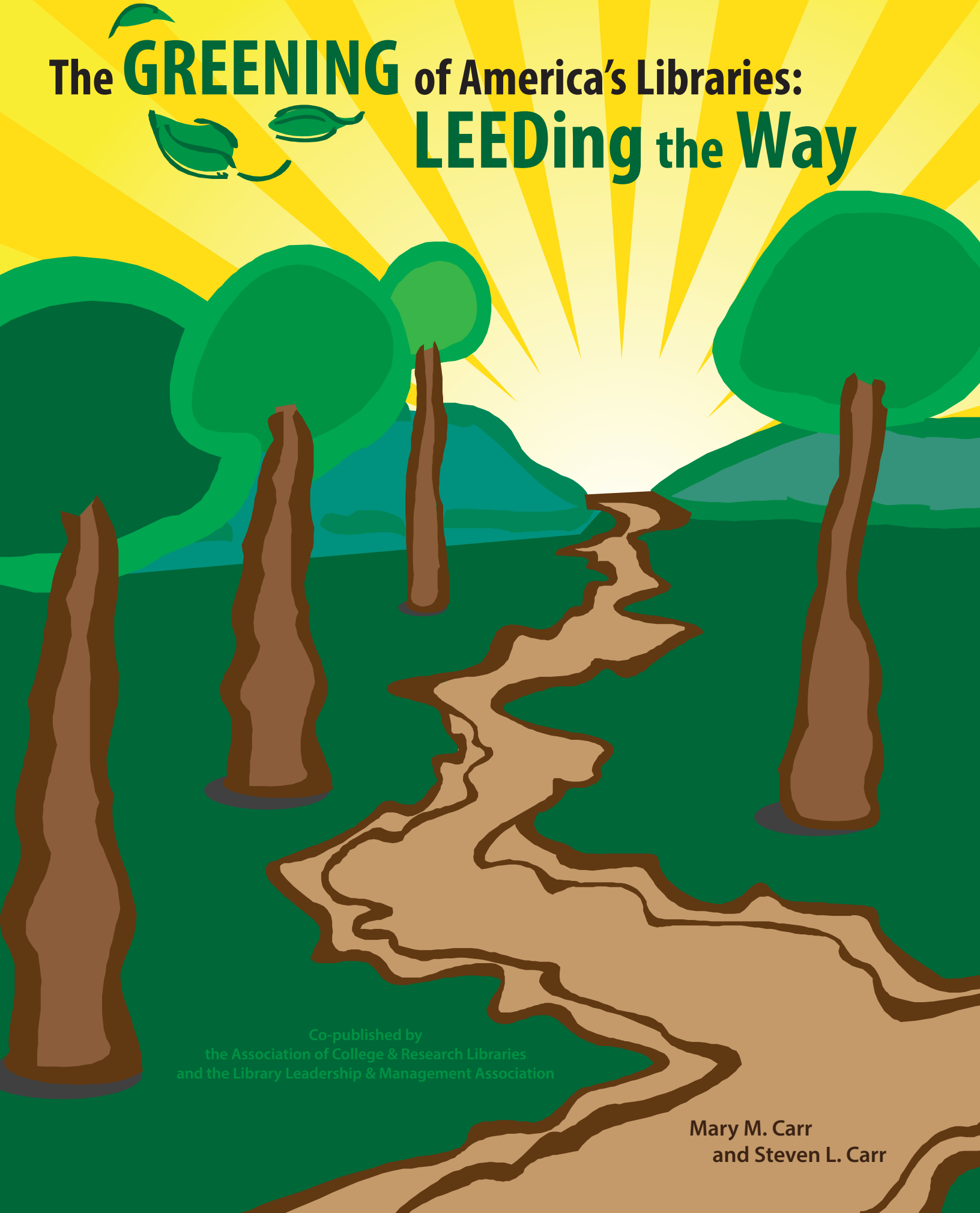
The GREENING of America's Libraries: LEEDing the Way



Co-published by
the Association of College & Research Libraries
and the Library Leadership & Management Association

Mary M. Carr
and Steven L. Carr

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LEEDing the Way

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Co-published by the Association of College & Research Libraries
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Chicago, Illinois | 2013

ISBNs

ePub: 978-0-8389-8663-9

PDF: 978-0-8389-8664-6

Mobi: 978-0-8389-8665-3

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Dedication

To my mother, Annella M. Winkes (1917–2011), who died while this book was being written and my father, Everett F. Winkes (1911–1991), both children of the Great Depression. Teachers first and always, they taught their children the principles of sustainability and the gentle use of the earth's resources. And, a thank you to Steve, a colleague and a friend.

~Mary M. Carr

To the special people in my life who make every day a joy, to my colleagues at the USGBC for their support, to my fellow librarians who inspire me daily, thanks isn't quite enough. A special thanks to Mary for everything. You all sustain me.

~Steven L. Carr

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Introduction

Welcome to the exciting world of LEED®, libraries, and sustainable building!

From their very beginning, libraries have practiced sustainability, using and preserving collections and providing multi-purpose facilities for the good of their communities. A critical issue for libraries is the ability to squeeze the value of every dollar in their (often meager) budgets. As money for education and the social good has been shrinking across America, libraries' budgets have diminished, even as their usage increases. Likewise, the ways in which customers use and view libraries are changing as well, demanding new resources and services.

Sustainable building practice recognizes that most of our buildings were designed with minimal consideration of the cost of operating them. At one point, operating costs were not that significant. But that has changed as the costs of labor, supplies, and equipment have continued to go higher. Furthermore, we have seen the increase in work force illness as a result of "sick building syndrome" and other environmental issues. With the long view in mind, sustainable building practices save substantial amounts of money—money libraries and their communities need desperately.

A small cadre of librarians has come to embrace this understanding and have gone into the field of sustainability out of interest and passion. As you will learn, "green" building practice has many flavors, but the primary method of training and certification today is achieved through the U.S. Green Building Council (USGBC) and its certification agent the Green Building Certification institute (GBCI). The authors of this book are two such individuals.

Steven L. Carr is a public librarian currently working in Arlington, Virginia, who has been involved in many library designs and building projects over the years, culminating in his most recent project at the Westover Branch Library of the Arlington Public Library, which was certified LEED gold. His current areas of study are focused on the sustainability of people in the built environment using Service Design (people need energy, too) and the promotion of LEED for libraries. Steve has served as chair of the USGBC's Education Development and Training Committee, and he has been a member of its Education Events Committee as well.

In addition to being an LEED accredited professional (LEED AP), Steve has also earned a Certificate of Public Management from the George Washington University and the Metropolitan Washington Council of Governments.

Mary M. Carr is the executive director of CCS Library Services, Community Colleges of Spokane, in Spokane, Washington. A nationally certified Sustainable Building Advisor, a LEED AP, and a Certified Green Professional of the National Association of Home Builders, she has been involved in various aspects of sustainability. She worked locally on the former Spokane Mayor's Task Force on Sustainability and served as treasurer of the local Main Market Co-op natural food store. She has been a leader in promoting sustainability through the humanities by leading Spokane Community College's Hagan Foundation Center for the Humanities' three-year study of sustainability. She also served as a member of the Technical Advisory Committee of the American Association of Community Colleges Sustainability Task Force. She has served for the last two years as as a member of the U.S. Green Building Council's Greenbuild Special Programs Working Group. She co-taught the Sustainable Building Advisory course of study during the 2011-2012 academic year. In addition to her green building credentials, Mary is in her second term on the ACRL/LLAMA Interdivisional Committee on Building Resources. She is also a certified Lean Technician.

While Steve Carr was serving on the ALA/IIDA Interior Design Award Committee of ALA's Library Leadership & Management Association (LLAMA) Building and Equipment Section, the idea for this book was born. (The first LEED AP librarian in the U.S., Anne Larsen, served on this committee; Steve was the second librarian in the U.S. so accredited.) Committee chair Dalia Corkrum was flying home to the state of Washington after an ALA conference, and she happened to meet her long-time colleague Mary Carr on the flight. When asked what she was up to, Carr replied that she was working on green buildings. Corkrum asked if Mary if she knew Steve Carr. Thus our harmonious and serendipitous collaboration—Carr^2 as we refer to it—was formed!

Mary Carr, who was then serving on the Association of College and Research Libraries (ACRL) Board of Directors, approached ACRL about a joint publication with LLAMA. ACRL approached LLAMA, and LLAMA agreed. Thus a second unique collaboration was born since this is the first joint ACRL/LLAMA publication. We bring to you the best of many worlds:

- Academic and public library expertise
- Green building expertise and accreditation
- LEED-certified building design experience

- Connections to the U.S. Green Building Council
- Passion for sustainability and green building
- Bi-coastal perspectives
- LEED Building Design and Construction accreditation
- LEED Existing Buildings Operations and Maintenance accreditation.

Our goal is to give you the information, tools, and confidence you need as a non-building or design professional to construct or renovate your library with sustainability in mind. We are both proponents of the U.S. Green Building Council's LEED program and process, and we have devoted this book to leading you through the system most applicable to your needs. The project could be a newly built library, renovation of an existing library, or the lease of a commercial space. All are viable options for libraries, and all are covered by specific LEED ratings programs.

This book is designed as a digital publication. Not only is this the most sustainable route, but it will allow us to keep the book in a constant state of currency for the foreseeable future. The rating systems are changing constantly and are revised substantially every two or three years, so the ability to update is imperative. Please note that this version is keyed to LEED 2009, and you can register to use this standard until June 1, 2015. It is also important to us and to our publisher that your investment in the content is worthwhile.

Please join us in this exploration, whether by necessity or interest. We hope that we have provided some clarity in this often confusing world of construction and design. We also hope to continue towards a *LEED for Libraries* standard that will address the library world's unique characteristics and functions.

Acknowledgements

The authors are grateful for the invaluable assistance of their many colleagues at the U.S. Green Building Council, especially members of the Education Department. Through their generosity, we have been permitted to integrate exact language to clarify and simplify the LEED ratings systems.

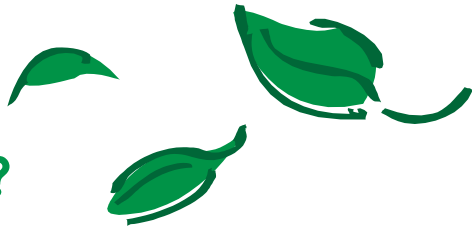
Equally important are our colleagues at the American Library Association. Dalia Corkrum of Whitman College brought the authors together and believed in the project early on and has earned our gratitude. Our colleagues at ACRL and LLAMA have also been very supportive; the list of their names would be too extensive.

Finally, to the best editor and enthusiastic project manager ever, Kathryn Deiss, we owe our eternal thanks and gratitude for her no-nonsense but ever supportive

work on this project. Kathryn is the content strategist for the ALA's Association of College and Research Libraries. Not only has she understood the basis on which this project is based, she offered immediate backing and brokered the joint publication arrangement between ACRL and LLAMA within ALA for us. Thank you, Kathryn—you are a green jewel!

CHAPTER 1

What Does "Green" Mean?



> *A sustainable community uses its resources to meet current needs while ensuring that adequate resources are available for future generations. It involves all its citizens in an integrated, long-term planning process to protect the environment, expand economic opportunities, and meet social needs.*
>
> —CONCERN, Inc.

The greening of America's libraries is happening. In some very real ways, it has always been happening. As pragmatic professionals, librarians have long practiced a basic element of sustainability: recycling library materials among an enthusiastic user population. We have excelled at multiplying the usefulness and life span of the information container known as the book. We have also moved beyond the book into the digital age as we now organize and disseminate digital information in its electronic manifestations. The core principle of our service has been to extend access to information and recreational reading to a much larger population of users—to move beyond the one-book, one-user model. A happy by-product of this idea has been to offer access to those who might not normally be able to afford the acquisition of printed information. Now, we are being challenged to expand this idea throughout the values and services that make up the foundation of our libraries today.

Another core principle of libraries is to be a presence in our communities. That presence takes many forms, from a librarian riding the circuit on horseback, to a bookmobile, to the physical space of a library building. More recently, libraries use technology to reach directly into a community member's home. These sorts of changes, along with the cost and scarcity of resources, have necessitated another look at our physical buildings. Librarians find themselves managing change of all sorts. We are at a crossroads, where every aspect of our lives is changing, be it the economy, technology, resources, climate, or culture.

Given these changes, it is no surprise that our buildings are also undergoing fundamental changes, too. Our buildings reflect the way we work and the way we live.

Definitions of "Green," "Sustainable," and "Sustainability"

The terms "green" and "sustainable" are used often in this book and need to be defined. In the *Oxford English Dictionary*, the term "green" is defined as "pertain-

ing to or supporting environmentalism." The term "sustainable" relates to "forms of human economic activity and culture that do not lead to environmental degradation, especially avoiding the long-term depletion of natural resources."[1]

Internationally, the most widely quoted definition for "sustainability" (though certainly not the only one) is the Brundtland definition, which first appeared in the 1987 *Report of the World Commission on Environment and Development.* The report defines "sustainability" as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The commission, known by the name of its chair Gro Harlem Brundtland, was convened by the United Nations (UN) in 1983. It was created to address growing concern "about the accelerating deterioration of the human environment and natural resources and the consequences of that deterioration for economic and social development." In establishing the commission, the UN General Assembly recognized that environmental problems were global in nature and determined that it was in the common interest of all nations to establish policies for sustainable development.[2]

The Green Building Movement

As it became apparent that some societies were consuming a disproportionate share of the earth's resources, attention was directed to identifying the greatest consumers of resources, particularly energy. According to the Worldwatch Institute, the population of the United States represents five percent of the world's population, yet the people in the United States consume twenty-five percent of the earth's fossil fuel resources. If the whole world were to consume resources at that rate, the earth's population would need the resources of five earths. Furthermore, buildings account for the use of more energy resources than do vehicles in the United States, since transportation uses twenty-eight percent of the energy supply.[3] Just how many resources do buildings use? In the United States alone, buildings account for

- 36 percent of total energy use
- 65 percent of electricity consumption
- 30 percent of greenhouse gas emissions
- 30 percent of waste output (136 million tons annually)
- 30 percent of raw materials use.

(Source: U.S. Green Building Council)

When we speak of green building, we're referring to the process of consciously designing a structure to be as sustainable as possible, i.e., to use as few resources as possible. Sustainability is achieved by fulfilling the functional needs of a building with design and products that enhance the value or impact they have on the owners and the occupants. In the United States, the average person spends ninety

percent of the day inside a building—according to a United States EPA study—be that at work, home, or elsewhere. Therefore, the built environment has a profound impact on our lives.

Increasingly, the green building movement is coming to embrace the idea of net-zero buildings. These structures produce and recover energy and waste in such a way that they do not take anything from the environment. The design compensates the environment for the resources it uses.

According to an April 2010 media release from the U.S. Green Building Council (USGBC), greater building efficiency could meet eighty-five percent of future U.S. demand for energy, if only we were to harness it. Additionally, a national commitment to green building would have the potential to generate 2.5 million American jobs.

It is a call to action. How can libraries do their part? More to the point, how can libraries lead the way?

Figure 1.1. Westover Branch, Arlington Public Library, Arlington, VA. A view of the children's room and the story area. Also featured is a plinth relocated from the Arlington National Cemetery. The plinth is one of the Louis Comfort Tiffany designed elements from the now destroyed tomb that were incorporated into the design of the library. (Photo courtesy of Arlington Public Library.)

Green Libraries

The California Integrated Waste Management Board defines a green or sustainable building as "a structure that is designed, built, renovated, operated or reused in an ecological and resource-efficient manner." Green libraries were a subset of green buildings. More recently the phrase "green libraries" has expanded to include libraries that have not only had the opportunity to make their buildings sustainable, either by building or renovating, but those that use green products, conserve resources (including power), and offer green resources and/or green programming to their communities.

The green movement in libraries dates back to the 1990s. Its definitive history, as traced through library literature, is well-documented by Monika Antonelli of Minnesota State University in *The Green*

Library Movement: An Overview of Green Library Literature and Actions from 1979 to the Future of Green Libraries, Antonelli's premise is that, as of 2008, the creation of green libraries was approaching a tipping point, "generating a green library movement comprised of librarians, libraries, cities, towns, college and university campuses committed to greening libraries and reducing their environmental impact."

The United States was not the only country at that time that had begun to recognize the importance of sustainability and libraries. The International Federation of Library Associations (IFLA) issued an official statement on the subject at its annual conference in 2002:

> *Statement on Libraries and Sustainable Development*
> Meeting in Glasgow on the occasion of the 75th anniversary of its formation, the International Federation of Library Associations and Institutions (IFLA):
>
> - Declares that all human beings have the fundamental right to an environment adequate for their health and well-being.
> - Acknowledges the importance of a commitment to sustainable development to meet the needs of the present without compromising the ability of the future.
> - Asserts that library and information services promote sustainable development by ensuring freedom of access to information.
>
> *(Source: IFLA's Statement on Libraries and Sustainable Development)*

Libraries around the world were becoming conscious of their role in environmental sustainability.

Interest in green library design intensified in December 2007 when the *Library Journal* Design Institute hosted its first *Going Green* seminar in Chicago, Illinois. The first library seminar of its kind, *Library Journal* has continued to sponsor these free, day-long design institutes periodically. The institutes feature the newest developments in green building techniques and discussion time for those who are considering or designing building projects. Its proceedings are recorded in the *Library Journal*'s Library By Design supplements which can be found by searching the Library Journal's website.

