimes seen their specifications disregarded by contractors who, through fear or ignorance, refuse to consider the greener process or product.

Special Interests

The mission of a trade association is to protect and promote the industry it represents. For the most part, trade associations can be useful resources for design practitioners looking for technical data. However, some trade associations' primary role is that of lobbyist, pressuring legislators to act in ways that are self-serving to the industry, yet perhaps contrary to ethical practice. The American Chemical Council, for example, lobbied members of Congress to ask the General Services Administration to stop using the LEED rating system in government buildings because of the proposed addition of two credits to disclose and limit toxic hazards from buildings. The effort failed (thus far) but the eventual credit additions to LEED v4 were altered in order to placate industry objections. Too often, regulations are written that are too lax or compliance measures are softened in order to boost the sales of trade association members. USGBC President and CEO Rick Fedrizzi, writing in the Huffington Post characterized them as "scoundrels ... who attempt to savage a mountain of scientific evidence in favor of obfuscation and innuendo ... [i]n their effort to protect a status quo that is good for them but not so much for the rest of us."¹³ For those individuals who are uneducated about the many facets and issues impacting a particular industry, it's often difficult to distinguish fact from fiction.

The much greater threat to the USGBC is to be on the wrong side of history, and for LEED to stand silent as more and more people make the link between the toxic chemicals in their LEED-rated home, office, school or delivery room, and the presence of those same chemicals in mother's milk and babies.

—Bill Walsh, executive director, Healthy Building Network newsletter, May 22, 2012

Lack of Standards, Guidelines, and Consensus

During many of the earliest years of the green building movement, design practitioners operated somewhat blindly, learning what worked and what didn't as they experimented with various strategies and practices. This problem subsided somewhat when the U.S. Green Building Council released LEED (Leadership in Energy and Environmental Design), its green building rating system, in 2000. However, LEED is a continuously evolving program and is not without some controversy. The USGBC was forced to delay the release of LEED v4 by a whole year in response to concerns that proposed changes to the previous version were too much too soon, and that some of the changes—especially in the Materials & Resources category—needed more refinement as approaches to material selection had changed significantly with each public comment draft. Experts are also wrestling with ways to best incorporate life cycle analysis (LCA) into materials selection. While there is widespread agreement that LCA is an essential tool in evaluating the ecology of a product, reaching consensus on how to frame the protocol has proved difficult. (See chapters 4 and 6 for more information on this topic.)

Aesthetics

Remember the days when "green design" meant "home-grown and dull"? Green designers everywhere are celebrating the fact that this obstacle to sustainability from years past has largely disappeared. It would be difficult to find more beautiful projects than the ones featured in chapters 8 and 9. Recognizing the growing interest in creating green interiors that delight and inspire, manufacturers have climbed aboard the sustainable product development train, providing designers with a plethora of stunning choices in furnishings and finishes.

Budget and Time Constraints

The argument that “green design costs too much and takes too long” has been made so often that it’s almost become a mantra. While it does contain kernels of truth (green design is a discipline to be learned), once it is mastered it becomes second nature, and with use it develops into an exciting and immensely valuable skill. Though intimidating at the beginning, the process of researching a product’s environmental properties, learning the fundamentals of energy-efficient technologies, and querying manufacturers about their environmental performance are truly rewarding intellectual pursuits.

Some clients also balk at the costs associated with certifying their buildings in accordance with the LEED Green Building Rating System. Only 48 percent of the 700 executives surveyed in Turner Construction Company’s 2012 Green Building Market Barometer said their companies were likely to seek LEED certification when constructing a green building. This number was down from 53 percent in 2010 and 61 percent in 2008. The reasons cited by these executives were the cost of the certification process (82 percent), staff time required (79 percent), time required for the process (75 percent), and the overall perceived difficulty of the process (74 percent).¹⁴

In the end, though, whether these executives seek certification or not, they are increasingly designing and constructing according to recognized green building practices. Fifty-six percent of executives in the Turner survey said that their companies were extremely or very committed to following environmentally sustainable practices in their operations, while an additional 34 percent said they were somewhat committed. These companies also are increasingly knowledgeable about the means and methods of designing and constructing green buildings, indicated by the fact that 52 percent of executives who are not likely to seek LEED certification would prefer to use their own company’s green building standards.¹⁵

Functional Limitations

Some materials perform beautifully but are so dangerous they should never be used. One of the best-known examples is asbestos. Another is PVC, which is especially problematic in the interior furnishings field because designers, accustomed to specifying vinyl flooring, furnishings, and window treatments, struggle to find practicable alternatives. It can be done, however, as many progressive practitioners have succeeded in installing PVC-free products without compromising either quality or performance. (The analysis of life cycle assessments in chapter 4 provides background information on methods for investigating alternative product choices.)

Fear of Litigation

A handful of lawsuits have arisen that cite a green building’s failure to perform according to expectations. As a result, some designers fear that they may be exposed to potential litigation as a result of claims from clients who seek to tie contractual assurances to sustainable design benefits and building performance. However, contractual provisions, disclaimers, and other exculpatory language can be crafted that preclude the establishment of a warranty of service or results, particularly guarantees to meet subjective compliance levels. Designers should work with their own legal counsel to write appropriate contract language or ask their professional design organizations for model contract forms or language that would prohibit these provisions.

Finally, designers should hold candid conversations with clients throughout the duration of the project to avoid unrealistic expectations. All members of the project team need to continually revisit previously stated or defined sustainable design goals in order to confirm progress toward achieving them.

The Dollars and Sense of Green Building Decisions

Billions of dollars are annually invested in buildings with high-performance lighting, heating/air conditioning and windows, passive-energy design features, eco-friendly materials and furnishings, and more effective interior layouts. Highly touted success stories, whether about the retrofitted Empire State Building or the growing number of LEED Platinum projects, have helped make the case. Government mandates in high-performance buildings have also spurred investment and innovation in the steady rollout of green schools, city halls, courthouses, recreational facilities, and other public buildings.

For each green project though, a sound business case must still be made. For example, higher capital costs for energy- and water-saving designs demand financial comparisons with potential long-term costs savings. Moreover, investments that lead to greater reductions in use of water, greenhouse gas, and raw materials, but without a solid financial justification, may require evidence of the total value of a project to go forward. Total value can be determined from impacts on owners, occupants, and the general public, in ways that account for triple bottom line (financial, environmental, societal) outcomes. Triple bottom line values of green design impacts can be readily computed using evidence in widely accepted economic literature. However, estimating these values is complicated because the results are influenced by a plethora of uncertainties in long-term system performance, capital costs, forecasts of utility rates, and overall value, to name a few. Such uncertainties can impact key design decisions, and best practice dictates that they be accounted for in business case evaluations.

One architecture firm, HDR, has effectively applied economic analyses to help determine the total value of project designs in a number of significant green projects. The integration of economics has helped to establish methods to determine:

- ◆ Financial Return on Investment (FROI), based on the life cycle cost savings in efficiency compared to a capital investment; and,
- ◆ Sustainable Return on Investment (SROI), which computes dollar-based measures of the total value reductions in energy, water, and waste, and enhanced productivity for building occupants (fig. 1-11).

Economic analysis tools can apply in different ways depending on the green design decision context.

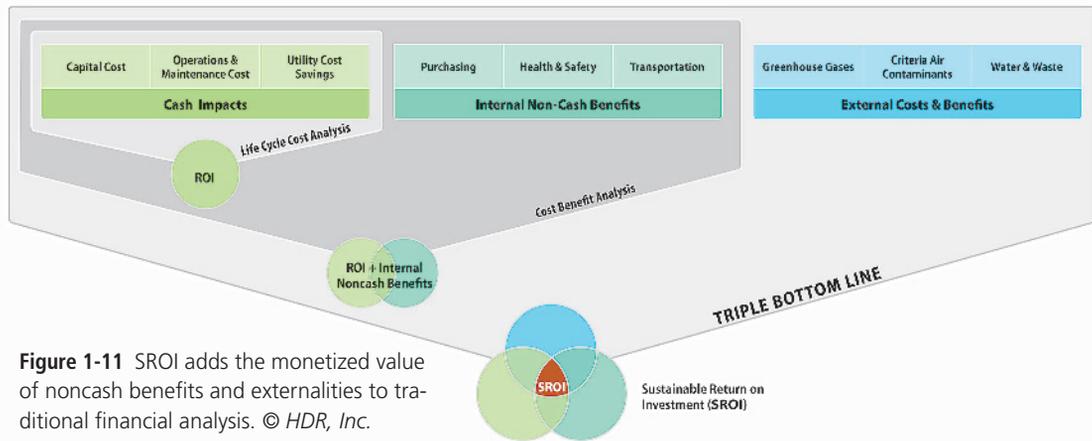
Sustainability-Adjusted Life Cycle Cost Analysis (SLCCA)

This approach accounts for not only the financial outcomes of investments but also the full environmental and social impact of water, air, material use and waste management, human health and productivity, and wider community impacts. This approach produces measures that help determine which investments are most cost-effective from a sustainability perspective and lead to monetary-based benchmarks or “footprints” for green design decisions.

Sustainable Return on Investment (SROI)

SROI is applied when making decisions among project alternatives, especially a green design improvement over conventional designs. SROI builds from SLCCA results and compares one

(continued)



project against another. The approach provides decision makers with credible measures of financial returns and presents this alongside total triple bottom line returns. SROI is often applied on projects that first meet other criteria of feasibility, affordability, and acceptability. SROI relies on evidence and expert opinion to determine the economic, social, and environmental value of design investments. Monetary values are assessed across probabilistic spectrums to quantify for this uncertainty.

An application for SROI for corporate clients accounts for additional performance measures that reflect the short- and long-term investment risk to corporate market value. For example, FROI and SROI would account for the impact of green design on reduced exposure to long-term resource constraints, site-specific environmental risks, market resiliency, stakeholder concerns, employee retention, and brand valuation. By assessing these risks and monetizing impacts with corporate clients, a broader perspective on the sustainable business case can be established.

Value-Based Rating Systems

Another application of SROI is in the use and development of rating systems, such as LEED. These rating systems apply subjective weights to performance criteria to establish points for implementing green design. SLCCA and SROI provide an objective perspective on how these points align with monetary value and can help decision makers better assess the trade-offs in design alternatives against their own sustainability goals.

HDR has found that best practices in economic analysis dictate that a transparent, evidence-based process is critical to generating credible measures of the potential value of design options. The process should follow a transparent methodology that obtains data, validates alternatives, assigns risk and probability, and communicates a rationale for decisions. A key feature in this process is facilitated workshops that are designed to reach consensus on design options, elements of triple bottom line value creation, and associated uncertainties. With this input, sophisticated modeling is undertaken to account for uncertainty by quantifying impacts with probabilities and forecasting all possible

future outcomes with Monte Carlo simulation. Through these workshops and uncertainty modeling, the process significantly improves information for identifying which options are best.

Accounting for the total value of projects can ensure greater rigor in the decision-making process and creates a defensible position for green design investments. Also, by involving all stakeholders in the process, each team member is an integral part

of the process, resulting in improved collaboration, increased transparency, and a greater level of consensus achieved earlier in the project. Above all, the SLCCA and SROI results provide the necessary evidence for clients to justify decisions in more responsible investments that lead to long-term financial, societal, and environmental value.

Source: HDR, Inc. Reprinted with permission, www.hdrinc.com.

Study Sustainable Design in School

The Council for Interior Design Accreditation (CIDA), founded in 1970, is an international non-profit organization that accredits postsecondary interior design education programs in the United States and Canada. The voluntary accreditation process uses internationally recognized educational standards to review programs. These standards undergo extensive scrutiny and constant monitoring to ensure that interior design education—and the graduates it produces—is fully prepared for what lies ahead in the profession. Since 2006, these standards have included specific sustainable design criteria, reflecting the increasing impact of green design on professional practice, both today and in the future.

One standard in the “Critical Thinking, Professional Values, and Processes” section of CIDA’s 2014 Professional Standards addresses the subject of “Global Perspective for Design” and calls for entry-level interior designers to have a global view and weigh design decisions within the parameters of ecological, socioeconomic, and cultural contexts. Student work is expected to demonstrate an understanding of the concepts,

principles, and theories of sustainability as they pertain to building methods, materials, systems, and occupants; and students themselves should understand the implications of conducting the practice of design within a world context and how design needs may vary in cultural and social groups with different economic means.

Standard 12, which can be found in the section titled “Interior Design: Core Design and Technical Knowledge,” addresses “Environmental Systems.” This standard examines how entry-level interior designers use the principles of lighting, acoustics, thermal comfort, and indoor air quality to enhance the health, safety, welfare, and performance of building occupants. Standard 14, “Regulations,” examines how entry-level interior designers should be able to use laws, codes, standards, and guidelines that impact the design of interior spaces. Students are expected to have an awareness of sustainability guidelines, examples of which could include LEED, CHPS, Energy Policy Act 2005, and/or California 01350.

Source: Council for Interior Design Accreditation (CIDA).