A second event was held a mere six months later in May 2008 in San Francisco. As Rebecca Miller stated when reporting on the second green design institute, "It's no surprise we're revisiting the topic [of green libraries], given the growing intensity

around the need for energy conservation and the importance of making sustainable choices across our lives." At both events, participants were given the message that it was important for libraries to "go green." Miller further observed in her article, "We [librarians] have a unique opportunity to model these sustainable choices for our communities, educating other community leaders and patrons along the way."

Modeling and educating are familiar roles for America's libraries. Libraries serve as symbols of the attitudes and values of their creators and their communities, mirroring what is best in society's values back to the community. So, as the nation begins to think differently about resources, libraries serve to extend those attitudes and values from present to future generations of occupants and visitors. And much as libraries have always served as landmarks in their communities, now the physical library buildings will serve as beacons from the present to future generations. Communities with the opportunity to build a new library or rennovate an existing library would do well to prioritize sustainable design measures for the health of the community.

Figure 1.2. Westover Branch, Arlington Public Library, Arlington, VA. Decorative louvers and overhangs add design dimension to the building, but are also calculated to diminish glare and solar disturbance, as well as excessive heat from the children's room located behind the floor to ceiling window. **(**Photo courtesy of Arlington Public Library.)

Making the Case for Going Green

Libraries have three powerful reasons to build or operate in a green way. They are all valid and excellent reasons for choosing to alter business and service models. These reasons are sometimes known as the "three Ps" or the "three Es." The three concepts are collectively referred to as the "triple bottom line."

People (or Social Equity). Americans spend about ninety percent of our time indoors. The quality of indoor air, therefore, has a greater impact on health and well-being of all people than does the quality of the air outdoors. Libraries could embrace the altruistic goal of providing a healthier environment for those who use them. They may also embrace substantial reduction in absenteeism and sick time. For example, a study of 31 green buildings from the City of Seattle reported that absenteeism was reduced by 40 percent. Another study, sponsored in part by commercial real estate giant Cushman & Wakefield, reported 30 percent fewer

sick days among one company's employees. Imagine the gains in productivity by healthier employees who work in a LEED[4] certified building!

Planet (or Environment). The apparent global warming/climate change is increasingly troubling. It is a fact that 99.9% of all species that existed on this planet are now extinct, according to Newman's *A Model of Mass Extinction*. This is a chilling statistic and begs us to pause and consider it. The World Health Organization (WHO) estimates that thirteen million deaths could be prevented every year by eliminating environmental health hazards. In children under the age of five, one third of all disease is caused by the environmental factors such as unsafe water and air pollution. WHO concludes: "Other interventions that can make environments healthier include: increasing the safety of buildings; promoting safe, careful use and management of toxic substances at home and in the workplace; and better water resource management."

Profit (or Economy). In the business world, green has begun to become a large source of financial return. Trips to the supermarket and the home supply store today reveal many more choices that are less polluting and more environmentally friendly. An increasing number of green products are available commercially. Around the world, businesses and landlords have discovered that consumers like healthier products and homes. Green products can save businesses and consumers money in the long run, so they are willing to spend a little more up front. A structure such as a library consumes many resources in the course of its construction, use, and eventual demolition. These resources cost precious dollars that could be better spent on library programs and services. Using fewer resources consumes fewer dollars.

The American Library Association's Social Responsibility Round Table (ALA-SRRT) Task Force on the Environment points to a report created under the auspices of a two-year grant collaboration between ALA and Global Learning, Inc. The report, *Libraries Build Sustainable Communities*, describes the three Es, albeit phrased a bit differently, in relation to libraries:

> While many community dynamics are at work, three are particularly important to building healthy and prosperous communities over the long term: economy, ecology and equity—the three Es.
>
> **Economy** is the management and use of resources to meet household and community needs.
>
> **Ecology** is the pattern of relationships between living things and their environment. We all know our shoe size. How many of us know the size of

our ecological footprint," the amount of air, land and water it takes to support us?

Equity is fairness. Ideally everyone in a community shares in its well-being. Where there is equity, decisions are based on fairness and *everyone* (regardless of race, income, sex, age, language, sexual orientation, or disability) has opportunities and is treated with dignity.

The three Es—economy, ecology and equity—provide a framework for libraries and their communities to explore and anticipate how the choices they make today affect tomorrow.

These are oft-quoted drivers of sustainability and are sometimes referred to as the "triple bottom line." As illustrated in Figure 1.3, sustainability lies where all three Es (or Ps) intersect.

Given the fact that people spend so much time indoors and a good part of their lives at work, it is only natural that we would make work spaces comfortable and healthy places, providing us with a connection to the outdoors when we are unable to be out in it. As more is learned about the psycho-physiological effects that buildings have upon their occupants, the importance of the health of library buildings becomes ever more important, both for library employees and for library users.

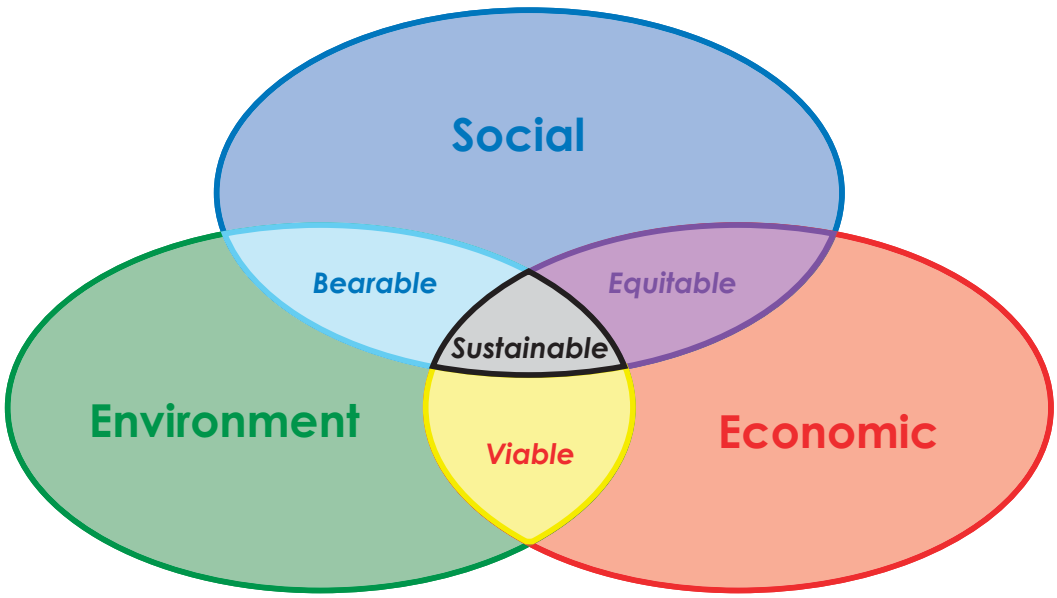


Figure 1.3. Scheme of Sustainable Development: At the Confluence of Three Constituent Parts. (Source: Wikipedia: Sustainable Development)

Numerous studies have shown that strategies used to reduce a building's environmental impact also have significant benefits for improved user and employee health and productivity. For example, the architectural firm Heschong Mahone conducted a study of the effect of daylighting, the practice of placing windows or other openings and surfaces so that during the day natural light provides effective internal lighting, on student performance. The study found that students who took their lessons in classrooms with more natural light scored as much as twenty-five percent higher on standardized tests than other students in the same school district.

In her research into the connection between green building strategies and occupant well-being, Dr. Judith Heerwagen reminds us that green building literature often focuses on air quality and physical health, but that "a full understanding of the human and organizational benefits of green buildings demands a broader perspective that links building design, organizational performance, and human factors research."

In fact, many of the prominent features of green buildings are likely to have great impact on cognitive and psychosocial well-being, for instance, contact with emotional functioning. According to Cynthia S. McCullough in her goggle book, Evidence-Based Design for Health Care Facilities, page 152, "Positive emotions, in turn, are associated with creativity and cognitive 'flow,' a state of high task engagement."

Given that there is evidence supporting a connection between green building strategies and occupant cognitive performance, library designers should be conscious of the opportunities inherent in those strategies for creating a quality space for occupants and for delivering a building optimized for resource and energy efficiency. Green building standards attempt to address these factors in an integrated way.

Most readily available energy resources are finite. The supply of fossil fuels, such as crude oil, is increasingly scarce. The point in time when global oil production will reach its maximum rate is often referred to as "peak oil." Although it can be debated as to whether or not the peak of oil production has been reached, common sense suggests that if it hasn't already happened, it will soon. Companies are "mining" the tar sands for oil, an expensive process that would not have occurred in years past when the commodity was more plentiful and the prices lower.

Our climate is changing and demand for energy is growing. Polar ice caps and glaciers are melting; the average temperature of the earth is climbing. These factors are integrally linked to the planet's health. The International Energy Agency has predicted an increase in demand of 191quadrillion BTUs in the next

twenty years. Traditional building design requires additional electrical outlets, heat registers, and similar accommodations to make a building more flexible in its use; offsets are not included to reduce the energy use and costs associated with these additional energy uses. The costs for energy have grown exponentially with increased demand. The efficient energy usage dictated by our built environment is the key to managing our consumption of energy resources and our resultant carbon footprint.

Libraries are certainly part of the building landscape, thus participating in the significant use of the planet's resources. Because the cost of constructing green buildings has become affordable, libraries have no reason not to build or renovate using green methods even with conventional budgets. No longer is it necessary to include a premium in the budget to accommodate green design and construction. (A more detailed discussion of building budgets appears in Chapter 7.) Sustainably designed libraries are built to last—to express the community's interest in the prudent use of resources for generations to come. Such a building can respond flexibly to changing functional demands, provide an environment that is inspiring and safe, perform efficiently, and provide great financial value to the community that is responsible for its creation.

A new library building is not possible or even necessary. A renovation of or a substantial addition to an existing library building might be more practical and make better use of the embedded energy already in the structure. Budget-strapped libraries where even an addition or renovation is not possible may still implement some of the strategies discussed in this book. Every green strategy that is implemented in an existing building, whether or not it is renovated, is worth considering.

Whether an historic renovation, an adaptive reuse, or a new construction, a library building that limits its impact upon the environment marks a change in how the community thinks about resources. Such libraries serve as landmarks in their communities, as libraries always have.

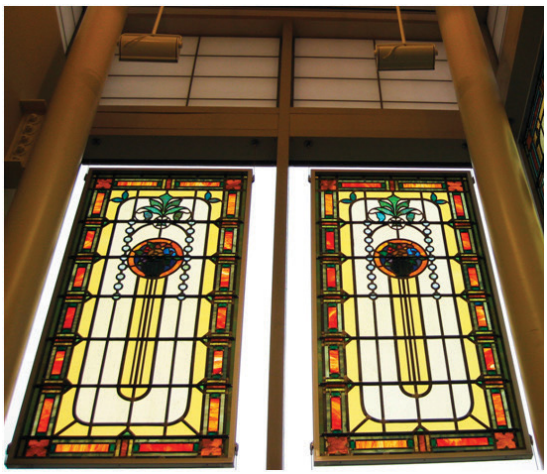


Figure 1.4. Westover Branch, Arlington Public Library, Arlington, VA. These three stained glass windows are hung inside the energy efficient new windows shown here. The windows on the exterior are at street level; inside, they are a story above the young adult area. The three windows were restored from four original Louis Comfort Tiffany stained glass windows rescued from Arlington National Cemetery. (Photo courtesy of Arlington Public Library.)

For libraries that are considering building green, resources are available to help you get started. Two seminal documents with the same title are definitely worth reading. They are *Why Build Green?* from the U.S. Environmental Protection Agency and *Why Build Green?* from the Rocky Mountain Institute. Additionally, two Web resources specific to libraries are also helpful:

- The ACRL/LLAMA Interdivisional Committee on Building Resources wiki, *Academic Library Building Design: Resources for Planning*. It includes information on green issues. Both ACRL and LLAMA are committed to green libraries, as evidenced by their publication of this work, the first joint publishing venture for these two ALA divisions. Further testimony to sustainability is the way in which the work is published – electronically.

- Sustainable Library Design. The material on this site was created by Johanna Sands, AIA, and provided through the Libris Design Project. The project was supported by the US. Institute of Museum and Library Services under the provisions of the Library Services and Technology Act, administered in California by the State Librarian.

Building Standards for Sustainability

A variety of industry-specific standards developed by professional organizations —such as the **American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)—**exist for products and materials that reflect sustainable manufacture and use. The federal government has also promoted standards that influence the built environment. While some of the federal programs and standards are mandated as law (such as the American Disabilities Act), others are voluntary.

The U. S. Green Building Council's Leadership in Environmental Education and Design (LEED) program has achieved wide acceptance in the United States and around the world for a number of reasons, according to the USGBC website. The program has been developed by practitioners in the building trades, and it is frequently revised to reflect advances in construction and materials. The LEED program allows flexibility in application. There are a variety of ways to achieve a green building using LEED, which allows for local decision-making and circumstances.

Other standards for green building exist—some based on LEED, others at least similar in intent. Although this work focuses on LEED as the standard of choice, we list below a few other standards and tools useful for libraries considering a green building project.

LEED

What exactly constitutes a green or sustainable building? What are the elements? In 1998, the U. S. Green Building Council (USGBC) set out to answer those questions. The USGBC is a consensus-based, not-for-profit organization that has a diverse membership of building-related specialists. It now offers activities and education through eighty local chapters across the country and is headquartered in Washington, D.C.

Soon after it began in 1998, the USGBC started an effort to provide structure, resources, and uniformity to sustainable building. Through its membership, it developed the Leadership in Environmental Education and Design (LEED) program. LEED is a standards-based program that certifies buildings and accredits building professionals. It was introduced in 2000.

LEED is considered a performance standard, which means it allows a building owner or planner to choose how to meet certain benchmark numbers without prescribing specific measures. It is comprised of point-based rating systems in which projects earn LEED points for meeting green building criteria.

All of the LEED rating systems, of which there are a number, look at the most important elements of any building and attempt to designate criteria that distinguish a green building from others. The elements that affect sustainability as defined by LEED, are:

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation in design
- Regional priority.

The USGBC allows for "shades of green," offering certification at the Certified, Silver, Gold, and Platinum levels.

In the 1980s, when interest in green building components began to grow in earnest, it was widely held that green construction was roughly two percent more costly than non-green construction. Costs have diminished as an increasing number of sustainable products have become available, and now a green building can be constructed for the same per-square-foot cost as a non-green building. Those built to LEED standards have demonstrated that, to date, the overall savings in

operational costs are lower, much lower, depending on the features incorporated into the building. In 2008, Turner Construction published the *Green Building Market Barometer*, which stated that over a 10-year span, overall operating costs would be reduced 59%—significant reduction.

The USGBC has prepared a document that provides an overview of the LEED program entitled *LEED*. In Chapters 3-5, we will look more closely at the USGBC's LEED standards, the impact their standards might have on a typical library building, and demonstrations of those standards in library buildings of today.

THE CHICAGO STANDARD

The City of Chicago has adopted The Chicago Standard to guide the design, construction, renovation, operation and maintenance of municipal facilities in a manner that provides healthier indoor environments, reduces operating costs and conserves energy and resources.

The Chicago Standard is based on selected points from the LEED standard that were considered reasonable and appropriate for Chicago. Adoption of the standard will result in "LEED certified buildings that save 15 to 20 percent in energy costs annually, conserve water and other natural resources, and provide healthier, more productive indoor environments." The Chicago Standard was adopted in 2004. The standard was designed to help Chicago build a base of architects and contractors experienced in sustainable design and construction.

Although originally developed for use in the City of Chicago's municipal facilities, the Chicago Standard can be used as a guide for any construction or renovation project, public or private. It was adopted in the hopes that private developers and contractors would use the Chicago Standard as a guideline for building green.

GREEN GLOBES®

The Green Globes system is a revolutionary building environmental design and management tool developed by the Green Building Initiative, a not-for-profit organization the mission of which is to accelerate the adoption of building practices. The system delivers "an online assessment protocol, rating system and guidance for green building design, operation and management. It is interactive, flexible and affordable, and provides market recognition of a building's environmental attributes through third-party verification."

LIVING BUILDING CHALLENGE 2.1

The Living Building Challenge is a program of the International Living Future Insti-

tute. In no way meant to compete with LEED, the Living Building Challenge has swept North America. As of January 2012, more than eighty registered projects from coast to coast were pursuing certification under this rigorous performance standard, and interest continues to rise. As of that same date, only three projects have been certified.

Once there were multiple LEED-certified buildings at the Platinum level constructed around the country, some with zero or small first-cost premiums, it was time to look at another, more sustainable course of action. The Living Building Challenge 2.1 is a cohesive standard—pulling together the most progressive thinking from the worlds of architecture, engineering, planning, landscape design, and policy. The standard challenges communities to ask the question: *What if every single act of design and construction made the world a better place?*

The Living Building Challenge is comprised of seven performance areas, or "petals": Site, Water, Energy, Health, Materials, Equity, and Beauty. Petals are subdivided into a total of twenty Imperatives, each of which focuses on a specific sphere of influence.

The purpose of the Living Building Challenge is straightforward—to define the highest measure of sustainability possible in the built environment based on the best current thinking, recognizing that "true sustainability" is not yet possible. The Living Building Challenge is by definition difficult to achieve. Although facets of this standard have been accomplished in numerous projects around the world, very few projects to date have integrated the challenge in its entirety.

The underlying principle is that we can have an impact on people by improving the quality of their environment, which enhances their health and satisfaction at work and home. We can also have an impact on the planet when we consciously design a building with services in mind. By designing a library or any other building to reduce our consumption of resources, we positively affect the library's and the planet's bottom line. Planning and designing well will free up resources, resulting in both staff time and dollars saved.