The Integrated Profession

So...you've made the personal decision to pursue the path of green design. In a perfect world, getting the rest of your firm's colleagues on board would be an easy task. However, communicating the personal convictions that led you to this decision might easily sway one or two others, but most likely not all. What's needed is a commitment from the firm's management. Small firms might hesitate to take a chance on pursuing green design, reluctant to commit the time and financial resources necessary to bring staff up to

speed on the topic. Larger firms, though better able to devote the resources necessary to pursue green design opportunities, might be hindered by top management's reluctance or bureaucracy to make inroads into this field. Ken Wilson founded his architectural and interiors firm, Envision Design, along with his partner, Diana Horvat, to include environmental accountability as part of its core mission. And while Envision Design is now part of the Perkins+Will architectural practice, Ken remains a staunch proponent for a number of insights into how best to green a design firm, which he shares below.

Integrating Sustainability into Your Design Practice

By Kendall P. Wilson

The sustainable design movement has arguably had a greater effect on the design community than any other trend in our lifetime. It has caused us to question the effects of our work on both humanity and our natural environment. Evidence of our negative impact on the ecosystem is indisputable, and slowly the world is recognizing that we have the ability to change our course. We are learning that there is a better way to live and do business—and there is a better way to design.

Design firms are making a shift toward integrated sustainable approaches for numerous reasons—many because they are looking to differentiate their services or are trying to keep pace with current trends, and some because they know it is the right thing to do. Enlightened clients are asking for green design, and many are even seeking LEED certification—especially institutional clients. Design firms need to be able to respond if they are going to keep pace with the times.

In order to successfully integrate sustainable thinking into a design practice, change must start with a commitment from the top people in an organization. Sustainability should never be viewed as an

add-on service, but rather should be integrated into the firm's overall design philosophy in order to be successful. Consider the idea of designing some projects that are handicapped-accessible and some projects that are not—it just doesn't make sense. Neither does designing some projects that are eco-friendly and some that are harmful to people and our ecosystem. As designers of the built environment, we have an obligation to design for the health and well-being of people; this notion needs to extend to our effect on the natural environment as well.

Although young designers seem to exude universal enthusiasm for sustainable design, they cannot be relied upon to lead the change toward sustainable practices within a firm. Successful integration of sustainable design must start with an honest commitment from the firm's leadership. Firm leaders, in turn, must understand and appreciate the benefits in order to promote a real shift in thinking.

In the design profession, learning comes from doing. One of the best ways to promote a change toward sustainable design within your firm is to find a client who wants to build a green project. This isn't as hard as it sounds—and the best opportunities may come from a repeat client. A repeat client already has your trust and knows you have their best interests in mind. I ask clients, "If I could show you a way to design a space that is filled with natural light, doesn't off-gas harmful chemicals, provides

TEN WAYS TO INTEGRATE SUSTAINABLE PRACTICES INTO YOUR DESIGN FIRM

1. Don't consider sustainable design as an add-on service. Incorporate equal- or low-cost sustainable design strategies in all projects. Sell other sustainable design strategies based on value or a return on investment over time.
2. Promote green professional development through membership and participation in organizations that promote green building, such as the American Institute of Architects (AIA), the International Interior Design Association (IIDA), the American Society of Interior Designers (ASID), and the USGBC. Encourage staff participation in events and on committees.
3. Commit to sustainable design practices from the top down. Agree that the principals should be the first to achieve LEED accreditation, thereby setting an example for the rest of the staff.
4. Promote LEED accreditation to the staff by paying for the LEED exam, and reward staff members who achieve LEED accreditation by sending them to green building conferences.
5. Seek out a green project or convince an established client to incorporate green strategies into a new project.
6. Commit to additional time researching green products and designate a file cabinet or shelf to green materials in your library.
7. Invite manufacturers of green products to give lunchtime presentations. Encourage staff to challenge questionable environmental claims.
8. Select consultants that have demonstrated a commitment to sustainable design and integrate them into the design process early.
9. Subscribe to magazines or newsletters that focus on green design.
10. Think about how you run your own life and what you can do personally to change bad habits and be more environmentally friendly. You may not live in an area that has easy access to public transportation, but you could consider buying a fuel-efficient hybrid when the lease runs out on your Chevy Tahoe.

improved indoor air quality, reduces energy costs, aids in the recruitment of new staff, and increases your productivity, would you be willing to consider it?" The answer should be a no-brainer—and I didn't even mention the word sustainability.

Firm personnel responsible for marketing need to understand sustainable design and be able to explain it to their clients. Bringing in the recently LEED-accredited intern to do the job will not instill much confidence. Clients want to know that firm principals think sustainability is a good idea and that they are committed to delivering a successfully integrated design.

As with the learning curve required in taking on any unfamiliar project type, additional time and effort needs to be accounted for in getting up to speed on green design. Think of it as an investment in a whole new area of market differentiation for your firm. Whereas individual efforts to learn green practices should be recognized and applauded, design firms seeking substantive change need to make a firm-wide commitment. If not, the self-taught brain trust of environmental expertise may end up walking out the door in favor of a firm with an honest commitment. Making a financial commitment to office-wide professional

development programs about sustainable design will be necessary.

Project managers and specification writers must learn to change old procedures and processes with the understanding that it is principal-driven. Attendance at one of the many green design conferences now offered is a good first step, especially the Greenbuild conference held annually. Regional USGBC chapters are also a great source for events and learning opportunities that are close to home.

Promoting LEED accreditation is also an excellent way to get your staff up to speed. Passing the LEED exam requires a basic understanding of green building practices, as well as knowledge about the LEED rating system. Your staff will need a copy of the appropriate LEED Reference Guide as a study tool, and attendance at a USGBC-sponsored LEED seminar will be beneficial. Consider covering the cost of the LEED exam as both a firm benefit and a way to encourage professional development. Creating an incentive is also helpful. One suggestion is to send staff to Greenbuild or some other green building conference as a reward for achieving LEED accreditation.

Although it is tempting to give the next sustainable project to the same group that just finished your first one, try very hard to pass these projects around to other staff members. It is important for staff to understand that everyone needs experience in this area and that no one can avoid changing bad habits out of convenience. It is especially important to rotate projects seeking LEED certification. More-experienced staff can certainly coach the novice staff and help them with lessons learned on previous projects. Whether you are LEED accredited or feel that you are very familiar with the LEED rating system, there is no substitute for actually going through the process. Once you have, you will never think the same way about another project. The goal is to have all your staff thinking this way.

Firm leadership needs to work at keeping sustainable design in the forefront of the firm's mindset and culture in order to maintain momentum and prevent slipping back into the old ways of thinking. New products need to be evaluated based on their environmental impact, as well as their functionality and cost. Regular in-house professional development meetings are a good way to share knowledge. These meetings can be focused on a particular project or can be a general review of new green products coming on the market. Staff members should be encouraged to ask tough questions of manufacturers and filter out any "greenwash."

Design can be considered the combination of beauty and functionality, and the measure of functionality can be defined as how well programmatic requirements are met. In addition to operational efficiency, durability, image, and value, programmatic requirements also need to include consideration for environmental impact and human well-being. For a project to be considered good design, it still needs to be beautiful. The saying "Easy things have the greatest chance of being mediocre, and hard things have the greatest chance of excellence" is a way of describing that the greater the challenge, the better the results.

Ultimately, practicing sustainable design is about leadership. It is about taking the high road and doing what is right for the community and the natural environment instead of acquiescing in the old way of designing. It is about educating clients to alternative strategies that provide return on investment for their companies and organizations. And it is about designing in ways that improve human well-being. Isn't that the way we all want to run our firms?

Ken Wilson was a founding principal of Envision Design, an award-winning multidisciplinary design firm with a focus on sustainable design. He is currently a principal in the Washington, DC office of Perkins+Will.

Nearly every major design firm in the United States has developed some degree of green capabilities. Transforming firms that think conventionally into big-picture thinkers, however, requires that “change has to take place within a firm both from the bottom up and from the top down,” say authors Nadav Malin and Jim Newman in the May 2004 issue of *Environmental Building News*.¹⁶ As a result, firms are employing a range of actions (some project-specific, others more general in nature) to gain green design capabilities (table 1-1). All, however, are intended to accomplish one or more of four things to promote the implementation of green design:

- Inspire and motivate designers
- Disseminate the information designers must know
- Provide the skills designers must have
- Change processes to improve support for integrated design

What the action plans indicate, notes the article’s authors, is that there’s no single right way to green a design firm: “Different actions are appropriate for different settings, and at different stages in each company’s evolution.”

Making Integrated Design Work

It has been estimated by the EPA that 80 percent of all buildings that will be standing worldwide 30 years from now have not yet been built. Whether or not this projection is true, the implications are clear: buildings of all types need to begin to address resource use and depletion, human health implications, and global consequences. Home builders, home owners, and the developers, managers, and tenants of commercial buildings will turn to the design professional for guidance and expertise. More and more architects, engineers, and interior designers are realizing the business advantages of marketing green design strategies.

Traditionally, projects have operated on a linear model, with the architectural/engineering and interior design work occurring sequentially rather than as a fully integrated team approach in which all those involved understand, at least in concept, each other’s contributions to the design and construction process. Mechanical engineers will continue to retain the primary responsibility for heating and cooling, for example, but if interior designers are going to retain their relevance as green buildings proliferate, they are going to have to become familiar with the impact of their decisions upon the “greenness” of the project, and vice versa. To do otherwise results in a lack of coordination, duplication of effort, and cost overruns and jeopardizes the environmental integrity of project.

Just how critical is the concept of an integrated design team to the sustainable design process? According to veteran green building consultant Bill Reed, it is absolutely essential because the age of specialization—or, as he describes it, the age of *disconnected* specialization—is dead.

“The industrial age has been an era in which humankind has generated so much information that no one person can hold it all, even in a specific area of expertise,” says Reed, principal of the Integrative Design Collaborative and the regenerative planning firm Regeneration. “The design process has evolved to one that is dependent upon interrelationships that has led to a different way of designing buildings and the spaces within, seeing them as systems and subsystems embedded in larger systems. Hence the term: Integrated Design.”

Gone are the days of master builders, whose intimate knowledge of local materials, workforce skills, economy, culture, and traditions, as well as conditions such as microclimates and soil conditions, enabled them to produce buildings and communities that were truly integrated with their environment, Reed explains. Today, the building process is more complex and dynamic, requiring specialists to design and implement diverse issues ranging from zoning policy to storm water management, building product design, energy efficiency, construction methods, ergonomics, and so on.

TABLE 1-1: Survey Results: Actions for Greening a Design Firm

Action	Firms for Which a Focus (%)	Self-Reported Value ²	Cost in Time (hrs/month ³)	Cost in Dollars (\$/year ³)	Comments
GREEN TEAM					
Organize a green team	65	very high	35	6,238	Very common, especially for firms with many offices, as a way of sharing resources and approaches.
Publish in-house newsletter	35	high	4	–	Common at largest firms, but too time-consuming for others.
Offer internal consulting to projects	65	moderate	40	–	Most useful when an element of training is explicitly included.
TRAINING AND EDUCATION					
Provide regular education sessions in the office	88	very high	32	7,475	Often provided at no cost by consultants who are working with the firm on a project.
Host regular presentations by green vendors	59	moderate	32	–	Vendors typically provide lunch, and those that bring the best food get the best attendance!
Support and encourage training	59	very high	30	6,190	Everyone recognizes that training is essential, but it's expensive. The best support is in firms with strong buy-in from management.
Support conference attendance	82	very high	12	5,257	High value for promoting motivation and knowledge, but expensive. Clever green teams are investing in their future by sending their bosses to conferences.
Pursue research funded by outside entities	29	very high	30	–	A huge opportunity to gain knowledge and skills at little cost (even at a profit!). Funding sources vary by state and region.
INFORMATION MANAGEMENT					
Hire a green-focused librarian	47	moderate	–	–	Seems to happen more by chance and personal inclination than by design.
Maintain a library of in-house research	29	very high	19	–	---
Make a firm-wide effort to green in-house specs	59	high	20	–	Nearly all firms with a strong in-house specification system are working on greening that spec. Others are relying on outside spec-writers or on ARCOM's greening efforts with MasterSpec™.
TOOLS FOR GREENING					
Provide information and modeling tools	47	moderate	–	2,200	Providing tools company-wide helps develop a shared set of language, concepts, and metrics.
Use information and modeling tools widely	29	very high	–	–	Getting busy designers to use new tools is a challenge.
EXPERTISE FROM THE OUTSIDE					
Give green champion input on new hires	24	high	3	–	Green team members rarely have the opportunity to influence hiring on the basis of their green interests.
Cultivate relationships with capable consultants	47	very high	3	–	Consultants' attitudes and abilities can make or break a project. Those who are strong in sustainable design can help bring a less-advanced in-house team along as well.
GREEN PROJECT GOALS					
Use LEED as a goal-setting tool with clients	71	high	2	–	More and more firms are introducing LEED as a goal-setting tool, even when clients don't ask for it.
Conduct an internal LEED review of all projects	35	high	–	–	LEED self-assessments can be overly optimistic.
Start with a green intent for all projects	35	very high	10	–	A green intent that diverges from LEED can be useful to focus a team.