"Greenwashing"

If what has been written thus far in this chapter is a description of "green," what then is "greenwashing"? A conflation of "green" and "whitewashing," the term "greenwashing" refers to the deceptive practice of promoting goods and services as green when they really are not. As we hoped to have made clear in the foregoing discussion, strategies, materials, and buildings that are truly green are best

measured against verifiable, industry-accepted standards, the "gold standard" of which is LEED.

LEED incorporates materials certification systems that are used to determine whether or not building materials are green. These materials certification systems will be discussed more fully, as applicable, in Chapters 3 through 5.

Operating in a green way revolves around the processes by which we use and allocate resources. Many of these processes—such as the use of office equipment, the location of services within in a facility, and the means of delivering services—are overlooked as we consider the greening of our operation. They are all essential elements in establishing sustainability. The processes and procedures that form the design of library services need to be evaluated to effect the changes needed to make libraries sustainable. We know that we use "stuff": commodities like books, paper, toner, and equipment. We also have overhead costs which are related to use and consumption of natural resources: heat, light, and cooling. Strategies to plan for and to use resources efficiently and effectively are covered in Chapters 6 and 7.

Green library design is strongly tied to the overall green building movement. Libraries are just buildings after all. That stated, it has often been said that libraries and hospitals are the most challenging buildings to construct. Libraries have unique needs that present some specific challenges for green builders. We have a multiplicity of user needs and space requirements. The biggest challenge libraries pose to the design and building community is the need to provide effective environments for passive print collections and for active human users. The needs of each differ.

Questions

1. What is your understanding of "peak oil?" If you'd like to learn more about the topic, check out Peak Oil News & Message Boards.

2. What do you know about climate change? Check out the facts about climate change at the U.S. Department of State's Global Climate Change website on the topic.

3. Do you know your own carbon footprint? Consider measuring it using the Nature Conservancy's Carbon Footprint Calculator.

Notes

1. John Simpson and Edmund Weiner, eds., *Oxford English Dictionary*, 2nd ed. (Oxford, New York: Oxford University Press, 1989), 811.
2. The World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987).
3. The NEED Project, Intermediate Energy Infobook, 44, http://www.need.org/needpdf/infobook_activities/IntInfo/ConsI.pdf
4. "LEED®–with the registered trademark superscript–is only necessary for the first use in a short document, or the first use in each section of a longer document. The authors have chosen to use the registered trademark superscript once at the beginning of each chapter.

Additional Resources

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CHAPTER 2

Leadership in Energy and Environmental Design (LEED®)

You can't solve a problem from the same consciousness that created it. You must learn to see the world anew.

—Albert Einstein

The Leadership in Energy and Environmental Design (LEED®) certification system was developed by the U.S. Green Building Council (USGBC),[1] a nonprofit organization of architects, construction companies, product manufacturers, engineers, consultants, and others.

The Council's stated vision is "Buildings and communities will regenerate and sustain the health and vitality of all life within a generation." Of the various initiatives and programs that have emerged from the council since it was founded in 1993, LEED is by far the most significant in terms of the interest it has generated and the impact it has had both on the building industry and the environment.

Early council members advocated the development of a system to define green buildings. After researching existing programs and metrics, especially the British Building Research Establishment Environmental Assessment Method [BREEAM] and Canadian Building Environmental Performance Assessment Criteria [BEPAC], the Council decided to develop a custom system for U.S. buildings.

Since the introduction of LEED in 1998, LEED has become the national standard for commercial and institutional buildings in the United States. During the first decade of the new millennium, the USGBC has focused its attention on some specific types of institutional projects, including schools, core-and-shell projects (i.e., projects that include just the base elements of a building's structure, envelope, and building-level systems), and healthcare projects. More recently, the USGBC has developed systems to apply to residential projects and neighborhoods. The USGBC has not yet directed specific focus to library buildings as a specific type of institutional building.

LEED is designed to encourage and accelerate global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted standards, tools, and performance

criteria. Although certainly not the only green standard for buildings, it is fair to say that it is the standard with the most recognition and acceptance, judging from the number of projects registered and certified under this standard. (See the *U.S. Green Building Council Directory.*) *Its acceptance can also be demonstrated by increasing number of localities and states that have adopted LEED as their standard for public buildings. (See U.S. Green Building Council, Advocacy: Code Adoption.)*

A building bearing the LEED certification mark is certified to deliver a higher performance using fewer resources than a building constructed without sustainability in mind. The LEED certification program is a nationally accepted benchmark for the design, construction, and operation of high performance green buildings. LEED gives building owners and operators the tools they need to have an immediate and measurable impact on their buildings' performance. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

A Brief History of LEED Green Building Certification

Of the various initiatives and programs that have emerged from USGBC since it was founded in 1993, LEED is by far the most significant in terms of the interest it has generated. LEED is a performance standard for green building which means it allows a building owner or planner to choose how to meet certain benchmarks without prescribing specific measures. The suite of LEED certification program uses point-based rating systems in which projects earn LEED points for meeting green building criteria.

LEED was created to accomplish the following:

- Define "green building" by establishing a common standard of measurement;
- Promote integrated, whole-building design practices;
- Recognize environmental leadership in the building industry;
- Stimulate green competition;
- Raise consumer awareness of green building benefits; and
- Transform the building market.

(Source: Bradley Corporation. *LEED Information.*)

Between 1994 and 1998 the Council developed the LEED system through a long, laborious, and consensus-based process. In 1998 LEED 1.0, the beta version, was released. Twenty buildings were certified under that first system, at a time when there were no defined points or rating levels. LEED 1.0 provided a framework for identifying and implementing practical and measurable green building design, construction,

Figure 2.1 Westover Public Library, Arlington VA. The Arlington Public Library's Westover Branch was designed to achieve LEED certification at the Silver level. (Courtesy Arlington Public Library.)

operations and maintenance solutions. The LEED system was designed to be applicable to all building types—commercial as well as residential, at all stages of a building's lifecycle—design and construction, operations and maintenance, tenant fit-out, and significant retrofit.

From 1998 to 2006 the LEED program grew from one standard for new construction to a comprehensive system of six standards covering all aspects of the development and construction process. LEED has developed as a tool for buildings of all types and sizes, including new construction and major renovation, existing buildings, commercial interiors, core and shell, schools and homes. The LEED organization also has grown from six volunteers on one committee to more than two hundred volunteers on nearly twenty committees and over two hundred professional staff in Washington, D.C.

LEED is not a static system, nor is it a single standard. LEED has evolved since it was first released in 1998. Every version of the LEED system is an improvement over the last, incorporating and representing emerging green building technologies. LEED 1.0 was a pilot version. The projects built using 1.0 helped inform the USGBC of the requirements for such a rating system, and this knowledge was incorporated into LEED 2.0, which came out in 2000. LEED-NC (New Construction) 2.1 followed in 2002. LEED-NC 2.2 was published in 2005. LEED versions 2.0 through LEED-NC 2.2 were based on a sixty-nine-point system.

- Beginning with the point system implemented in 2000, LEED adopted rating levels. At first they were Bronze, Silver, Gold, and Platinum. Later the Bronze level was dropped. Currently, the rating levels are Certified, Silver, Gold, and Platinum.
- While LEED-NC, the rating system for new construction and major renovations, has gone through substantial changes, other LEED standards have also been developed. By 2008 the following LEED standards were in print and in practice:

- LEED for New Construction (includes new construction and major renovations and is the most commonly applied for LEED certification)
- LEED for Existing Buildings
- LEED for Commercial Interiors (applies to fit-outs by tenants)
- LEED for Core and Shells (applies to base elements of the total building minus tenant fit-outs)
- LEED for Homes
- LEED for Neighborhood Development
- LEED for Schools (recognizes the unique nature of the design and construction of K-12 schools)
- LEED for Retail (consists of two rating systems, one based on New Construction and Major Renovations version 2.2 and the other based on Commercial Interiors).

(Source: U.S. Green Building Council, *LEED: Rating Systems*.)

The current rating system is LEED 2009 (also called LEED Version 3 or v3). It was launched on April 27, 2009, and uses a one-hundred-point system. The new version was long awaited. It had been over ten years since the first LEED was released. LEED 2009 incorporates new construction, major renovations, core and shell, and schools into one standard.

This release is intended to initiate a pattern of biennial updates. Whether or not the USGBC keeps to that ambitious schedule remains to be seen. Whatever the pattern of updates and new editions, the authors are ready to respond. The digital nature of this book will allow the authors to update and revise individual chapters of this work in response to changes and new releases from the USGBC.

Since LEED Version 2009 was published, the USGBC has published an addendum that includes guidelines for retail spaces. Much of that work will likely be incorporated into the new version of LEED for new construction that is due for release in mid-to-late 2013.

The USGBC continues to change and improve LEED. The world has come to see LEED as a common language and a collaborative opportunity.

LEED systems for neighborhood development, retail, and healthcare are currently pilot testing. LEED certification offers validation of a project's green features and verifies that the building is operating exactly the way it was designed to. According to the USGBC website, as of July 2012 the total footprint of projects certified under USGBC's Green Building certification programs has reached nearly nine billion

square feet, with 1.6 million certifying every day around the world. The number of projects and square feet continues to grow. The LEED International Roundtable now consists of sixteen engaged and committed countries.

An Overview of the LEED 2009 Green Building Certification Program[2]

The internationally recognized LEED green building certification program is a suite of rating systems "providing third-party verification that a building or community was designed and built using strategies aimed at improving performance across all the metrics that matter most: energy savings, water efficiency, CO_2 emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts."

The green building industry had been asking for changes to LEED for some time. One of the criticisms of LEED Version 2 was the inequity of the one-point-per-strategy system. For example, cleaning up a brownfield site involves far more effort and resources than using a low-emitting carpet; however, each earned one point under Version 2. In LEED 2009, credits are weighted to reflect a set of environmental and health priorities.

LEED 2009 was not a "tear down and rebuild" of the LEED rating systems, but rather a reorganization of the existing commercial and institutional systems, along with several key advancements. The LEED 2009 version combines formerly separate rating systems into broader systems. For example, the Building Design & Construction rating system expanded to include building design as well as new construction for new construction, renovations, core and shell and schools. LEED continues to develop rating systems for various types of buildings and developments. LEED 2009 (the printed versions and draft updates) includes the following rating systems:

- **Building Design & Construction (BD+C).** This rating system incorporates LEED for New Construction (NC), Core and Shell (CS), Schools (SCH), Retail, Data Centers, Warehouses and Distribution Centers, and Hospitality systems.
- **Interior Design & Construction (ID+C).** This system incorporates Commercial Interiors, Retail, and Hospitality systems.
- **Building Operations & Maintenance (O+M).** This system incorporates LEED for Existing Buildings: Operations & Maintenance, Schools, Retail, Data Centers, and Hospitality systems.
- **Homes.** This system incorporates Homes, Mid-Rise, and Neighborhood Development systems.

LEED 2009 TECHNICAL ENHANCEMENTS

LEED 2009 was developed to create a more harmonized and integrated point system across the commercial rating systems. The new systems focus even more attention on buildings and building construction with the least environmental impact. The point system changed to a standardized one-hundred-point system. More points are awarded to credits that provide a relatively lower impact on the environment. In fact, LEED 2009 includes three major enhancements to the LEED rating system: harmonization, credit weightings, and regionalization:

> ***Harmonization.*** Credits and prerequisites from all LEED commercial and institutional rating systems have been consolidated and aligned, drawing on their most effective common denominators, so that credits and prerequisites are consistent across all LEED 2009 rating systems. Necessary precedent-setting and clarifying information from Credit Interpretation Rulings (CIRs) were incorporated into the rating systems.
>
> ***Credit Weightings.*** The second major advancement in LEED 2009 is that credits are weighted differently based upon impact on different environmental and human health concerns. With revised credit weightings, LEED 2009 awards more points for the strategies that will have greater positive effects on what matters most—energy efficiency and CO_2 reductions. Each credit was evaluated against a list of thirteen environmental impact categories, including climate change, indoor environmental quality, resource depletion, and water intake, among others. The impact categories were prioritized, and credits were assigned a value based on how they contributed to mitigating each impact. The result revealed each credit's portion of the big picture, giving the most value to credits that have the highest potential for making the biggest change. The original credits are all intact; they are just worth different amounts. As a result, LEED 2009 operates on a 100-point scale rather than the sixty-nine-point scale in Version 2.2. (U.S. Green Building Council, *LEED 2009: Technical Advances to the LEED Rating System*,

The following examples demonstrate areas where system credits have changed in LEED 2009:

Sustainable Site Credit 4.1(SSc4.1): Close proximity of a building to public transportation enables building occupants to utilize alternative transportation methods. This ability, in turn, has impacts associated with fossil fuel depletion, land use,

acidification, ozone depletion, smog formation, ecotoxicity, and overall human health effects caused by reducing single-occupant vehicle use. It also affects a large component of the building's environmental impact—its carbon footprint associated with transportation to and from the building. LEED for New Construction 2009 has increased the point value of this credit.

Water Eficiency Credits (WE): Reduction in water use associated with irrigation outside the building and fixture/fittings use inside the building has impacts on resource depletion and water shortages leading to agricultural, human, plant, and animal affects. While the impacts of these credits are primarily in water use, the benefits of water reduction are heavily emphasized in LEED for New Construction 2009.

Energy and Atmosphere Credit 2 (EAc2): Utilizing renewable energy for a building's energy needs reduces the dependency on less environmentally sound energy sources, which have a variety of impacts on the environment and human health. Using renewable energy has an impact on a building's carbon footprint, contribution to fossil fuel depletion, ozone depletion, and rate of particulates (which can lead to chronic and acute respiratory symptoms).

Regionalization. LEED 2009 includes regional enhancements identified through USGBC's regional councils, chapters, and affiliates. Six LEED credits have been prioritized because they address specific environmental issues significant to the region. A project may be awarded up to four extra points (one point per credit) for earning the priority credits.

The following examples illustrate how regional credits may vary:

Urban Florida: In urban Florida, LEED projects can earn the additional points for Sustainable Sites credit 5.2 (SSc5.2), Materials and Resources credits 1.1 and 5 (MRc1.1 and MRc5), Water Efficiency credit 2 (WEc2), Energy and Atmosphere credit 1 (EAc1), and Indoor Environmental Quality credit 8.1 (IEQc8.1). These additional points provide incentives for (among other things) decreased reliance on fossil fuels, reuse of existing building stock, decreased reliance on insufficient municipal wastewater plants, and utilization of abundant local sunshine.

Rural Michigan: In rural Michigan, LEED projects may earn additional points for Sustainable Sites credits 1, 6.1, 6.2 and 8 (SSc1, SSc6.1, SSc6.2, and SSc8); Materials and Resources credit 5.2 (MRc5.2); and Energy and Atmosphere credit 2 (EAc2). These additional points offer incentives for (among other things) the preservation of prime agricultural land, reduction of light trespass into neighboring natural habitats, and minimizing the amount and improving the quality of storm water flowing into the Great Lakes.

(Source: U.S. Green Building Council, *Regional Priority Credits*. Graphics courtesy of the USGBC.)

THE LEED CREDIT CATEGORIES

LEED operates on both prerequisites and points. Each of the first five credit categories has prerequisites. Meeting the prerequisite(s) in each category does not automatically lead to points, but it is mandatory for all projects. Prerequisites must be met before any points in a category may be earned.

The LEED categories are: Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), and Indoor Environmental Quality (IEQ). Two additional categories, Innovation in Design (ID) and Regional Priority (RP), may garner an additional ten points (six and four point, respectively). Thus, a building project may earn a total of one hundred and ten (110) LEED points.

Prerequisites require that the building is planned well in advance and seen holistically; prerequisites may not be reconstructed after the fact. The team of players involved in building or renovating must come together early in order to understand the significance of all the prerequisites. The USGBC sees the LEED prerequisites as the absolute minimum of green building performance. Because prerequisites make planning essential for a LEED building project, we have included a chapter on planning in this work. (See Chapter 7.)

The following is a brief discussion of each LEED category and its prerequisite(s):

Sustainable Sites (SS). Choosing a building's site and managing that site during construction are important considerations for a project's sustainability. The Sustainable Sites category discourages development on previously undeveloped land; minimizes a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls storm water runoff; and reduces erosion, light pollution, heat island effect, and construction-related pollution.

SS Prerequisite 1. Construction activity pollution prevention

Water Efficiency (WE). Buildings are major users of the potable water supply. The goal of the Water Efficiency credit category is to encourage smarter use of water, inside and out. Water reduction is typically achieved through more efficient appliances, fixtures, and fittings inside and water-wise landscaping outside.

WE Prerequisite 1: Water use reductions

Energy & Atmosphere (EA). According to the National Institute of Building Sciences' Whole Building Design Guide: Optimize Energy Use, buildings use thirty-nine percent of the energy and sixty-eight percent of the electricity produced each year in the United States. The Energy & Atmosphere category encourages a wide variety of energy strategies: commissioning, or implementing a process to insure the building functions properly; energy use monitoring; efficient design and construction; efficient appliances, systems, and lighting; the use of renewable and clean sources of energy, generated on-site or off-site; and other innovative strategies.

EA Prerequisite 1: Fundamental commissioning of building energy systems

EA Prerequisite 2: Minimum energy performance

EA Prerequisite 3: Fundamental refrigerant management

Materials & Resources (MR). During both the construction and operations phases, buildings generate waste and use a lot of materials and resources. This credit category encourages the selection of sustainably grown, harvested, produced, and transported products and materials. It promotes the reduction of waste as well as reuse and recycling, and it takes into account the reduction of waste at a product's source.

MR Prerequisite 1: Storage and collection recyclables

Indoor Environmental Quality (IEQ). The U.S. Environmental Protection Agency estimates that Americans spend about ninety percent of their day indoors, where the air quality can be significantly worse than outside according to Glenn Shivers in USGBC LEED Certification: the costs associated with it. The Indoor Environmental Quality credit category promotes strategies that can improve indoor air and the quality of the working environment, such as access to natural daylight and views and improved acoustics.

IEQ Prerequisite 1: Minimum indoor air quality performance

IEQ Prerequisite 2: Environmental tobacco smoke (ETS) control

Innovation in Design (ID). The Innovation in Design credit category provides bonus points for projects that use new and innovative technologies and strategies to improve a building's performance well beyond what is required by other LEED credits or in green building considerations not specifically addressed elsewhere in LEED. This credit category also rewards projects for including a LEED Accredited Professional (LEED AP) on the team to ensure a holistic, integrated approach in the design and construction phases.

Regional Priority (RP). As discussed earlier in this chapter, the addition of bonus points for addressing regional priorities is one of the enhancements of LEED 2009. USGBC's regional councils, chapters, and affiliates have identified the environmental concerns that are most important for every region of the country; six LEED credits that address those local priorities were selected for each region. A project that earns a regional priority credit will earn one bonus point in addition to any points awarded for that credit. Up to four extra points can be earned in this way.

See the Regional Priority credits for your state.

THE LEED CERTIFICATION LEVELS

The number of points the project earns determines the level of LEED certification the project receives. LEED certification is available in four progressive levels according to the following scale:

- Certified 40–49 points
- Silver 50–59 points
- Gold 60–79 points
- Platinum 80 points and above

As discussed earlier in this chapter, the credit points are weighted based on their positive impact on energy efficiency and CO_2 reduction. When a building is certified by LEED, its owner is presented with a plaque that states the level of LEED achieved. The building is also listed in the LEED project directory. A directory of certified and registered LEED projects is available at the USGBC website.

CHECKLISTS

Among other improvements made with LEED Version 2009 are the new checklists,

or scorecards as they are sometimes known. Each LEED category has a checklist that lists the credits that can be applied for and/or tasks that need to be done. In conjunction with the different versions of LEED, the USGBC has released new and genuinely improved Excel checklists that feature two tabs: a one-page simplified printing option and a more detailed view similar to past editions:

LEED-NC 2009 Checklist
LEED-CS 2009 Checklist
LEED-CI 2009 Checklist
LEED-EBO&M 2009 Checklist
LEED-Schools 2009 Checklist

OTHER CHANGES IN LEED 2009
Besides technical advances to the LEED rating systems credits and points in 2009, there are several other changes worth noting.

LEED Online. Changes to LEED Online make it faster and easier to use by the project's LEED Accredited Professional (AP) or whoever is submitting the LEED information for review.

Certification Model. A new, expanded certification infrastructure was established, based on International Organization for Standards (ISO) standards, in January 2008. LEED certification is administered by the Green Building Certification Institute (GBCI) for improved capacity, speed, and performance.

Green Building Certification Institute (GBCI). Green Building Certification is a third-party certification through this independent organization committed to ensuring precision in the design, development, and implementation of the processes used to increase and measure green building performance (certification) and green building practice (credentialing). The GBCI assures that buildings are constructed and continue to operate as intended. GBCI includes a network of ISO-compliant international certifying bodies, ensuring the consistency, capacity, and integrity of the LEED certification process.

GBCI administers LEED project certification for commercial and institutional buildings and tenant spaces. GBCI also independently manages the professional credentialing programs based upon the LEED program, including the LEED Green Associate and LEED Accredited Professional credentials. The independent administration of the Credential Maintenance Program (CMP) under GBCI provides balanced, objective management of the credentialing program, including exam

development, application, registration, and delivery. Such rigor ensures that LEED professional credentials are the industry's means of driving ongoing excellence in green building practice, providing certainty and relevance for the marketplace. GBCI also develops professional certificates for those involved in the verification of green building projects.

LEED Accredited Professional (AP) Credentialing

The LEED AP without specialty credential earned before July 2009, also known as a Legacy LEED AP, represents a demonstration of green building knowledge through testing. This credential does not require any further continuing education and does not expire. It is recognized as a valid credential in LEED 2009. However, starting with the next version of the LEED standard, the LEED AP on the project must hold the appropriate specialty for that type of project. In other words, LEED APs without specialty will find that their credentials will be obsolete.

Currently, LEED AP credentialing is offered in three tiers. The LEED Green Associate credential (earned since May 2009) represents a demonstration of a basic level of green building knowledge and LEED concepts through testing, as well as ongoing credential maintenance either through continuing education and practical experience or through biennial retesting. This credential must be maintained on a two-year cycle; if not, it expires. It is Tier 1 of the LEED Professional Credentials; thus, it cannot be held concurrently with a LEED AP with specialty credential.

The LEED AP with specialty credentials (earned since May 2009) represent a demonstration of an advanced level of green building knowledge and LEED practices through testing, as well as ongoing credential maintenance either through continuing education and practical experience or through biennial retesting. This credential must be maintained on a two-year cycle; if not, it expires. It is Tier 2 of the LEED Professional Credentials; thus, it cannot be held concurrently with a LEED Green Associate credential. (Legacy LEED APs are assigned a specialty based on the original test they took. In order to earn the specialty credential, they can either take a new, specialized exam or opt into a credential maintenance program which consists of thirty hours of prescribed continuing education.)

The third tier of LEED AP credentialing is the new LEED Fellow. The LEED Fellow Program was developed to honor and recognize an elite class of distinguished LEED APs who have made a significant contribution to the field of green building and sustainability at a regional, national, or international level over many years. There are various eligibility requirements regarding who can be nominated and, in fact,

who can make the nominations. The LEED Fellows Program is so new that nominations for the first cohort of LEED Fellows closed in January 2011.

Building projects with a LEED AP on the project team are awarded with a bonus point. The combination of librarian and LEED AP with specialty is a rare breed indeed. The co-authors know of only a handful of other LEED-credentialed librarians in the United States. The *LEED Professional Directory* is an online listing of LEED-accredited professionals, the *LEED Professional Directory* and a good source for identifying a potential team member. Search fields in the directory enable the user to locate LEED professionals in a particular geographic area.

According to the USGBC's *About USGBC*, as of February 2012 there were more than 170,000 LEED Accredited Professionals (AP) around the globe. However, the changes to the LEED AP program, with its multi-tiered approach and continuing education requirements, may well stem the growth in the number of APs. The LEED Professional Credentials and Exams are now administered by the Green Building Certification Institute (GBCI).

LEED FAQs

There are often questions regarding LEED, what it is and what it isn't, what it does, what it doesn't do. What follows are some simple FAQs in an attempt to clarify LEED further.

CAN PRODUCTS BE CERTIFIED UNDER LEED?

No, LEED applies to green building projects. Individual products can contribute to points under the certification system; LEED criteria are performance-based. In attempting to meet these requirements, LEED practitioners identify products that have desired attributes. However, some LEED criteria do require specific product data as a part of a successful submittal.

HOW DO YOU REGISTER A PROJECT FOR LEED CERTIFICATION?

After determining that LEED is right for a project, the next step is to register it. Registration serves as a declaration of intent to certify a building or neighborhood development under the LEED Green Building Rating System. Registration provides access to a variety of tools and resources necessary to apply for LEED certification. Registered and certified projects are also listed in the online LEED project database. To register a project for LEED certification, visit the *Green Building Certification Institute's Building Certification: Choose a Rating System*.

Once the appropriate LEED rating system has been determined and the registration fee based on the size of the project has been paid, the project will be imme-

diately accessible in LEED Online. From there, the project team is assembled, and the documentation process begins.

WHAT IS THE AVERAGE LEED CERTIFICATION FEE?
The certification fees vary by project size. Additionally, there are preferential fees for USGBC members. There is no single rate to quote. That being said, the average cost is roughly 3-5 cents per square foot for new construction. For more specific information visit the GBCI's, *Building Certification: LEED Registration and Certification Fees*.

CAN PEOPLE BE CERTIFIED UNDER LEED?
No. LEED certifies green-building projects and buildings. People are credentialed under the LEED program.

DOES GREEN BUILDING COST MORE?
No. Green buildings need not cost any more than non-green buildings. It used to be said that you could expect to pay a two percent premium on LEED projects when compared to "regular" construction, but that has changed. LEED-certified projects now demonstrate that you can achieve LEED certification and reap its many benefits with a common-sense approach to design with no additional dollars. Depending on your green building strategy and the level of certification that your project targets, there may be mid- and long-term returns on investment associated with additional green features that merits an investment in initial costs. A careful life-cycle analysis will determine the "cradle to grave" costs for project construction and operations.

In July 2007 Davis Langdon, a construction cost-management company, published the report *Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption*. The study produced three findings: 1) Many projects were achieving LEED certification within budget and in the same cost range as non-LEED projects; 2) Construction costs had risen dramatically (the new economic realities of the last several years notwithstanding), but projects were still achieving LEED certification; 3) The idea that green features are elective or add-ons continues to be a problem in the adoption of green construction. The report summarizes the change in cost management as follows:

> The 2006 study shows essentially the same results as 2004: there is no significant difference in average costs for green buildings as compared to non-green buildings. Many project teams are building green buildings with little or no added cost, and with budgets well within the cost range

of non-green buildings with similar programs. We have also found that, in many areas of the country, the contracting community has embraced sustainable design, and no longer sees sustainable design requirements as additional burdens to be priced in their bids.

WHAT ARE THE BENEFITS OF LEED CERTIFICATION?

LEED certification is a rigorous third-party validation of a building's performance. LEED-certified projects blend environmental, economic, and occupant-oriented performance. They cost less to operate and maintain, are energy and water efficient, have higher lease-up rates than conventional buildings in their markets, are healthier and safer for occupants, and are a physical demonstration of the values of the organizations that own and occupy them.

The U.S. Green Building Council has listed these as the benefits of LEED building:

ENVIRONMENTAL BENEFITS

- Enhance and protect ecosystems and biodiversity
- Improve air and water quality
- Reduce solid waste
- Conserve natural resources

ECONOMIC BENEFITS

- Reduce operating costs
- Enhance asset value and profits
- Improve employee productivity and satisfaction
- Optimize life-cycle economic performance

HEALTH AND COMMUNITY (SOCIAL EQUITY) BENEFITS

- Improve air, thermal, and acoustic environments
- Enhance occupant comfort and health
- Minimize strain on local infrastructure
- Contribute to overall quality of life.

(Source: Resource Dynamics, *Why Green?-Why Build Green?*)

LEED certification offers compelling proof that a green building project has achieved its environmental goals and that the building is performing as designed. Certification allows an owner or organization to take advantage of a growing number of state and local government incentives, and it can boost positive press interest in your library building.

WHO DECIDES WHAT IS INCLUDED IN THE LEED STANDARDS?

In addition to recommending policies to the USGBC Board, LEED committees have primary responsibility for the development, implementation, and revisions of LEED rating. The committees remain in existence until their rating system is fully implemented. In an effort to harmonize and align credits across LEED, the LEED committee structure has transitioned to include three core committees to oversee the project implementation process, market responsiveness, and technical rigor of LEED certification.

All LEED core committees have associated corresponding committees made up of USGBC members. Any interested member (or employee of a USGBC member organization) may join a corresponding committee to receive regular updates and minutes from the core committee, and he or she may submit questions or comments to the core committee. Core committee and working group members may be elected or appointed from the corresponding committee member body. Only corresponding committee members are eligible to vote in core committee elections.

LEED committees rely on Technical Advisory Groups (TAGs) to provide a consistent source of sound technical advice with respect to LEED. The TAGs are committees of the LEED Steering Committee (LSC) and under direct management by the Technical Committee, charged with assessing and recommending technical solutions to the LSC for review and approval. The TAGs ensure that the integrity of LEED is grounded in technical and scientific considerations of the highest quality. These advisory groups also work on LEED credit and prerequisite development based on their specific area(s) of expertise.

The TAGs are structured to include commercial, residential, and neighborhood development expertise for specific technical issues within LEED categories. These categories include Sustainable Sites (SS), Water Efficiency (WE), Energy and Atmosphere (EA), Materials and Resources (MR), Indoor Environmental Quality (IEQ), and Location & Planning (LP). For more information see the USGBC's *LEED Committees*.

LEED has experienced exponential growth in the U.S. and worldwide since the release of LEED 1.0 in 1998. As of August 2013, Breaking Energy.com announced that "there are two billion square feet of LEED-certified commercial space." Numbers of square footage and associated projects will continue to grow because LEED is an accepted standard. LEED is now commonly seen as something good for people, good for profits, and good for the planet. As a matter of fact, in late 2011, the milestone of 10,000 LEED certified buildings was reached. According to

USGBC's About USGBC, as of August 2013, "we are 77 chapters, 13,000 member organizations and 188,000 LEED professionals strong that share the same vision of a sustainable built environment for all within the next generation." Regional chapters to facilitate local green building activity and LEED implementation numbers continue to rise. In the next few years thousands of buildings will complete the certification process, representing billions of dollars of investment and millions of hours of time, all with the goal of improving the environmental performance of buildings.

WHERE IS LEED IN USE?

LEED may have been developed in the United States by the USGBC, but it is now an internationally recognized certification system that measures how well a building or community performs. LEED provides building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions. 35,000 projects are currently participating in the LEED system, comprising over 4.5 billion square feet of construction space in all 50 states and 91 countries. These numbers continue to grow and change, as LEED continues to gain acceptance.

While the specifics within the LEED standards may vary slightly from country to country, the principles upon which the standards are developed are the same. In each country, the standards are developed to encourage stewardship and accelerate the global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria.

WHAT DOES LEED DELIVER?

LEED enables project teams to deliver certified performance for their buildings. An organization's participation is usually voluntary, although in many states and localities, public buildings of a certain size are required to go through the LEED process and attain a certain LEED standard. Participation in the technically rigorous LEED process demonstrates leadership, innovation, and environmental stewardship.

IS THERE A LEED RATING SYSTEM SPECIFICALLY DEVELOPED FOR LIBRARIES?

There is no specific LEED standard developed for libraries. Library buildings are certified under LEED 2009 without regard to building type. Therefore, it is appropriate to use the *LEED Reference Guide for Green Building Design and Construction, 2009 edition* for planning a library building project, whether building a new facility or renovating. Commonly called simply LEED 2009, this reference guide is a unique tool for all new construction projects, as it incorporates guidance for the three

design- and construction-based LEED rating systems including New Construction and Major Renovations, Schools, and Core and Shell Development.

Because LEED does not have a rating system specific to libraries, this work focuses on strategies of interest to library building design teams that are planning a new green library or a major renovation. See Chapter 7 for more planning tips.

HOW DOES MY PROJECT ACHIEVE CERTIFICATION?
The simple answer is that a project achieves certification through proper registration of the project and proper reporting of a sufficient number of LEED points. But there is a caution that must be issued with this answer.

LEED is based on the principles of integrated design. A building may not become LEED certified without integrating LEED considerations into the total process, from choosing a site to measuring how the completed building functions. Integrated design requires that all professionals work together on the project and inform one another of the requirements they have. Additionally, the process allows everyone to address problems and issues together. As a result, everyone has similar goals for the project and a common commitment to the sustainability principles that the building owners hope to achieve.

WHAT IS THE LEED POINT SCALE?
Credits toward LEED certification are awarded on a one-hundred-point scale, and they are weighted to reflect their potential environmental impacts. Additionally, ten bonus credits are available, four of which address regionally specific environmental issues. A project must satisfy all prerequisites and earn a minimum number of points to be certified.

WHO USES LEED?
Architects, real estate professionals, facility managers, engineers, interior designers, landscape architects, construction managers, lenders, government officials, *and librarians* all use the LEED certification program to help transform the built environment to sustainability. State and local governments across the country are adopting LEED for publicly owned and publicly funded buildings. LEED Canada, Brazil, Mexico, and initiatives in federal agencies include projects in the departments of Defense, Agriculture, Energy, and State; and LEED projects are in progress in 120 different countries, including India.

WHO SHOULD UNDERSTAND LEED?
Anyone who is undertaking a LEED building project should have a general under-

standing of LEED and its implications for the project, whether it is a major renovation or a new building. Although it is critical to have a LEED Accredited Professional (AP) assigned to the project, the project "owner" should also have a general understanding of what is involved in a LEED project.

Librarians affected by a library building project will benefit from an understanding of LEED's integrated approach. Understanding LEED allows librarians to give valuable input into the design of library buildings and renovations—they are the ones who will occupy the building for many years after the construction workers, engineers, and architects have completed the punch list and gone on to other projects. The input of library employees into the credits and the level of certification the building team pursues will affect how well the library building serves the needs of its customers and employees for years to come.

WHAT IS THE LEED ACCREDITED PROFESSIONAL'S SIGNIFICANCE TO THE PROJECT?

Having a LEED AP on the project garners a point toward certification for the project. However, that point attainment is secondary to the fact that a LEED AP understands the absolute necessity of looking at the project holistically. The LEED AP understands the need to bring all those who will use the building together with all those who are designing and constructing the building. The librarian with a general understanding of LEED and a complete understanding of how the building needs to function to deliver its services is equipped to ask intelligent questions of all the building team members and help interpret patron needs to them.

WHY USE LEED RATHER THAN OTHER STANDARDS?

What defines a green building? Its green characteristics are not necessarily shiny or pretty, and they start from the minute the site is chosen. LEED began with the goal of focusing public attention on energy-efficient buildings. Now it is a dominant set of standards in the marketplace. LEED has become a brand. LEED certification has critics, to be sure, but the number of organizations that would pay a premium to build or buy a LEED building far outweighs those that would not. Organizations have come to understand that a LEED building's life-cycle costs will be lower. And LEED buildings are comfortable buildings in which people want to spend time.