Notes: 1. Indicates percent of firms for which this is a focused effort, not just something that happens casually (based on data set of 20).

2. Self-reported value among firms that focus on this action.

3. Amount spent in time (labor hours per month) and direct expense (dollars per year) by firms that focus on this action, based on data from those firms that were able to provide an estimate, normalized to a hypothetical 100-person firm.

“We have moved from a time of common sense integration to a century of it’s-not-my-job disintegration,” notes Reed. “How do we shift to a process that will result in better integrative and sustainable design? To realize any movement toward a sustainable condition requires change—change from the conventional way of thinking and doing things.”

In a conventional design process, Reed notes that an interior designer creates a space to meet typical functional and aesthetic requirements. The interior designer then sends the design to the mechanical and electrical engineer to make it comfortable and provide adequate light. Or another common scenario, he says, is that the designed space will be sent to the interior designers, who are expected to conform to what the architects/mechanical, electrical, plumbing engineers (MEPs) already have in place.

What Reed champions instead is a systems design process—an integrative design process—where engineers, interior designer, and client program and design spaces in a joint manner from the very beginning (table 1-2). Instead of simply adding more-efficient lighting and comfort equipment to the space or building (which alone can be costly), the engineer may alert the designer that a more appropriate functional layout of the offices or activities in the space relative to daylighting opportunities may save more energy than any level of equipment efficiency. Integrated decisions usually decrease the cost of the building while increasing its environmental performance.

Change is hard for humans. Yet it is the process of changing that is actually the most exciting aspect of reaching toward sustainability. When we build in a sustainable manner it is the change of perspective, the change of heart, and a fundamental reawakening of an awareness of our relationships to the systems of life that makes all this worthwhile.

—Bill Reed, principal of the Integrative Design Collaborative and the regenerative planning firm Regensis

TABLE 1-2: IDP Comparison with Conventional Process

Integrated Design Process	vs.	Conventional Design Process
Inclusive from the outset	vs.	Involves team members only when essential
Front-loaded: time and energy invested early	vs.	Less time, energy, and collaboration exhibited in early stages
Decisions influenced by broad teams	vs.	More decisions made by fewer people
Iterative process	vs.	Linear process
Whole system thinking	vs.	Systems often considered in isolation
Allows for full optimization	vs.	Limited to constrained optimization
Seeks synergies	vs.	Diminished opportunity for synergies
Life cycle costing	vs.	Emphasis on up-front costs
Process continues through postoccupancy	vs.	Typically finished when construction is complete

Roadmap for the Integrated Design Process, BC Green Building Roundtable. © 2007

“Sustainable design requires a mental model that is able to look at systems in a more complex way,” Reed says:

A mental model that is open and willing to drive the successful integration of green design. Instead of looking at just the physical elements of the building and the furniture, furnishings, and equipment, the invisible connections between the elements need to be understood. These invisible connections and patterns, for example, may be manifest in the downstream impact of toxins in building materials, the multiple efficiency and cost relationships between the many variables in an HVAC system, daylighting and the building envelope, or the impact on social systems due to logging practices or other raw material extraction. This level of analysis requires a rigorous level of enthusiastic and early engagement from the participants and an understanding of tools used to make these evaluations. Since no one has all of this knowledge themselves, the role of the team takes on great importance; the role of questioning assumptions takes on an equal importance in order to elicit answers beyond the conventional.

Above all, he cautions, a systems approach requires a collaborative approach. “Yet fostering and working within a collaborative framework is sometimes difficult because we have been trained to be ‘experts.’ The client expects it, and design team members feel they need to exhibit it.”

What Reed advocates is a move from being “experts” to being “co-learners,” pointing out that the most successful green projects (i.e., projects that achieved the high environmental goals they originally set out to achieve, within budget) have done so not because of adding technology and products to the building, but because the design team members had the willingness to focus on the environmental issues—the invisible and critical connections—as essential to the success of the design. “They had the willingness to ask many questions about the potential beneficial relationships between all the systems in the building, interiors, site, and region and explore the many different ways to reach toward better ecological integration. The environmental concerns were not secondary, nor were they dominant—they were just an integral part of the design.”

Clients looking to achieve cost-effective sustainable building solutions need to select design teams or green building experts with expertise in integrative design in order to optimize systems in a cost effective manner. “Even more important than green expertise,” Reed argues, “is the willingness or attitude of the design team to learn new ways of looking at systems and the willingness to change their design process.”

Reed offers these essential elements of an effective integrative design process.

- Client (main decision maker) involvement in the design decision process
- Selection of the right design team (attitude is critical—i.e., teachable)
- Alignment of expectations and purposes between the stakeholders and design team
- Setting the targeted environmental goals (if you can’t measure it, you can’t manage it)
- Identify champions or a core team (to hold these goals through the project)
- Optimization of the design of systems (using evaluation tools and an iterative process in predesign and schematic design—after this it can get expensive to add green technologies to a project that wasn’t designed with these in mind from the beginning)
- Follow-through in the construction process
- Commissioning of the project (making sure it performs the way it was designed to perform—just because it’s built doesn’t mean it works)
- Maintenance and monitoring (entropy happens—feedback is essential to maintain performance)

Authors Allyson Wendt and Nadav Malin, writing in the article, “Integrated Design Meets the Real World,” published in the May 2010 issue of *Environmental Building News*, also emphasize that in an integrated design process, all project team members need to work in a collaborative relationship from conception to completion. What they found from interviews with many design professionals, is that, by and large, “humans—not technology—are the drivers of the integrated design process.”¹⁷ But they also concede that just as each project is different, so, too, are the exact elements of the integrated process needed to achieve project goals. Wendt and Malin offer some no-nonsense tips and tricks for working around obstacles (table 1-3).