WHAT DO THE TERMS "NEW CONSTRUCTION" OR "MAJOR RENOVATIONS" MEAN IN RELATION TO LEED CERTIFICATION FOR LIBRARY BUILDING PROJECTS?

The LEED for New Construction (LEED-NC) rating system may be used for certifying the renovation of an existing structure as well as for a new library building project.

LEED-NC is appropriate for projects that include significant changes to the exterior of the building (e.g., additions, re-building of walls), major HVAC removal and/or replacement, or major interior rehabilitation. LEED for Existing Buildings (LEED-EB) is appropriate when certifying an existing building for the first time or for a project focused on operational efficiencies and maintenance activities rather than construction.

LEED is a voluntary certification program that can be applied to any building type and any phase of a building's life cycle. It promotes a whole-building approach to sustainability by recognizing performance in key areas of the standards.

WHAT DO YOU RECEIVE WHEN YOUR BUILDING PROJECT IS LEED CERTIFIED?
The owner of the building is presented with a plaque which states the level of LEED achieved. The building is also listed in the LEED Certified Project Directory.

HOW CAN I RECEIVE TRAINING IN THE LEED PROCESS?
Because the LEED process is evolving and consensus-based, it has enjoyed wide acceptance within the United States and abroad. The U.S. Green Building Council (USGBC) holds an annual conference, entitled Greenbuild, to provide training and inspiration for green builders. The 2010 conference held in Chicago drew over 28,000 attendees and had over eighteen hundred exhibitors. Greenbuild 2011 held in Toronto, Canada drew about 23,000. The regional chapters of the USGBC also hold conferences. If you are contemplating a project, it would be well worth it to attend one of the conferences.

LEED and/or Green Libraries

In 2006, fewer than twenty Platinum LEED for New Construction (LEED-NC) library projects were in progress, according to Monika Antonelli's The Green Library Movement. An overview of Monika Antonelli's *Green Libraries* website reveals that the Barrington Area Library set a goal of being the first public library in Illinois to receive Platinum certification. Unfortunately, due to the economic downturn, on November 4, 2008, Barrington area citizens voted against the $34.3 million bond issue to fund the Library Improvement Plan.

Until recently, in the U.S. there were only two LEED-certified Platinum library buildings: the William J. Clinton Presidential Library in Little Rock, Arkansas, and the Lake View Terrace Branch Library, part of the Los Angeles Public Library District. The Clinton Presidential Library originally received Silver Certification under the USGBC's LEED-NC program. In 2007 the library achieved LEED for Existing Buildings (LEED-EB) Platinum certification by adding additional green cleaning and

recycling programs, climate-neutral and energy efficiency strategies, water-wise landscaping, and a green roof. The Platinum-certified Lake View Terrace Branch Library opened in 2003. Some of the Library's green features include: natural daylighting, shading to filter direct sunlight, solar panels, sensors that control indoor lighting for improved energy efficiency, and bamboo wood flooring. The library is located close to electric car charging stations and mass transit. It also offers a bike rack and a horse-hitching post. Both of these libraries can be studied in depth as case studies in the chapters relevant to their LEED program.

The push to build green libraries continues to grow. In 2008 Massachusetts cities were offered five million dollars to build or renovate green libraries. The State Board of Library Commissioners plans to award construction grants to thirty-one Massachusetts cities and towns. The selected libraries must follow LEED design standards to qualify for the grant money.

Chicago, Illinois, is clearly a leader in green library building. Chicago prides itself on being one of the first cities to incorporate environmentally friendly practices into public buildings. As noted in Chapter 1, the city has even created its own building standard known as the Chicago Standard, which is based on selected points from the LEED Green Building certification program. Beginning in 2002, the city of Chicago decided to use green building technologies in the construction of municipal buildings, such as libraries and police stations. The first green library, Budlong Woods Library, opened in spring 2003, followed by the West Englewood Library in the summer 2003, and the Oriole Park Library in spring 2004. By December 2007, seven Chicago branch libraries had received certification—with more planned.

The number of LEED libraries continues to grow, with no end in sight. The *Green Libraries* documents them all, although it is important to note that the website includes libraries with green features that do not either apply for or attain LEED certification.

Anticipation: LEED Rating System Development

LEED rating system development is iterative. Once a version is published, the USGBC starts to work on another version. As described more fully in Chapter 8, the next version of the LEED, LEED v4, is scheduled to be released in late 2013. Although many elements of the standard may change before its release, it is instructive to take a look at the proposed changes. The changes, even now, show the direction that the USGBC is moving and the plans the Council has for LEED's future. See Chapter 8 for more information regarding the next version of LEED.

The USGBC has adopted a "continuous improvement" model. The council acknowledges that, while LEED buildings may perform better than conventional buildings, current LEED rating systems certify buildings (at all levels) that still generally have some negative environmental impact. USGBC's goal is to evolve the rating systems until LEED certification implies a neutral or positive environmental impact. The process will be gradual, first with Platinum-rated buildings, then proceeding through the other rating levels, until even certified projects (the lowest level of certification) are providing a neutral or positive impact on the environment.

It is important to Question

Having read this introduction to the LEED certification program, can you construct a cogent argument for your library's use of LEED in your green building project? What are the social-equity arguments that would apply to your project? What are the economic arguments? What are the environmental arguments?

Notes

1. According to *USGBC Trademark Policy* found at http://www.usgbc.org/sites/default/files/USGBC_Trademark_Policy.pdf, the official organization name is the U.S. Green Building Council. "USGBC" is the official acronym.
2. These examples and icons for LEED categories and credits are used with the permission of USGBC.

Additional Resources

Brown, Bill. "The New Green Standard: With the LEED Rating System in Place It Is Easier to Make Sure Your New Library Saves Money as It Treads Lightly on Natural Resources." *Library Journal*, December 15, 2003. Reprinted at The Green Library, http://thegreenlibraryblog.blogspot.com/2008/12/article-new-green-standard.html

California Integrated Waste Management Board. "Sustainable Building Tool Kit." www.ciwmb.ca.gov/greenbuilding/ToolKit.htm.

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Kubba, Shamil A.A. *LEED Practices, Certification and Accreditation Handbook*. Burlington, MA: Butterworth-Heinemann/Elsevier, 2010.

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CHAPTER 3

LEED® for New Construction and Major Renovations: Category by Category, Point by Point

We shape our buildings and thereafter they shape us.

—Winston Churchill

Form follows function—that has been misunderstood. Form and function should be one, joined in a spiritual union.

—Frank Lloyd Wright

Figure 3.1. Edy Ridge Elementary School, Sherwood, OR. Mechanical systems and technology are visible allowing students to gain an understanding of what makes up these systems and how they are distributed throughout the building. The building is highly engaging for students and adults alike in terms of the transparency afforded to the primary building systems. (Photo courtesy of USGBC.)

Library buildings are long-term investments in the community, so when designing libraries architects need to look fifty or one hundred years into the future. Precisely because of that long view, libraries need to be built flexibly in order to make room for expansions in size as well as changes in service needs and in wiring requirements. These factors by no means present insurmountable challenges to green libraries. The special needs of the library just need to be taken into consideration from the project's very beginnings and kept in mind all the way through completion and into building use.

As noted in Chapter 1, libraries and hospitals are two of the most challenging buildings to design. One of the main reasons is because both libraries and hospitals must find the balance between and among the sometimes conflicting needs of patrons, materials, technology, and staff. The interplay of all these factors requires careful consideration. After all, books are composed of organic materials but are inert. Technology has its own requirements regarding power and environment. Staff members have comfort issues, too, along with the need to work efficiently within the building's space and environment.

These sorts of needs, if not carefully considered, may be in competition with one another. Potential conflicts in supporting all the needs and requirements present a design challenge.

Libraries are unique structures. They are community spaces, often having a pedagogical mission. In this sense, the building IS the message. Perhaps it is no surprise, then, that as early as 2003 libraries accounted for sixteen percent of all LEED® projects.

How libraries might balance competing needs is addressed within this chapter in very specific terms. Educating the public about the integrated nature of the building and how it functions can be part of the design, as addressed in the LEED Innovation in Design category of credits. As Peter Corbet declared simply in an *Arizona Republic* headline, "Green is good."

Even as the building is considered an integrated whole, the building team needs to look at all the categories and credits individually, consider which they will pursue, and look at how these credits affect one another from category to category within the LEED 2009 New Construction and Major Renovations rating system (LEED-NC). In other words, how the building sits on the site and what vegetation surrounds it (from the Sustainable Sites [SS] category) will ultimately affect its heating and cooling (covered in the Energy and Atmosphere [EA] category). Since less than one percent of the earth's water is potable, and buildings and the people within are primary consumers of that precious resource, the standard also considers how much water the building uses both indoors and out in the Water Efficiency (WE) category. Water use is affected by many factors, including the building site, its landscaping, how the building was built, what fixtures were used, how water is treated, and the efficiency of the building's energy systems. What materials are chosen (covered in the Materials and Resources [MR] category) will affect indoor air quality (Indoor Environmental Quality [IEQ]). Where the building is built and how innovative the owners are will also be germane and garner credits in the last two categories of credits, Regional Priority (RP) and Innovation in Design (ID), as well as in the first five.

In other words, a chosen strategy may well affect several credit areas. The credits and the points dovetail with one another. The standard is designed that way to underscore that a building must be considered holistically even before an architectural drawing is rendered.

Getting Started with LEED-NC BD+C Using This Chapter

Though written in some detail, this chapter is still a broad-brush look at each LEED

category and the credits therein for green building design and construction (BD+C) and major renovations under this rating system. The *LEED Reference Guide for Green Building Design and Construction, 2009 Edition* is a 644-page, detailed book (also available as an e-book) that covers the detailed credits for new construction (and major renovations), schools, and Core and Shell buildings for this standard.

For the purposes of selecting a LEED rating system, major renovation involves major heating, ventilation, and air conditioning (HVAC) modifications, significant changes to the building's exterior surface (or envelope), and major interior rehabilitation. For a major renovation of an existing building, LEED for New Construction (NC) is the appropriate rating system. If the project scope does not involve significant design and construction activities and focuses more on operations and maintenance activities, LEED for Existing Buildings: Operations & Maintenance (LEED EB: O&M) is a more appropriate rating system because it addresses operational and maintenance issues of working buildings. LEED EB: O&M is covered in Chapter 4.

Should there be any doubt whether your project falls into a renovation under LEED-NC or greening your existing building under LEED EB: O&M, here are the guidelines which will be repeated in Chapter 4.

According to the registration walk-through process on the Green Building Certification Institute website, a project is eligible for LEED-NC if the scope of work is more than sixty percent of the *total* project square footage. Conversely, a project is ineligible for current registration for LEED EB: O&M if the scope of work is greater than fifty percent of the *existing* project square footage.4 A minimum and maximum of changes that affect the usable space must be observed, which will be outlined more specifically in Chapter 4.

This chapter, as its title suggests, is organized by LEED category, and by each credit (and its intent and options) within the category. Credits for the three distinct types of buildings (New Construction, Schools, and Core and Shell) contained within this standard vary slightly from one to another. This variation is a result of the rating system's history. Each distinct building type originally had its own rating system. In LEED 2009, these systems have been integrated into one. The authors have chosen to focus primarily on the credits for new construction (including major renovation) since this is the most likely type of construction with which librarians will be involved. However, where school credits vary significantly, they have been mentioned, since these credits would affect school libraries. Also, public libraries may find themselves working with a Core and Shell building. Core and Shell construction can be thought of as the building envelope with HVAC, waiting

for the finishes of the interior space by a lease holder. In addition, it is interesting to note that LEED has been in existence long enough that entire campuses (including libraries) are now being built to LEED standards. Therefore, the authors attempt to be inclusive in order to illustrate how the credits have been applied in a variety of instances.

It should also be noted that LEED 2009 is replete with numerous formulas, codes, regulations, and standards, most of which are not mentioned in this text. You should expect the LEED accredited professional (LEED AP) and others on your team to understand these formulas and details and to apply them as required. Your role, as the librarian and building "owner," is to understand the categories and credits and to help conceptualize and discuss (both credibly and creatively) potential strategies with members of your building team.

The examples used here are (almost) all LEED projects. More about the LEED projects can be found in the U.S. Green Building Council's database of LEED certified projects. Some of these projects are also included on the Green Libraries website. This website includes green libraries of all sorts, not all of which are LEED certified. The green libraries listed at this website may or may not have been held to an official standard for verification or certification. Others are listed in the Green Libraries Directory. The authors also used the Library Journal website, the College Sustainability Report Card, and Google to identify examples.

One more note about information presented in this chapter. If a credit category has one or more prerequisites, the prerequisites are noted. However, since LEED certification requires compliance with prerequisites, there is little to discuss with regard to how projects may or may not have completed the prerequisites or which projects completed them. Every project completed all the prerequisites. Failure to comply is not an option. Without meeting all the prerequisites, there is no certification. No plaques. No awards.

Luckily, some of the prerequisites are incorporated into credits. For example, if you achieve EA Credit 1 (Optimize Energy Performance), in doing so you will fulfill EA Prerequisite 2 (Minimum Energy Performance). Also, many states already have building requirements that fulfill LEED prerequisites. For example, California has many standards with which contractors must comply. For instance, SS Prerequisite 1 (Construction Activity Pollution Prevention) is similar to California's Stormwater Pollution Prevention Plan (SWPPP), which mandates that every job have a stormwater pollution prevention plan.

This chapter's outline, including category headings, category descriptions, credits, credit intents and options is taken directly from the *2009 Leadership in Energy and Environmental Design Green Building Rating System™*. If a credit applies to all three types of buildings—New Construction, Schools, and Core and Shell—the authors simply list the number of points that may accrue to that credit. If the credit only applies to one or two of the building types, that is so indicated.

In the case of credits that relate only to schools, the authors did not cite examples. These credits relate to the entire school campus and are not particular to the school library itself. For instance, SS Credit 10 relates to the joint use of school facilities by the community. While that may include the joint use of the school library by an outside entity, it is more likely to relate to the joint use of the playground and meeting spaces.

Throughout this chapter the authors refer to the LEED project scorecard. This is a handy tool for the contractor, owner, and/or architect. The scorecard is a guide to the LEED certification process. As the design team incorporates parts of the LEED requirements into the construction documents, the owner can track expected credits to see where your project stands. You can gauge whether or not your project will meet its goals. It can be a reality check. Reality must meet up with hope.

Credit Categories, Point by Point

The format of this and other credit-by-credit chapters (Chapter 4 and 5) is to cite the credit and its intent and options, followed by real world examples or demonstrations of how libraries have met the credit requirements. The authors have permission from the USGBC to cite the credits, their intent statements, and their options, both verbatim and abbreviated (*italicized, indented, and in green*).[1] It should be noted that the demonstrations shown do not constitute an endorsement and are designed to be illustrative.

SUSTAINABLE SITES (SS)

Choosing a building's site and managing that site during construction are important considerations for a project's sustainability. The Sustainable Sites category discourages development on previously undeveloped land; minimizes a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls stormwater runoff; and reduces erosion, light pollution, heat island effect and construction-related pollution.

The basis of the credits included in Sustainable Sites is to reduce or reverse environmental damage to a site either during construction or as a result of construction.

Once damaged, a site can take years to recover. As public stewards, we also have a responsibility to determine the best location for our library and how it relates to the surrounding area.

SS PREREQUISITE 1: CONSTRUCTION ACTIVITY POLLUTION PREVENTION
Required

> ***Intent:*** *To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dusts generation. Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the requirements of the 2003 EPA Construction General Permit or local standards and codes, whichever is more stringent.*

SS PREREQUISITE 2: ENVIRONMENTAL SITE ASSESSMENT
Required

> ***Intent:*** *To ensure that the site is assessed for environmental contamination and if contaminated, that the environmental contamination has been remediated to protect children's health. This would apply to school libraries.*

SS CREDIT 1: SITE SELECTION
One point is possible

> ***Intent:*** *To avoid the development of inappropriate sites and reduce the environmental impact from the location of a building on the site.*

> ***Options:*** *This credit does not allow you to develop buildings, hardscape, roads or parking areas in portions of sites that may include prime farmland. It also precludes building on previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood level (a technical finding of the US Geological Survey relating the probability of a catastrophic flood and used as a basis for flood insurance) land specifically identified as habitat for any species on federal or state threatened or endangered lists, land within 100 feet of any wetlands, isolated wetlands or areas of special concern, previously undeveloped land that is within 50 feet or a water body, or land that prior to acquisition for the project was public parkland.*

All of these criteria are a bit more specific than stated here, citing codes and rules of various municipal, regional and national agencies. That being said, this credit is essentially a "no-brainer." It is unlikely, in this day and age, that any municipal, regional, or state agency under whose regulations your library exists and operates will allow building in such locations. Please note that you will be required to document that you have met the requirements of SS Credit 1.

The building should protect surrounding habitats. In much of America, farmland is being built on at an alarming rate. Farmers can realize an extreme profit from selling their land compared to the marginal profit from continued farming. Some communities, such as Lancaster County in Pennsylvania, have developed programs that purchase the building rights to farmland in exchange for zoning the property as farmland in perpetuity.

Even when all these requirements are met, it is still important to consider the environment before choosing the library's location. A building should have a site that is developed wisely to reduce any interference in the existing ecosystem. When such planning does not occur, consequences are likely. For instance, the central library in Arlington, Virginia—not a LEED building—is built over an underground stream. Periodically, when the electricity fails, the underground parking garage fills with water. The building has added costs for the electricity to operate the pumps to keep the garage dry as well as for repairs when inevitable flooding occurs.

Demonstration: Hillsdale Library, a part of the Multnomah County Library system was awarded LEED Gold in 2004. It is one of many libraries that have made the reduction of environmental impact a top consideration in site selection. The library has an approved erosion plan that was implemented during construction.

SS CREDIT 2: DEVELOPMENT DENSITY AND COMMUNITY CONNECTIVITY
Up to five points are possible (Schools = 4)

> ***Intent:*** *To channel development to urban areas with existing infrastructure, protect greenfields and preserve habitat and natural resources.*

This credit has two options, one focused on development density and the other on community connectivity.

> ***Option 1:*** *To meet the standards for the development density option, the library must be constructed or renovated on a previously developed site AND in a community with a minimum density of 60,000*

square feet per acre net. The density calculation is based on a typical two-story downtown development and must include the area of the project being built. School projects have special considerations under this option.

***Option 2:** The constructed or renovated building must meet the specific criteria, including location on a previously developed site, be within a ½ mile of a residential area or neighborhood with an average density of 10 units per acre net, be within ½ mile of at least 10 basic services, and have pedestrian access between the buildings and services.*

This option is designed to limit urban sprawl and reduce transportation impacts, by locating development within walking distance of existing services. It is interesting to note that libraries are considered one of the ten basic services. Also note that mixed use projects have further requirements.

Demonstration: Houston Public Library has addressed this particular credit by remodeling older, existing branches—previously developed sites by definition. The latest branch is Oak Forest Neighborhood Library, which s seeking LEED Silver. Information about other Houston Public Library renovation projects is available at the Houston Public Library website.

Assuming the bones of the building are good, using an existing structure offers many benefits, since many older buildings are located in areas where the population is dense. Buildings constructed in the era before air conditioning usually are oriented to take proper advantage of sun and shade. They are often built with expensive, hard-to-replicate materials such as rare woods, rich marbles, and precious metals. Because they are existing structures in an urban area, they have no trouble meeting the community connectivity and/or the development density criteria. As you proceed through these standards, you will see the many ways in which renovation is favored.

SS CREDIT 3: BROWNFIELD REDEVELOPMENT
One point is possible

***Intent:** To rehabilitate damaged sites where development is complicated by environmental contamination and to reduce pressure on undeveloped land.*

There are two options for new construction core-and-shell projects.

> ***Option 1:*** *Develop on a site documented as contaminated by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local voluntary cleanup program.*
>
> ***Option 2:*** *Develop on a site defined as a brownfield by a local, state or federal government agency.*

Schools again have special considerations.

Demonstration: Bozeman Public Library (Montana), a LEED Silver library, used a brownfield site, remediating heavy metal and asbestos contaminants. Foundation Director Paula K. Beswick describes the project in the article Green from the Ground Up. Darien Public Library in Darien, CT, a LEED Gold library, also used a brownfield site. Hastings Public Library in Michigan is the state's first LEED Gold library. Being built on a brownfield site contributed to its total LEED points.

There are many considerations before using a brownfield site. Aside from understanding the definitions and required documentation, it is also important to consider the economic advantages and disadvantages of using a brownfield site. Remediation is sometimes expensive. On the other hand, brownfield sites often have existing infrastructure in place that may lower the project costs and offset some of the remediation dollars and efforts.

SS CREDIT 4: ALTERNATIVE COMMUTING TRANSPORTATION
Up to three to fifteen points are possible

A multi-part credit, all four sections of this credit promote mass transit, bicycle use, pedestrian access, and use of low-emitting and alternative fuel vehicles. The number of points assigned to this credit speaks to its importance.

Creating a building that helps reduce emissions associated with transportation is primary to this credit. Perhaps the biggest site question to ponder is where to situate our libraries. A review of the design literature suggests that libraries need a large number of parking spots to satisfy customer demand. Building size is the basis used by municipal zoning entities to determine the number of parking spots needed. However, as the density of an area increases, the zoning demand for parking can be reduced or eliminated. By locating in a large open area, as libraries often do, we are forcing our customers to come by car. Unless we are integrated into a public

transportation network, existing retail site, or multi-use facility, we are adding to the burden of vehicular use on the environment.

LEED recognizes this challenge by rewarding planners who integrate facilities for bike riders to bike to work (showers, bike racks, and bike storage). Additional credit is realized by choosing a location with public transit options. Finally, the parking that does exist is prioritized to reward car-poolers, van drivers, and low-emission vehicle drivers with spots that are reserved for their use, and close to the building.

SS CREDIT 4.1: ALTERNATIVE TRANSPORTATION—PUBLIC TRANSPORTATION ACCESS
Three to six points are possible (Schools = 4 points)

> ***Intent:*** *To reduce pollution and land development impacts from automobile use.*

There are two options.

> ***Option 1:*** *Locate the project with ½-mile walking distance of an existing or planned and funded commuter rail, light rail or subway station.*
>
> ***Option 2:*** *Locate the project within ¼-mile walking distance of one or more stops for two or more public, campus, or private bus lines usable by building occupants. A school bus system may count as one of these lines.*

Demonstration: Seattle Central Library, which achieved LEED Silver, received points because of its access to public transportation. Candler Library at Emory University, a LEED Silver project, is close to public transportation. Occupants have access to eight bus routes available within one-quarter mile of the building.

SS CREDIT 4.2: ALTERNATIVE TRANSPORTATION—BICYCLE STORAGE AND CHANGING ROOMS
1 point (Core and Shell = 2)

> ***Intent:*** *To reduce pollution and land development impacts from automobile use.*
>
> *Calculations are required to determine the number of secure bicycle storage spaces and changing and showering facilities needed to accommodate the building's occupants.*

Demonstration: Seattle Central Library, which achieved LEED Silver, earned these points by providing appropriate bicycle storage and changing rooms for its patrons. Candler Library at Emory University, a LEED Silver project, installed bike racks and a changing/shower room to support those who bike or walk to work.

SS CREDIT 4.3: ALTERNATIVE TRANSPORTATION—LOW-EMITTING AND FUEL-EFFICIENT VEHICLES

Up to three points are possible. (Schools = 2)

> ***Intent:*** *To reduce pollution and land development impacts from automobile use.*
>
> ***Option 1:*** *Provide preferred parking for low-emitting and fuel-efficient vehicles for 5% of the total vehicle parking capacity of the site. Providing a discounted parking rate is an acceptable substitute for preferred parking for low-emitting or fuel-efficient vehicles.*

Demonstration: Timberglen Branch Library, a LEED Gold building located in Dallas, Texas, provides preferred parking spaces for ultra-low-emitting vehicles.

Depending on the library's location and your clientele's perspective, priority parking spaces for electric vehicles or alternative transportation may be seen as either a wonderful idea or a major inconvenience. If you choose to include priority parking, you will want to be sure to cover this feature well in any community or public meetings held in advance of the project. You may also want to be sure you are not submitting the minimum points to qualify for whatever level of LEED you set as your goal. That way you can eliminate the priority parking without jeopardizing your application to LEED, if it becomes a major issue with your clientele.

> ***Option 2:*** *Install alternative-fuel fueling stations for three percent of the total vehicle parking capacity of the site. Liquid or gaseous fueling facilities must be separately ventilated or located outdoors. There are other considerations in this credit for both Core and Shell and school facilities. This option seems an unlikely credit for libraries given the nature of our services and our various patron profiles.*

SS CREDIT 4.4: ALTERNATIVE TRANSPORTATION—PARKING CAPACITY

Up to two points are possible

> ***Intent:*** *To reduce pollution and land development impacts from automobile use.*

There are three options for non-residential projects.

> ***Option 1:*** *Size of parking capacity must meet but not exceed minimum local zoning requirements.*
>
> ***Option 2:*** *For projects that provide parking for less that 5% (for New Construction) or 3% (Core and Shell) of full-time equivalent building occupants.*
>
> ***Option 3:*** *Provide no new parking.*

Demonstration: Candler Library at Emory University, a LEED Silver project, is served by Emory's alternative transportation system of clean-burning natural gas and electric buses that reduce local emissions and result in a no-net increase in vehicle parking. Occupants have access to eight bus routes available within one-quarter mile of the building.

SS CREDIT 5: SITE DEVELOPMENT
Two points are possible

A multi-part credit, site development relates to other later credits within *SUSTAINABLE SITES*, including stormwater design and the heat island effect. It also relates to *WATER EFFICIENCY*, particularly water-efficient landscaping.

SS CREDIT 5.1: SITE DEVELOPMENT—PROTECT OR RESTORE HABITAT
One point is possible

> ***Intent:*** *To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.*

The building should be planned to have a sustainable landscape, one that uses native or drought resistant plants that can thrive without excessive reliance on additional chemicals, fertilizers, and water. Use or restoration of native plants also can provide wildlife habitat.

Use of a landscape architect, local garden club, or extension service can be invaluable in designing this feature. Because libraries are often the most used building in

a community or on a campus, the power of demonstrating these landscaping principles cannot be over-emphasized. The ability to attract library advocates who enjoy gardening is also valuable (if labor agreements permit use of volunteers).

Demonstration: The Central Library at Seattle Public Library, which achieved LEED Silver, used drought resistant plants in its landscaping. The Ossining Public Library (New York), a LEED-certified building, used native plants.

Figure 3.2. Park Library, San Francisco CA. Natural daylighting is integrated throughout the space including the children's section and seating of the Park Library, originally constructed in 1909. (Photo courtesy of USGBC.)

SS CREDIT 5.2: SITE DEVELOPMENT—MAXIMIZE OPEN SPACE

One point is possible

***Intent*:** To promote biodiversity by providing a high ratio of open-space-to-development footprint.

The building should protect surrounding habitats. In much of America, farmland is being developed at an alarming rate. Farmers can realize a greater profit from selling their land than from continued farming. Some communities, such as Lancaster County in Pennsylvania, have developed programs to purchase the building rights to farmland in exchange for zoning the property as farmland in perpetuity. The restoration of native plants also can provide wildlife habitat.

Here are some suggestions for fulfilling this credit's requirements. First, the designated open space required by this credit does not have to be one contiguous space. Secondly, if your project has a zero lot-line site (i.e., a site on which a building is situated on or very close to the property line), this credit is not easily achievable. And, finally, in campus applications, it might be possible to earn this credit by dedicating open space on neighboring sites if the neighboring space is purchased with the project's construction budget.

Demonstration: The Durango Public Library, certified as LEED Gold, earned a credit for maximizing open space. Located on a redevelopment site next to the Animas River, the library provides significant opportunity for river views, access to open space, and natural lighting.

SS CREDIT 6: STORMWATER DESIGN

Two points are possible

The building should be designed in a way to manage stormwater runoff. As we pave more and more of the surface of our communities, the land's ability to absorb water is diminished. Runoff travels through sewage systems where it often overwhelms water treatments facilities or adds pollutants washed from the surface into streams, rivers, lakes, bays, and oceans. By developing systems that treat stormwater on site, we can reduce the impacts of this potentially destructive problem.

SS CREDIT 6.1: STORMWATER DESIGN—QUANTITY CONTROL

One point is possible

> ***Intent:*** *To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff, and eliminating contaminants.*

Demonstration: Hillsdale Library, a part of the Multnomah County Library system, was awarded LEED Gold in 2004. As part of a storm-water management plan, the library included a "bioswale" (a low-gradient channel filled with plants) at the back of the building to hold and filter rain-water runoff from the roof. The use of such pervious features or materials, including pervious pavers and planting soil, also reduces runoff. These features work together to keep rainwater from overburdening the sewer system.

Figure 3.3. UC Davis Brewery Winery and Food, Davis CA. UC Davis researchers were consulted on how to build this swale to provide for proper slope and drainage and allow the plants to thrive. (Photo by UC Davis, courtesy of USGBC.)

SS CREDIT 6.2: STORMWATER DESIGN—QUALITY CONTROL

One point is possible

Intent: To limit disruption or pollution of natural water flows by managing stormwater runoff.

The building needs to have water-efficient landscaping. Potable water, or water that is safe for drinking, is becoming scarce in some parts of the world. Outdoor water uses (hoses, car washes, etc.) account for thirty percent of the daily water

consumed in the United States. Improved landscape practices can dramatically reduce or even eliminate irrigation needs.

Demonstration: Hillsdale Library, a part of the Multnomah County Library system, was awarded LEED Gold in 2004. As part of its stormwater management plan, the library also placed three large planters on Sunset Boulevard, which borders the building. The planters are part of the landscaping, capturing the natural water flow.

Although not a LEED building, the Oaklyn Branch of the Evansville Vanderburgh Public Library, in Evansville, Indiana, has a green roof which was part of a stormwater management system. It collects graywater, wastewater suitable for irrigation use, from its green roof to water the landscaping. The Oaklyn Branch Library's green roof is the first in the United States to be outfitted with a base trickle irrigation system. The base trickle irrigation approach improves plant vitality, reduces water usage, and reduces maintenance costs compared to conventional spray or drip. It also increases the service life of the irrigation system.

Had the library been registered as a LEED project, this green roof and water system might have helped to receive credits in several areas, including Sustainable Sites (SS Credit 7.2), Water Efficiency (WE Credit 2), and/or Innovation and Design (ID). LEED certified or not, the Oaklyn Branch Library project is a good example of how a planned approach to building allows the owner to address many sustainable goals in an integrated way.

SS CREDIT 7: HEAT ISLAND EFFECT

SS CREDIT 7.1: HEAT ISLAND EFFECT—NONROOF
One point possible

Intent: To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

Green buildings reduce the amount of sunlight reflected back into the atmosphere. Known as the heat island effect, non-reflective surfaces for parking lots, roofs, and walkways absorb and transmit heat back into the local atmosphere, raising ambient temperature and having an impact on the vegetation and wildlife in the community. An article in *Slate* indicates that one sixth of the electricity used in the United States is used to cool us. By installing reflective surfaces, we can reduce the external and internal building temperatures and thus the need for electricity.

Demonstration: Planting trees and other vegetation also reduces the heat island effect. The Central Library of Seattle Public Library, a LEED Silver building, uses this non-roof strategy. Hillsdale Library, a part of the Multnomah County Library system, was awarded LEED Gold in 2004. It uses underground parking to eliminate large, paved surfaces exposed to sunlight.

SS CREDIT 7.2: HEAT ISLAND EFFECT—ROOF
One point is possible

Intent: To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

Also known as vegetated roof-tops or eco-roofs, these roofs are installed with living vegetation, from small gardens and planters to roofs that are completely covered with sod and plants. The "roots" of green roofs can be traced to ancient cultures, but vegetated roof-tops are now viewed as novel. Green roofs have many other positive benefits, including:

- helping to regulate the temperature of the building beneath;
- improving air quality by removing carbon dioxide and absorbing pollutants;
- providing a valuable wildlife habitat;
- regulating water flow from the roof by slowing the flow rates;
- requiring little maintenance; and
- reducing outside noise that travels through the roof.

Demonstration: Located in sunny Arkansas, Fayetteville Public Library's Blair Library, a LEED Silver building, chose a white membrane roof to reflect the heat of the sun and to reduce the need to cool the structure.

The Collingwood Public Library in Ontario, Canada, received LEED Gold certification and installed a green roof as part of its construction project. Hillsdale Library, a part of the Multnomah County Library system in Oregon, was awarded LEED Gold in 2004. The building's ENERGY STAR™ roof is treated to reflect sunlight.

SS CREDIT 8: LIGHT POLLUTION REDUCTION
One point is possible

Intent: To minimize light trespass from the buildings and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction and reduce development impact from lighting on nocturnal environments.

There is a need to control light pollution. There is far too much light pollution in most cityscapes. As a result it is impossible in urban areas of the country to see the stars on many evenings because the light reflected off the streets, buildings and monuments is so bright. Poorly designed outdoor lighting can have a negative effect on an adjacent property's view of the sky. Conversely, controlling the amount of light that escapes from windows, street, and exterior lights can reduce this effect. Light emissions have impacts on birds' migratory patterns and on other species as well. To learn more about light pollution, visit the International Dark-Sky Organization.

Demonstration: The Bozeman Public Library, a LEED Silver building, used "night sky"-compliant exterior light fixtures to reduce light pollution. The Central Library at Seattle Public Library, which achieved LEED Silver, chose to reduce light pollution by adopting outdoor lighting that is shielded.

SS CREDIT 9 (CORE AND SHELL): TENANT DESIGN AND CONSTRUCTION GUIDELINES
One point is possible

Intent: To educate tenants about implementing sustainable design and construction features in their tenant improvement build-out.

This credit is intended to help Core and Shell projects educate tenants about the base building sustainable design and ways tenants might enhance the sustainability of their tenant spaces, including support for earning LEED for Commercial Interiors (LEED-CI) certification.

The authors found no examples demonstrating this credit.

SS CREDIT 9 (SCHOOLS): SITE MASTER PLAN
One point is possible

Intent: To ensure that the environmental site issues included in the initial development of the site and project are continued throughout future development caused by changes in programs or demography.

This is a complex credit. In order to achieve it, the building must achieve four out of seven of the following credits: SS 1, SS 5.1, SS 5.2, SS 6.1, SS 6.2, SS 7.1, SS 8. This requires recalculating these credits with data from the master plan. The master plan must not only include current construction activity, but future construction plans as well. The authors found no examples demonstrating this credit.

SS CREDIT 10 (SCHOOLS): JOINT USE OF FACILITIES
One point possible

Intent: To make the school a more integrated part of the community by enabling the building and its playing fields to be used for non-school events and functions.