LEED v4 now offers integrative process credits in all building design and construction rating systems. It is likely that even though it only commands two points, teams will choose to pursue them, because they encourage documentation of a process that should be happening anyway, according to Scot Horst in his article, “Lessons for the LEED v4 Beta Test,” published in September 2013 in *Environmental Design + Construction* magazine. “What they learned, however, is that the process wasn’t necessarily happening as well as they thought, and the new credit introduced some very helpful steps.”¹⁸

TABLE 1-3: Integrated Design Tips

Integrated Design Element	Best Practices	What Can Go Wrong
Charrettes	Plan on several (five or more), depending on the complexity of the project.	Lack of preparation, weak communication between gatherings, poor facilitation.
Convening the team	Find the right balance of inclusiveness and effectiveness for each part of the process.	Leaving out key players, such as code officials or key members of the client group, who have both expertise to share and power to affect outcomes.
Brainstorming	Make everyone feel safe in a mix of building professionals and occupant or stakeholder groups (“no bad ideas”).	Lost time pursuing ideas that don’t make sense.
Project management	Facilitate communication among team members, check the design against stated goals, and make sure the process is on track to meet deadlines.	Lack of a clear champion for sustainability goals, losing sight of the big pictures, communication failures.
Collaboration software	Keep it simple.	Systems too complicated to learn easily.
Goal setting	Set goals. Communicate them clearly, and check in with them regularly.	Setting and forgetting, or setting goals that are vague and difficult to test during design and construction, or changing them arbitrarily.
Performance analysis	Test design iterations early and often.	Models not constructed properly for analysis, simplified exports that lack relevant data, resistance to repeated testing.
Communication	Communicate through several channels, both at meetings and between them.	Sideline communication that leaves people out of the loop, not having the right people at the right meetings.
Virtual meetings	Pick a system that works for your team, whether it’s screen sharing and a conference call or high-definition video conferencing.	Not giving the meeting your full attention, software or Internet failures, team members who are unfamiliar with chosen meeting method.

Source: Allyson Wendt and Nadav Malin, “Integrated Design Meets the Real World,” *Environmental Building News*, May 2010

For example, Horst explains, every LEED project is supposed to be guided by two documents that define project goals and the strategies for meeting those goals: the Owner’s Project Requirements (OPR) and Basis of Design (BOD). “These documents are required as part of the basic commissioning process, which has long been mandatory in LEED,” he says.

“Basic commissioning doesn’t begin until the design documents are 50 percent completed, however—and project teams, being deadline driven, all too often fail to produce the OPR and BOD until that time. The integrative process credit defines steps that must happen before design gets underway to inform the content of those documents.”¹⁹

What's LEED Got to Do with It?

The Integrative Process section of LEED for Commercial Interiors offers 1 credit and up to 2 points.

Credit Integrative Process. Support project outcomes through early analysis of interrelationships among the systems. This credit has two compliance options. (Up to 2 points)

- ◆ Option 1: *Site Selection and Energy-Related Systems*: Starting in predesign and continuing through the design phases, identify opportunities to achieve synergies across disciplines and building systems. Conduct analyses in site selection and energy-related systems. Document how the analysis informed design decisions. (1 point)
- ◆ Option 2: *Water-Related Systems*: Comply with Site Selection and Energy-Related Systems requirements AND perform a preliminary water budget analysis before completion of schematic design that explores methods for reducing potable water loads. (1 point)

Adapted from the LEED Green Building Rating System for Commercial Interiors, version 4. Visit www.usgbc.org to access the complete rating system.

The Design Charrette

The process for beginning a design project can be somewhat standardized, proceeding rather predictably from programming and data collection to the design and construction phases. What's missing from this traditional process is the opportunity for true creativity and innovation on a level that can yield extraordinary results.

In the green design arena, standard practices may preclude the types of relationships and synergies nec-

"The term 'charrette' is adopted from the storied practice of Ecole des Beaux Arts architectural students in nineteenth century Paris who reputedly could be seen still drawing their projects until the last minute as they were carried on the 'cart' or en charrette on the way to the design jury."

—AIA Committee on the Environment (COTE)

essary for incorporating sustainable thinking. As Bill Reed states in his interview, incorporating sustainable thinking on a project is not difficult. The difficulty is in accepting that older, conventional practices need to be reconsidered. One of the surest ways to step away from traditional thinking and achieve green design excellence is to begin the process with a charrette—an intensive planning session where the design team collaborates on a vision for the project.

A good way to describe a charrette is as a fast-paced work session for group brainstorming. Its value is twofold. First is a design charrette's ability to compress the amount of time needed to arrive at consensus by bringing together disjointed information. It reduces redundancies and the probability of unforeseen results, increasing the likelihood of the project's success. The role of the team is critical, as is listening to each team member to establish trust and to more easily reach agreement. The charrette's success is based on the ability of the team to work together toward goals determined by all participants. Additionally, the design charrette can ensure that more time and resources are devoted to the front end of the project when the impact of critical decisions is high and the cost of implementing them is low. It is also intended that fewer changes will be necessary as the project progresses because stakeholders have bought into the design earlier.

The benefits of holding a charrette early in the design process are many and diverse, as is explained in *A Handbook for Planning and Conducting Charrettes for High-Performance Projects*, produced by the National Renewable Energy Laboratory.²⁰

- Establish a multidisciplinary team that can set and agree on common project goals.
- Develop early consensus on project design priorities.
- Generate early expectations or quantifiable metrics for final energy and environmental outcomes.
- Provide early understanding of the potential impact of various design strategies.
- Initiate an integrated design process to reduce project costs and schedules and to obtain the best energy and environmental performance.
- Identify project strategies to explore with their associated costs, time considerations, and needed expertise to eliminate costly “surprises” later in the design and construction processes.
- Identify partners, available grants, and potential collaborations that can provide expertise, funding, credibility, and support to the project.
- Set a project schedule and budget that all team members feel comfortable following.

The design charrette can be used for any type of project; when the focus is on sustainability, the term eco-charrette may be applied. All disciplines should be represented, although they do not necessarily have to be on the team that will eventually design the project. Depending on the type of project, charrette participants may include the client, broker, community representative, building owner, architect, facility manager, contractor, interior designer, MEP engineers, lighting consultant, product suppliers, code officials, commissioning agent, and landscape architect—in other words, anyone who may contribute unique and valuable knowledge to inform the outcome of the exercise.

Although it is essential to involve as many disciplines as possible, it is equally important to make sure that the participants have the necessary knowledge and experience to contribute positively to the outcome. Charrettes can be intellectually demanding and physically exhausting exercises under the best of circumstances; the importance of selecting the right team cannot be overemphasized.

The purpose of the charrette will also determine the type and length of charrette, as well as the exper-

tise of the participants. As illustrated in Table 1-4 and Figure 1-12, the purpose will affect the event’s format, along with all other decisions made during the event planning process. A good understanding of the intended outcome and participant characteristics will improve the likelihood of a successful event.²¹

David Nelson, an architect and lighting designer and a participant in many charrettes, differentiates between the design charrette, which is a one-day intensive exercise to discuss broad issues and concepts, and a longer building design charrette, which is more detailed and in-depth. The first exercise may identify opportunities for a client that will be further fleshed out during the subsequent meeting. The value of this two-stage process is to allow ideas to be digested before any substantial investment is made in design time or fees.

Charrettes may evolve in different ways, but Nelson provides some common strategies that have proven successful.

- Convene team-building opportunities, prior to the actual meeting, to establish relationships and understandings, perhaps via e-mail “conferences” or at a social gathering the evening before.
- Begin the charrette with a show-and-tell introducing some of the sustainable concepts that may be considered.
- Form focus groups of individuals with complementary skills to develop goals and strategies.
- Encourage cross-pollination and movement between the groups.
- Reconvene to share ideas and develop integrated strategies.

Nelson advises to be wary of some common pitfalls such as forming quick opinions and cherry-picking the easy and obvious solutions (although they may be what the client wants to hear). Ultimately, better results will be obtained by pushing the concepts further. Buildings or interior spaces will not be completely designed in the course of one charrette, but a road map may be created that will guide the project through to completion.²²

TABLE 1-4: Summary of Charrettes for High-Performance Projects			
Event Type	Descriptions	Length	Purpose
Workshop	Large group presentations and discussions	½ day	Introduce participants with limited time to high-performance design concepts. Introduce participants to the charrette process. Educate participants about individual high-performance design strategies. Engage participants in “practice” charrette exercises. Conduct a low-cost, high-performance event.
Mini charrettes	Workshop plus interactive exercises	1 to 1½ days	Provide basic training in high-performance design topics (conduct in a workshop format). Conduct charrette activities within breakout groups for a specific project. Identify high-performance design strategies appropriate to consider for a specific project
Full-scale charrettes	Workshop plus intensive breakout group discussions	2 or more days	Discuss the high-performance design strategies that were identified while conducting the predesign energy analysis as being appropriate for the specific project (conduct in a workshop format). Select specific strategies to incorporate into the project. Develop sketches and drawings to be incorporated into the project design.

Source: *A Handbook for Planning and Conducting Charrettes for High-Performance Projects*. National Renewable Energy Laboratory, August 2003

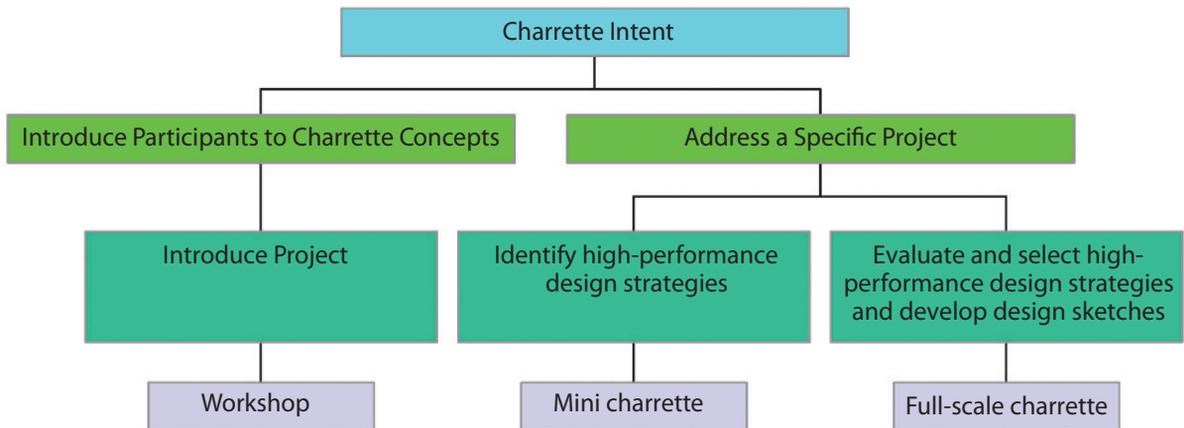


Figure 1-12 Flow chart for determining type and length of charrette. From *A Handbook for Planning and Conducting Charrettes for High-Performance Buildings* by the National Renewable Energy Laboratory.

An Actual Charette Case Study

Here is an example of the factors at play in an actual project and of how the presence of key players in one room at one time in a charrette fostered rapid communication and decision making.

- ◆ The client wanted to optimize use of natural light in the new office building and contain costs.
- ◆ The architect proposed high-performance glazing for the windows to maximize light coming into the building and control heat loss.
- ◆ The electrical engineer suggested using fluorescent lamps with light sensors to modulate the electric light in proportion to available natural light, and then proceeded to calculate the annual savings.
- ◆ The contractor surmised that the glazing and the lights with sensors would substantially increase the project budget.
- ◆ The mechanical engineer suggested smaller mechanical units because the building would be in a cooling mode most of the year and the electric light fixtures would be a source of heat.
- ◆ Quickly calculating the cost of the smaller mechanical units, the contractor determined that this integrated solution would reduce the total project cost.
- ◆ The electric utility representative offered substantial rebates for the high-performance glass, energy-efficient light fixtures, and daylight sensors.
- ◆ The owner was delighted with this collaborative problem solving.

The result was a high-performance building at a lower cost, annual energy savings, and naturally lighted interior spaces for the building occupants.

Source: From "Eco-Charrettes Save Resources, Build Teams," January 2003, www.aia.org. Contributed by Nathan Good, AIA, IIDA, Architect PC, Salem, Oregon.

Taking the Mystery Out of Commissioning

Commissioning is the least understood yet potentially most valuable green building strategy to be added to the design and construction process. It ensures that the building mechanical, electrical, and plumbing systems are installed and operate as the designers intended. The commissioning agent inspects and tests during the design and construction phases, which makes it far easier and less expensive to find and correct errors than it would be by waiting until the project is completed.

Commissioning agents charge for their services—costs will vary depending on the size of the project and

what systems are included—but commissioning always results in energy and/or construction savings and may help avoid liability exposure. Consider, for example, a situation where a contractor incorrectly installs a damper that obstructs air passage through a duct. A commissioning agent doing field testing prior to drywall installation will catch the error while corrective measures are inexpensive. Had the walls been closed in, the mistake might not have been discovered until the occupants in the completed building started complaining of being too hot or cold. The investigation into the problem and the repair would then be far more costly, to say nothing of the loss of productivity from uncomfortable workers.

Commissioning agents are valuable additions to the integrated design team and should have a place

at the charrette table to help develop and clarify system goals. Many recommend that the process begin as early in the project as possible. Karl Stum of Portland Energy Conservation, Inc. is quoted in an *Environmental Building News* article as saying, "Owners considering commissioning for the first time have more of a show-me attitude. Any owner who has done commissioning at some point during the construction phase will say, 'Next time we want to start sooner.'"²³

Commissioning the Interiors Project

By Jay Enck

The measure of a high-performing building is its positive environmental and social impact and the economic performance over its lifetime. A high-performing building is the culmination of good design, construction, and operation that achieves the lowest total cost of ownership while meeting the specific needs of the occupants. The success or failure of sustainable development principles often hinges on the assessment of which principles to apply. There is not one strategy that fits all. Each project requires blending the owner's goals and objectives, business model, and mission with sustainable, healthy, high-performing building principles in a way that is balanced and realistic over the life of the building.