Option 1: In collaboration with the school board or other decision-making body, ensure that at least 3 of the following spaces included in the school are accessible to and available for shared use by the general public: auditorium, gymnasium, cafeteria/cafetorium, 1 or more classrooms, playing fields, and/or joint parking.

Option 2: In collaboration with the school board or other decision-making body, engage in a contract with the community or other organization to provide at least 2 dedicated-use spaces in the building. Dedicated use spaces include, but are not limited to:

- *Commercial office*
- *Health clinic*
- *Community services centers (provided by state, city, or county offices)*
- *Police offices*
- *Library or media center*
- *Parking lot*
- *One or more commercial sector businesses.*

Provide a separate entry to the spaces intended for joint use. The entry can be from a school lobby or corridor near an entrance convenient to public access, which can be secured from the rest of the school after normal school hours and which has toilets available.

This credit provides the incentive to tie a community together and make school an even more important part of residents' daily lives. As social trends move toward unifying communities and maximizing efficiency, joint-use facilities will become a more regular part of school design-and community design. Joint-use may require additional programmatic requirements because of use by multiple populations. Restroom availability and security are just two factors that would need consideration. However, such considerations might be offset by shared financing of that portion of the campus, and by contracts that address continued maintenance and operations of the joint-use facilities.

The authors found no examples demonstrating either of these two options.

WATER EFFICIENCY (WE)

Buildings are major users of our potable water supply. The goal of the Water Efficiency credit category is to encourage smarter use of water, inside and out. Water reduction is typically achieved through more efficient appliances, fixtures and fittings inside, and water-wise landscaping outside.

According to the Carbon Footprint of Water, current water consumption in the United States exceeds 43.3 billion gallons per day. The three biggest uses of water are by thermoelectric power production (forty-eight percent), irrigation (thirty-four percent) and buildings (eleven percent). Fourteen percent of the water is lost to evaporation; the rest is used, treated, and discharged into the nation's water bodies. Discharged water contaminates rivers, lakes, and potable water with bacteria, nitrogen, toxic metals and other contaminants.

Green buildings are designed to reduce the use of potable water. Strategies include low-flow or waterless bathroom fixtures and other water-efficient fixtures. According to the Massachusetts Water Resources Authority, commercial building in Boston, for example, replaced 126 toilets that used 3.5 gallons per flush with low-flow toilets that only used 1.6 gallons per flush. The initial cost was $32,000. The fifteen percent reduction in water use saved the occupant $22,800 in the first year. Another neighboring building simply replaced the aerators on 30 faucets at a cost of $300 and a savings in water of $1,250 per year.

Building owners should be able to measure and monitor water usage through the installation of water efficient fixtures that can control the amount of water discharged for each use. Often, in commercial or leased spaces, a library is unable to monitor its water consumption and must rely on the building owner for the information. More and more projects are calling for sub-metering, the use of individual water and electrical meters that allow the occupant to view the actual usage, to make changes, and to monitor the impact.

Reduction in water consumption also saves energy. According to Jennifer Easton, about fifteen percent of total commercial building energy use can be attributed to water heating alone. According to Waste Management World, water conservation that reduces the use of hot water conserves energy and reduces energy-related pollution. Water efficiency also reduces energy consumption in the wastewater infrastructure. Waste treatment consumes 56 billion kilowatt hours each year.

WE PREREQUISITE 1: WATER USE REDUCTION
Required

> ***Intent:*** *To increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.*

Employ strategies that in aggregate use twenty percent less water than the water use baseline calculated for the building (not including irrigation).

New construction, schools, and core-and shell projects must employ strategies that in aggregate use twenty percent less water than the water use baseline calculated for the building (not including irrigation). Methods for calculating the baselines for use by commercial fixtures, fittings, and appliances are included in the credit.

WE CREDIT 1: WATER EFFICIENT LANDSCAPING
Up to four points are possible

> ***Intent:*** *To limit or eliminate the use of potable water or other natural surface or subsurface water resources available on or near the project site for landscape irrigation.*

There are two options for new construction, schools, and Core and Shell projects.

> ***Option 1 (2 points)****: Reduce potable water consumption for irrigation by 50% from a calculated midsummer baseline case.*

> ***Option 2****, with two compliance paths (4 points): No potable water use or irrigation, which includes meeting the requirements in Option 1 along with one of two additional requirements: 1) using only captured rainwater, recycled wastewater, recycled graywater or treated water conveyed by a public agency specifically for nonpotable uses for irrigation, or 2) installing landscaping that does not require permanent irrigation systems, Temporary irrigation systems used for plant establishment are allowed only if removed within a year of installation.*

The building needs to have water efficient landscaping. Potable water or water that is safe for drinking is becoming scarce in some parts of the world. Outdoor water uses (hoses, car washes, etc.) thirty percent of the daily water consumed in the United States, according to the Environmental Protection Agency's *Outdoor*

Water Use in the United States. Improved landscape practices can dramatically reduce or even eliminate irrigation needs.

Demonstration: The Central Library of Seattle Public Library, which achieved LEED Silver, provides all irrigation by rainwater collected from the building exterior. The rainwater is stored in a 40,000-gallon tank. Seattle Public Library has produced a Web video about the tank and water conservation at the Central Library. Fayetteville Public Library's Blair Library, a LEED Silver building in Arkansas likewise uses a cistern to catch rainwater for irrigation.

Bozeman Public Library in Montana, which achieved LEED Silver, uses a groundwater and a stormwater management system for irrigation so that the city's processed drinking water does not need to be used to keep the library's landscaping green. The "streambed" theme in the parking area medians is also part of the water conservation strategy for the library's landscaping. The river rocks allow some rain and snowmelt to drain back into the ground (storm retention ponds) instead of across the parking area and provide for snow storage in winter.

WE CREDIT 2: INNOVATIVE WASTEWATER TECHNOLOGIES
Up to two points are possible

> ***Intent:*** *To reduce wastewater generation and potable water demand while increasing the local aquifer recharge.*

There are two options for new construction, schools, and Core and Shell projects.

> ***Option 1:*** *Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (e.g., water closets, urinals) or nonpotable water (e.g., captured rainwater, recycled graywater, on-site or municipally treated wastewater).*
>
> ***Option 2:*** *Treat 50% of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.*

Reduce potable water use for building sewage conveyance by 50% though the use of water-conserving fixtures, or treat 50% of wastewater on-site to tertiary standards.

Demonstration: Oldham County Public Main Library in LaGrange, Kentucky, a LEED Gold library, addressed Option 1 of this credit by using rain catchment, not only for watering, but also for flushing toilets, thus reducing the burden on the municipal

water supply. Rainwater used for flushing toilets results in fewer gallons of wastewater flowing into the municipal system. Hillsdale Library, a part of the Multnomah County Library System in Oregon awarded LEED Gold in 2004, installed innovative wastewater technologies to reclaim irrigation water. Ninety percent of the stormwater is recycled. The Rain Bird Corporation, a manufacturer of irrigation equipment, features the Hillsdale Library as a case study (including a diagram of the water reclamation system) in its online guide for achieving LEED water efficiency credits.

WE CREDIT 3: WATER USE REDUCTION
Up to four points are possible

> ***Intent:*** *To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.*
>
> *Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). Thirty percent reduction merits two points; a thirty-five percent reduction merits three points; and a forty percent reduction merits four points. As you may have noted, these percentages are to extend the efforts made in the prerequisites.*

This LEED category has minimum standards for bathroom fixtures that must be met before any credit is awarded:

Commercial use	
Toilets	1.6 gallons per flush
Urinals	1.0 gallons per flush
Faucets	2.2 gallons per minute
Spray valves	less than 1.6 gallons per minute.
Home use	
Toilets	1.6 gallons per flush
Faucets	2.2 gallons per minute
Showerheads	2.5 gallons per minute.

Additional points are awarded based on how far the minimums can be exceeded in terms of gallons saved.

Demonstration: A number of LEED libraries have decided to address the issue of water use. Candler Library at Emory University added low flow aerators to its water fixtures, resulting in a thirty percent reduction in water consumption to the library's

LEED Silver renovation and addition. The Lewis Library at LaGrange College in Georgia, a LEED-certified library, reduced its water usage by thirty percent by installing dual flush toilets and waterless urinals. Darien Library, the first LEED Gold Library in the Northeastern United States, uses non-potable water not only for irrigation but within the building. Portsmouth Public Library, a LEED-certified library, installed low-flow restroom faucets and toilets as well as New Hampshire's first approved no-water urinals.

WE CREDIT 4: PROCESS WATER USE REDUCTION
Up to two points are possible (Schools = 1 point)

Intent: To maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Through other WE credits, water savings are already realized from landscaping (WE Credit1), wastewater processing (WE Credit 2), and specific domestic water fixtures and fittings (WE Prerequisite1 and WE Credit 3). This credit, which applies to Schools, deals with the "rest" of the water—the process water. It covers any fixtures, appliances, and processes (such as food-waste disposals or water-cooled ice machines) that aren't included in other credits or in the Energy and Atmosphere category.

You may have access to records that will reveal how much water is used in your current library building. Review them with an eye to considering and implementing strategies such as those outlined above to reduce your usage in your current building. You don't have to wait until you have a new or a newly renovated facility to start to save.

A valuable exercise is to investigate just how much water you use in your own home using a water audit tool such as the one suggested by the Maryland Department of the Environment's Water Supply Program.

ENERGY AND ATMOSPHERE (EA)
According to the United States Energy Information Administration, in 2010 the building sector accounted for more than one-fifth of total worldwide consumption of delivered energy. The Energy & Atmosphere category encourages a wide variety of energy strategies: commissioning; energy use monitoring; efficient design and construction; efficient appliances, systems, and lighting; the use of renewable and clean sources of energy, generated on-site or off-site; and other innovative strategies.

Generating electricity from fossil fuels such as oil, natural gas, and coal negatively affects the environment at each step of production and use. The extraction, transportation, refinement, distribution, and consumption of fossil fuels consume additional resources and cause pollution. Electricity is most often generated by burning fossil fuels whose combustion releases carbon dioxide and other greenhouse gases that contribute to climate change. Coal-fired plants accounted for more than half of the United States electricity generated in 2006. Natural gas, nuclear fission, and hydroelectric generators all have adverse environmental consequences as well.

The energy performance of a building depends on its design and use. Materials, construction methods, building envelope, and water efficiency as well as the heating, ventilating, and air-conditioning (HVAC) and lighting systems all play a role in determining how efficiently the building uses energy.

Green buildings address energy performance issues in two ways. One way is to reduce the amount of energy required for building operations, and the second way is to use more benign forms of energy. The better the energy performance of a building, the fewer greenhouse gases are emitted from energy production. Electricity generation from sources other than fossil fuels also reduces the environmental impacts from a building's energy use. Additionally, improved energy performance results in lower operating costs.

Often, in real practice, the building's owner specifies the requirements (e.g., How many temperature control units will there be? Who can access them? How many people will occupy a space?). Subsequently the architect will hire an engineer to design the systems, and the contractor will hire sub-contractors to install them. It is critical to stay involved in the process throughout in order to ensure that the initial criteria are met.

Here are some of the criteria monitored under this provision:

- Meet American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 2007 standards.
- Insure newly purchased equipment contains no chlorofluorocarbons (CFCs).
- Size HVAC systems on actual loads and zones.
- Make ventilation compliant with ANSI/ASHRAE 62.1-2007.
- Complete tests for air leakage and air exchange.
- Connect HVAC system to outdoor air monitors.
- Make replacement schedule for filters available.
- Install exhaust systems where hazardous gases or chemicals are used.
- Enable individual control of temperature and ventilation wherever possible.

- Insure HVAC controls meet ANSI/ASHRAE 55-2004 requirements.
- Install lighting systems, including daylight-responsive controls.
- Insure hot water systems can be tested.

We want our building to have mechanisms in place to track the energy performance of the building, so we can make and track improvements and changes throughout its lifespan. This process involves commissioning.

The term "commissioning" comes from shipbuilding. A commissioned ship is one deemed ready for service. Before being awarded this title, however, a ship must pass several milestones. Building commissioning is much the same process in that equipment is installed and tested, problems are identified and corrected, and those who will inhabit the building are trained. A commissioned ship and a commissioned building are ones whose materials, systems, and staff have successfully completed a thorough quality assurance process. The process begins during design and continues through construction, occupancy, and operations. Commissioning ensures that the building operates initially as the owner intended and that building staff are prepared to operate and maintain its systems and equipment.

While fundamental commissioning encompasses the design and construction phases, enhanced commissioning goes a step farther, requiring these additional tasks:

- Conduct design review prior to the end of design development.
- Review contractor submittals for energy-related systems.
- Develop re-commissioning manual.
- Inspect operation of energy-related systems within ten months of final acceptance and develop plan to resolve outstanding issues.

Total building commissioning recognizes and measures the interrelationships between individual building components and systems that affect overall performance, occupant satisfaction, and cost.

The additional work associated with enhanced commissioning tends to result in a fifteen percent first-cost premium compared with fundamental commissioning. The owner should be encouraged to assess the life-cycle implications of enhanced commissioning as part of the decision-making process as to whether or not to pursue the enhanced commissioning credits.

A simple example of the need for commissioning is the performance of windows. Many windows are designated as energy-efficient. Measured in terms of an "r-

factor," windows are selected based on the manufacturer's designation (borne out by documentation) of the window's ability to reflect heat and cold back out of the building. Commissioning may involve testing to see if the windows perform as promised. For instance, pressure tests are also conducted on the installed windows to see if they are water tight by shooting them with pressurized water.

Properly executed, commissioning can substantially reduce costs for maintenance, repair and resource consumption and improve indoor environmental quality which enhances the occupant's productivity and satisfaction.

EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems
Required

> ***Intent:*** *To verify that the project's energy-related systems are installed, calibrated and perform according to the owner's project requirements, basis of design and construction documents.*

Fundamental commissioning offers many benefits, as identified in the *LEED 2009 Green Building Design and Construction Reference Guide*. They include reduced energy use, lower operating costs, reduced contractor callbacks, better building documentation, improved occupant comfort and productivity, as well as verification that the systems perform in accordance with the owner'sproject requirements.

EA PREREQUISITE 2: MINIMUM ENERGY PERFORMANCE
Required

> ***Intent:*** *To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.*

School projects must establish an energy performance rating goal for facility design using the U.S. Environmental Protection Agency's (EPA) Target Finder rating pool.

There are three options given for this prerequisite.

> ***Option 1:*** *New construction, schools and Core and Shell projects may choose a whole building energy simulation. Demonstrate a 10% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating.*

Option 2: *For new construction and Core and Shell projects, use a prescriptive compliance path. The projects need to comply with the prescriptive measures of the ASHRAE Advanced Energy Design Guide for the climate zone in which the building is located.*

Option 2 *lists three prescriptive compliance paths for New Construction and Core and Shell projects. Compliance depends on the size and use of the project. There is a separate Option 2 for schools. There is also a limitation on this option by school size.*

Option 3: *This is a prescriptive compliance path applicable to New Construction, Core and Shell, and schools. It is applicable for new construction, schools, and Core and Shell projects if they are less than 100,000 feet.*

Each of these options references a different set of energy performance standards, developed either by the American Society for Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) or New Buildings Institute.

EA PREREQUISITE 3: FUNDAMENTAL REFRIGERANT MANAGEMENT
Required

Intent: *To reduce stratospheric ozone depletion.*

This prerequisite is designed to eliminate the use of chlorofluorocarbons (CFCs) in refrigeration equipment used in all types of buildings covered by this standard.

EA CREDIT 1: OPTIMIZE ENERGY PERFORMANCE
Up to nineteen points are possible (Core and Shell = 21 points maximum)

Intent: *To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.*

For new construction, schools, and Core and Shell projects, select one of the three options. Any of the options listed here could also be used to satisfy EA Prerequisite 1 above.

Option 1: *This option involves a whole-building energy simulation for which the potential points earned are variable. LEED 2009 includes*

a chart showing the types of projects and the minimum percentage improvement required for a certain number of points. Since it is possible to achieve multiple points and achieve energy savings over the building's lifetime, most choose this option.

***Option 2:** This is a prescriptive compliance path using the ASHRAE Energy Design Guide series. There are several design guides appropriate to the project type, including a guide for small office buildings, small retail buildings, small warehouses and self-storage buildings, and K-12 school buildings. Only one point is possible with this option.*

***Option 3:** This is a prescriptive compliance path using Advanced Buildings Core Performance for buildings less than 100,000 square feet. Only one point is possible with this option.*

Each of these options is complex, with many requirements. They are explained fully in LEED 2009.

Demonstration: Since this is a credit with many potential points and many benefits in terms of energy savings over the building's lifetime, libraries focus on it and find many ways to address improved building performance.

In its LEED Silver renovation and addition, Candler Library at Emory University reduced its heating and cooling requirements by over thirty percent by careful selection of building system components, insulation, and building automation and control devices. Energy savings were also realized by utilizing variable-speed motors and occupancy sensors. The Arabian Library of Scottsdale Public Library, which is a LEED-certified project, installed an HVAC system particular to its cooling needs. The HVAC system circulates air in an underfloor system.

The Cleveland Public Library's Rice Branch, a LEED Silver building, also uses a raised floor. The modular flooring system sits twenty-four inches above a separate floor below to allow for the installation of the air conditioning (AC), heating, and electrical units. This raised floor allows for a more efficient air flow than most AC systems, which deliver air from above and must force air downward. As a result, the Rice Branch uses less energy to control the temperature of its interior than it would have if a traditional overhead heating and cooling system had been installed.

When considering insulation, consider more than the walls. For instance, Budlong Woods Branch of the Chicago Public Library, a LEED-certified library, incorporated

improved wall and roof insulation, lighting controls, and windows that keep heat out but let in light. This building needs twenty percent less energy than required by the Chicago Energy Code.