Designers focus on the nuts and bolts needed to create buildings. They listen to the owner's needs, define square footages, identify adjacencies of tasks within a building, select construction materials, and develop construction documents intend to communicate the scope of the work to the contractor. Contractors focus on execution of the construction documents. They obtain the building materials, hire the labor to construct the project, and focus on schedule and budget. Unfortunately, this traditional method of delivering projects often results in a failure to meet all of an owner's objectives. The shortcoming is often due to a combination of factors.

Design and construction issues that are not identified during the delivery of a project can nega-

Originally commissioning involved only HVAC systems, but it has expanded to include other building components such as water delivery, lighting, shell, structure, and even finishes. For that reason, commissioning has been placed here at the front of the book to put it into the context of whole-building thinking. In his essay, Jay Enck, an experienced commissioning agent, presents a comprehensive look at the not-so-mysterious commissioning process.

tively impact occupant satisfaction and create long-term building problems that cause poor energy efficiency, uncomfortable conditions for the occupants, and increased operation and maintenance costs. Uncomfortable conditions for occupants can result in poor work performance, increased absenteeism, increased maintenance requests, and increased tenant turnover. These types of problems have led to the need for commissioning.

Commissioning is a quality-focused process for documenting and verifying that systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's objectives. Originally applied to heating, ventilation, and air conditioning (HVAC) systems, commissioning has evolved to include most systems in the built environment: building enclosure, electrical distribution, voice and data systems, security, fire protection, as well as others. The commissioning process as defined by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) in ASHRAE Guideline 0, "The Commissioning Process," provides an outline of each of the elements in the process and provides guidance for implementation.

The commissioning process documents the owner's project requirements early in the predesign phase of a project. The owner's goals, objectives (including specific sustainability goals), and success criteria are documented in the owner's project requirements (OPR). Defining measurable benchmarks of success helps to avoid one of the main pitfalls of project teams: not fully understanding the owner's objectives for a project. The OPR also helps provide

key information that reduces effort if an architectural program is developed.

Starting with a clear vision that is documented in the OPR is the foundation of successful integrated design that can achieve sustainable, healthy high-performing buildings and meet requirements and principles contained in Executive Orders, corporate stockholder mandates, and various building-performance rating systems. Beginning the commissioning process in predesign can significantly improve the delivery process and sets the foundation for lower total cost of ownership for the life of the building.

Design-phase commissioning provides the project with a “second pair of eyes” to identify problems when they are easiest to fix. Design-phase commissioning also helps with coordination between disciplines and delivers better construction documents that provide more concise instructions to the contractors and result in tighter bids. Using the OPR, the commissioning provider can compare the needs, requirements, and sustainable goals to the design team’s documents and help identify disconnects or misinterpretations so that the team as a whole can address these issues and implement course corrections if necessary.

Construction-phase commissioning can identify installation, serviceability, and operational problems early in the construction process and bring these problems to the team for a timely resolution. Teams can develop solutions to issues while they are still engaged and all materials and equipment are on site, improving the subsequent operation and maintenance efficiency of the facility. The commissioning process can also identify compromises in construction practices and installation schedules that would impact current and future building occupants. Areas of occupied buildings under construction often affect the occupied areas. By implementing a construction indoor air quality plan, negative impacts on adjacent occupied spaces or, for new construction, the building as a whole can be significantly reduced.

Commissioning is a required component to achieving many green rating systems, such as the U.S.

Green Building Council’s LEED certification. Project teams pursuing green certifications should take care to recognize the intent of sustainable building principles instead of becoming focused on the credits. Failing to do this can result in projects “buying” credits in lieu of integrating good sustainable, healthy, high-performing building design—a practice that prevents owners from reducing the total cost of ownership. Additionally, it can result in owners and their project teams becoming disenchanted with the concepts of the green rating systems. Investing in higher-efficiency strategies such as daylighting, demand-based ventilation, advanced control systems, and better insulation without verification of performance can lead to higher project costs and lower performance.

Owners may elect to implement sustainable building principles based on their financial, social, and environmental benefits. LEED for Commercial Interiors provides strategies that owners and their teams should consider when building out an interior space. An example of this is water and sewer savings, which can be realized by implementing low-water-consuming toilets, waterless urinals, and low-flow lavatory faucets in lieu of standard plumbing fixtures. In a recent project in Atlanta, Georgia, the owner is saving 4.4 million gallons and \$53,781 per year by implementing water-efficient plumbing fixtures. Collecting rainwater to displace potable water used for flushing toilets on this project saved an additional 1.8 million gallons and \$14,072 per year, resulting in an annual total savings of \$67,853 with a 1.6 year simple return on investment.

Green rating certifications such as LEED are easy enough to attain with a small investment, typically from 0.7 to 1.5 percent of the construction cost. That estimate includes hard and soft expenditures, including sustainable building consultant, commissioning, and documentation to receive a certification from one of the green rating systems. The certification does not ensure performance, which is why the selection of the independent commissioning provider is critical. The proper commissioning provider will verify that the

project is achieving the owner's objectives and meeting the criteria that are documented in the OPR. The Commissioning Authority is the single thread that is involved from the beginning of a project through the life of the building.

Team dynamics is an essential element of success and having a Commissioning Authority who has experience with projects of similar scope and type provides a powerful team partner. This strategy helps both the designers and contractors because, as a team, problems can be identified and corrected early, providing a higher-quality product to an owner.

Commissioning supplements the design team's efforts to understand the owner's requirements

and needs and the contractor's quality-assurance practices, which, in turn, results in better-quality construction, fewer problems, improved quality of life for the occupants, lower operating costs, and increased financial return. Commissioning can lower project risk, reduce misunderstandings between team members, improve project efficiency, and identify problems early, while the team is fully engaged. Commissioning helps to ensure that the money invested by an owner provides the desired results both financially and environmentally. It is money well spent.

H. Jay Enck, the principal of Commissioning and Green Building Solutions (CxGBS), has conducted commissioning processes for over \$5 billion in construction.

So what about the millions of existing buildings in the United States that were designed, built, and occupied without the benefit of commissioning? For those buildings, the process of retro-commissioning applies. Retro-commissioning is the application of the commissioning process to existing buildings in order to im-

prove how building equipment and systems function together. Although the age of the building does have an impact, retro-commissioning can often resolve problems that occurred during design or construction or address problems that have developed throughout the building's life.

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