The heating, cooling, and ventilation system was designed to consume 32.5% less energy than a standard system in Portsmouth Public Library, a LEED-certified library building in New Hampshire. The amount of energy used by Bozeman Public Library's new facility, a LEED Silver building, was only slightly more than that of the old library. This efficiency is due, in part to the installation of R-20-rated translucent insulating wall panels manufactured by Kalwell Corporation. According to the Kalwall website, the energy savings were achieved

> …in large part with daylighting by Kalwall, specifically, the Kalwall+ Nano-gel daylight diffusing system, with insulating properties. Nanogel translucent aerogel is a silica aerogel and the world's lightest and best-insulating solid material. Incorporated within Kalwall's standard daylighting system, the product provides as much energy savings as a solid roof or wall. In addition, the translucent material allows natural, even daylight to be transmitted into interior areas. With an achievable U-value of 0.28 W/m²K (.05 btu/ft²/°F), the system provides insulation that is four times better than insulating glass units or any other light-transmitting system.

Bozeman Public Library also employs night flushing to reduce summer cooling loads and high efficiency HVAC equipment.

Fayetteville Public Library's Blair Library, a LEED Silver building in Arkansas, decided on a white membrane roof in order to deflect the heat of the sun. Later that same library added solar panels on that same roof. Oldham County Public Main Library in LaGrange, Kentucky, a LEED Gold library, uses efficient low-voltage artificial lighting fixtures.

Eden Prairie Library of the Hennepin County Library system in Minnesota, although not a LEED library, is worthy of note. It is believed to be the first library in the United States to use a natural gas fuel cell to create power and heat on-site. The fuel cell generates five kilowatts of electricity, which is enough power to operate a typical home and has an annual utility savings of $82,000.

EA CREDIT 2: ON-SITE RENEWABLE ENERGY
Up to seven points are possible (Core and Shell = 4 points)

Intent: *To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce the environmental and economic impacts associated with fossil fuel energy use.*

A green building uses on-site renewable energy. Energy generation from renewable sources—such as solar, wind, and biomass—avoids air and water pollution and other environmental impacts associated with producing and using coal, nuclear energy, oil, and natural gas. Renewable energy also has the potential to have an impact on air quality as particulates in the air are reduced.

Since this option has the possibility of graduated points based on the percentage of renewed energy, libraries focus on it and find many and varied ways to address improved building performance. LEED 2009 provides charts with graduated percentages and achievable points. There is one chart for new construction and schools and a second chart for Core and Shell projects.

Credit for "grid-source" green power is awarded in EA Credit 6.

Demonstration: Darien Library in Connecticut is the first LEED gold-certified library in New England. The library is primarily heated by 30 geothermal wells extending 230 feet into the earth. The library incorporated heavy mass to provide for thermal efficiency and comfort.

Anythink Brighton, a LEED Gold building in the Rangeview Library District in Colorado, became the first carbon-positive library in the United States in 2009. The combination of the library's 108kW photovoltaic system, geothermal heating and cooling, sustainable building features, the purchase of carbon credits, and the collaborative spirit of the project, Anythink Brighton is now giving energy back to the grid. Total energy savings for the district are upwards of $30,000 per year:

> "From the beginning of our capital projects, the library trustees set the standard to incorporate LEED into our buildings," says Rangeview Library District director Pam Sandlian Smith. "At every step, we have made our decisions based upon long-term sustainability. While the short-term costs may be higher, over the lifespan of the library, we are much more energy efficient and giving our community a higher return on their investment. Our goal is to eventually be carbon neutral at all of our libraries.

Bozeman Public Library, a LEED Silver facility, uses energy generated from a sixteen kW photovoltaic system on the library roof. Energy that isn't used to meet the

library's energy needs is sold to the local utility, Independent Power Systems, Inc. The library can monitor real time energy generation, including the total number of kW generated to date, and the amount of greenhouse gas emissions avoided since installation on November 27, 2006.

Oldham County Public Main Library in LaGrange, Kentucky, a LEED Gold library, uses geoexchange technology (also called a geothermal heat pump) for heating and cooling, resulting in lower electricity use, lower utility bills and lower carbon dioxide emissions.

Figure 3.4. 4940 Building, Omaha, NE. Dual-layer solar panels provide electrical output that exceeds their rated values, due to the white ethylene propylene dieneterpolymer EPDM roofing on the rear incident side. These panels were installed in part with grant money from the State of Nebraska Energy Office. Live output data is available on the MEI website. (Photo courtesy of USGBC.)

EA CREDIT 3: ENHANCED COMMISSIONING

Three points are possible

> ***Intent:*** *To begin the commissioning process early in the design process and execute additional activities after systems performance verification is completed.*

While fundamental commissioning encompasses design and construction phases, enhanced commissioning goes a step further, requiring the following additional tasks:

- Conduct design review prior to the end of design development.
- Review contractor submittals for energy-related systems.
- Develop the re-commissioning manual.
- Inspect operation of energy-related systems within ten months of final acceptance and develop plan to resolve outstanding issues.

Total building commissioning recognizes and measures interrelationships between individual building components and systems that affect overall performance, occupant satisfaction, and cost.

The additional work associated with enhanced commissioning tends to result in a fifteen percent first-cost premium compared with fundamental commissioning. The owner should be encouraged to assess the life-cycle implications of enhanced

commissioning as part of the decision-making process as to whether or not to pursue the enhanced commissioning credits.

This is a credit worth considering. Although it costs more to have a commissioning agent return to measure the building's performance a year after the owner has occupied it, it may well be worth it. The measurements performed a year later may well catch mistakes or reveal that systems and equipment need additional adjustment in order to maximize savings and avoid unnecessary expense and energy waste. Checking the building's performance may also avoid occupant complaints and callbacks, indoor air quality and thermal comfort problems, premature equipment failure, and perhaps even litigation.

Demonstration: The Annie Fisher Magnet School in Hartford, CT includes a library. It is a LEED Silver project that used enhanced commissioning. The Amenta/Emma Architects developed a case study for the project which can be found online. It summaries all the credits employed on the project.

EA CREDIT 4: ENHANCED REFRIGERANT MANAGEMENT
Up to two points are possible (Schools = 1 point)

> ***Intent:*** *To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to climate change.*
>
> ***Option 1:*** *Do not use refrigerants.*
>
> ***Option 2:*** *Select refrigerants and heating, ventilating, air conditioning, and refrigeration (HVAC&R) that minimize or eliminate the emission of compounds that contribute to ozone depletion and global climate change. The base building HVAC&R equipment must comply with a specific formula that sets a maximum threshold for the combined contributions to ozone depletion and global warming potential.*

Demonstration: Hillsdale Library, a part of the Multnomah County Library system in Oregon, was awarded LEED Gold in 2004. In order to fulfill Option 1, no chlorofluorocarbon-based refrigerants were used in the building's heating or cooling systems. The authors found no library projects which chose Option 2.

EA CREDIT 5: MEASUREMENT AND VERIFICATION
Up to three points are possible (Schools = 2; Core and Shell = 0)

Intent: *To provide for the ongoing accountability of building energy consumption over time.*

This credit requires that projects develop and implement a plan for measuring and verifying energy use that conforms to either Option B or Option D of the International Performance Measurement and Verification Protocol, Volume III. In LEED for Core and Shell, this credit applies only to the base building, and tenant sub-metering is handled separately.

Option 1: *Develop and implement a measurement and verification (M&V) plan consistent with Option D: Calibrated Simulation, as specified in the International Performance Measurement and Verification Protocol (IPMVP), Volume III.*

Option 2: *Develop and implement a measurement and verification (M&V) plan consistent with Option B: Energy Conservation Measure Isolation, as specified in the IPMVP, Volume IIIConcepts and Options for Determining Energy Savings in New Construction, April 2003.*

For Core and Shell projects, this credit applies only to the base building. Tenant sub-metering is handled separately.

Demonstration: The Georgia Gwinnett College Library, a LEED Gold library, implemented fundamental refrigerant management by measurement and verification.

EA CREDIT 6: GREEN POWER
Two points are possible

Intent: *To encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.*

Option 1: *Determine baseline electricity use. Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance.*

Option 2: *Estimate baseline electricity use. Use the U.S. Department of Energy's Commercial Buildings Energy Consumption Survey database to determine the estimated electricity use.*

This credit specifically applies to "grid-source" renewal energy. Credit for on-site green or renewal energy can be found in EA Credit 2.

Demonstration: Hillsdale Library, a part of Multnomah County Library in Oregon, was awarded Gold certification in 2004. It achieved its status, in part, by using green power (or renewable energy) in the building.

Green power may be a less popular way to attain points since green power obtained from the grid, in many areas of the country, costs more. (See also Chapter 6: Green IT.)

MATERIALS AND RESOURCES (MR)
During both the construction and operations phases, buildings generate a lot of waste and use a lot of materials and resources. This credit category encourages the selection of sustainably grown, harvested, produced, and transported products and materials. It promotes the reduction of waste as well as reuse and recycling, and it takes into account the reduction of waste at a product's source.

Building construction and operations generate a large amount of waste. Meeting the LEED credits in this category can reduce the quantity of waste while improving the building environment through the use of sustainable materials. The credits in this section focus on two main issues: the environmental impact of materials brought into the building project and the minimization of landfill and incinerator disposal for materials that leave the project building.

Sustainable materials are a hot market right now, and the interest and consumer demand have brought prices down considerably over just the last five years. We need to consider the relative environmental, social, and health benefits of the available choices when specifying materials and furniture. For example, the purchase of products containing recycled content expands markets for recycled materials, slows the consumption of raw materials, and reduces the amount of materials entering the landfill. This issue is often the area that a librarian will have the most direct influence over in their environment, and an understanding of the types and consequences of available products is important.

Waste reduction is also a key strategy here. Our waste production in the United States is about 4.6 pounds per person per day. Careful construction to reduce waste, use of recycled products, and the adaptive re-use of existing structures and materials have a dramatic impact. Even during demolition, many companies will pre-sort the demolished materials so they can be recycled into other building materials once removed from the site.

All LEED-certified projects, no matter the level of certification, will have a recycling area based on the overall size of the facility. Municipalities vary dramatically in the way they recycle materials into the waste stream, assuming they recycle at all. Some require pre-sorting and others permit co-mingling of waste because it has been proven that when trained workers go through trash, they are able to recycle a significantly higher percentage of material than the average employee can or will. Five types of material must be recycled in this category: paper, glass, plastics, cardboard, and metals. These five types alone constitute fifty-nine percent of the waste stream.

Many furniture suppliers will have their products certified by a third party that will attest to resource-saving criteria. A particular library chair, for example, can be certified by the GREENGUARD Environmental Institute. The manufacturer will pay about $35,000 per style and finish for this certification—cost that will be passed on to you as the consumer. Simple understanding of these principles can achieve the same result without excessive added costs. Furniture made with sustainable wood, staining compounds with non-volatile organic (non-VOC) compounds, and non-VOC glues purchased from a reputable library supplier guarantee similar results.

MR PREREQUISITE 1: STORAGE AND COLLECTION OF RECYCLABLES

Required

> ***Intent:*** *To facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.*

Buildings are required to provide an easily accessible area for the collection and storage of materials for recycling for the entire building. At a minimum, materials to be recycled must include paper, corrugated cardboard, glass, plastics, and metals.

Figure 3.5. Austin Convention Center, Austin, TX. View of the recycling area where the convention center waste team sorts the trash. (Photo by Maureen Roskowski, Photo courtesy of USGBC)

MR CREDIT 1: BUILDING RE-USE

Up to three points are possible (Core and Shell=1 point)

> ***Intent:*** *To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce en-*

vironmental impacts of new buildings as they related to materials manufacturing and transport.

The Core and Shell projects have only MR Credit 1, without parts 1 or 2.

MR CREDIT 1.1: BUILDING REUSE—MAINTAIN EXISTING WALLS, FLOORS, AND ROOF
One point is possible (Schools=MR Credit 1)

> ***Intent:*** *To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they related to materials manufacturing and transport.*

Charts indicating the minimum percentage building reuse for each point threshold are included in LEED 2009.

Demonstration: Many branches of Houston Public Library have been renovated. As Wendy Heger, architect, LEED AP and assistant director for planning and facilities for Houston Public Library, stated to co-author Mary Carr, it was much easier to achieve LEED certification, at whatever level, when renovating an older building than to start anew since the points for building reuse gave the library a head start toward LEED certification. Also, as she and many others have observed, buildings that have "good bones," appealing architectural features, and are aligned with or oriented to the sun, can often be the most interesting buildings when completed.

MR CREDIT 1.2: BUILDING REUSE—MAINTAIN INTERIOR NONSTRUCTURAL ELEMENTS
One point is possible

> ***Intent:*** *To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.*
>
> *For renovation of an existing building that has some interior elements (such as walls, ceilings, and doors) that are in perfectly good condition and do not need to be replaced, this is a credit to consider. This credit awards one point for refinishing and reusing fifty percent of these elements. Projects are only eligible for this credit if the gross built area of the final building is less than two times the existing built area.*

The authors were unable to find a LEED library that has garnered points under this credit. The good news is that no project has to meet all credits.

MR CREDIT 2: CONSTRUCTION AND WASTE MANAGEMENT
Up to two points are possible

> ***Intent:*** *To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials in appropriate sites.*

This credit requires a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and determines whether the materials will be sorted on-site or comingled. Calculations can be done by weight or volume, but must be done consistently. If fifty percent is recycled, one point is awarded; if seventy-five percent is recycled, two points are awarded.

Demonstration: Many libraries earn these points. One such library is Seattle Public's Central Library, a LEED Silver library. When it was built, more than seventy-five percent of the demolition and construction waste was recycled.

MR CREDIT 3: MATERIALS REUSE
Up to two points are possible

> ***Intent:*** *To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening negative effects associated with the extraction and processing of virgin resources.*

To receive points for this credit, the project must use salvaged, refurbished, or reused materials, the sum of which constitutes at least five percent (one point) or ten percent (two points), based on cost, of the total value of materials on the project.

There is possible confusion about the difference between "reused" and "recycled." Often the terms are (incorrectly) used interchangeably—but there is a distinct difference, especially for the purposes of LEED. According to the GoGreenCommercially.com website, reused refers to materials that are returned "to active use in the same or a related capacity as their original use, thus extending the lifetime of materials that would otherwise be discarded."

By contrast, recycling is the "collection, reprocessing, marketing, and use of materials that were diverted or recovered from the solid waste stream." Recycled building materials incorporate either post-consumer recycled material, or pre-consumer recycled material (also known as post-industrial material), or both.

Post-consumer materials are those that are generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product which can no longer be used for their intended purpose. Pre-consumer materials are those that are diverted from the waste stream during the manufacturing process. In either case, the materials are diverted from the waste stream and repurposed.

The large and thriving market for reused furniture makes this credit an easy one to achieve—and often items that are as good as new can be easily found. It can be a bit more time-consuming to search for furnishings that are appropriate for a specific project and to ensure that what is found is durable enough.

As a bonus, if furniture is salvaged onsite and reused again onsite for another purpose, the material can count as both toward this credit and toward the construction waste management credit. Additionally, when reused furniture is salvaged locally, use the vendor or salvage location in order to also count toward MR Credit 5 (Regional Materials). Materials salvaged onsite automatically contribute to MR Credit 5.

Furniture manufactures are willing to help the library achieve this credit. For instance, the Worden Company makes this offer: "If the project has existing Worden furniture, it can be reused and/or refurbished. In addition, any existing furniture can be evaluated to see if the materials could be salvaged or reused." Other library furniture companies may have developed similar offers.

Demonstration: The authors were unable to identify a project that used this credit. Instead they offer this tip. This credit only works on a specific sort of project. If salvaged materials are appropriate for your project, this credit should be easy to achieve. In order to achieve this credit's thresholds, you have to use a lot of salvaged materials. This credit is most feasible for small projects that target sources of salvaged materials early in the design process. Even then, it can be tricky because you often cannot specify salvaged resources and count on being able to order them from a supplier. The contractor or owner usually has to procure and stockpile salvaged items when they become available. Procurement has to happen early enough that salvaged goods can be included in the design, which is often long before they are needed on the job site.

MR CREDIT 4: RECYCLED CONTENT
Up to two points are possible

> ***Intent:*** *To increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.*

To receive this credit, the project must use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least ten percent (one point) or twenty percent (two points), based on cost, of the total value of the materials in the project.

Knowing how influential LEED and green building are to libraries, library furniture suppliers have established product lines that meet the LEED's specifications for furniture and furnishings that are made from low-emitting materials. For instance, Brodart Furniture's website states: "By adopting the *LEED® (Leadership in Energy & Environmental Design) Green Building Rating System,* Brodart joins the building industry to promote environmentally responsible building practices."

The website explains how Brodart furniture may (and the word "may" here is intentional) help contribute points toward certification through a number of credits including, Materials and Resources Credits 4.1, 4.2, 5.1, 5.2, 6, and 7 and Indoor Environmental Quality Credit 4.4. The project owner and team are responsible for ensuring that the products purchased meet the LEED criteria and that the information about the products is appropriately documented in the LEED system.

Demonstration: The Arabian Library, a branch of Scottsdale Public Library that is LEED certified, used recycled cotton insulation. The cotton came from nearby towns in Arizona, thus helping to address the regional materials credit. The ceilings are made from recycled perforated medium-density fiberboard (MDF). Fayetteville Public Library's Blair Library, a LEED Silver building purchased recycled content furnishings as part of its project.

Oldham County Public Main Library in LaGrange, Kentucky, a LEED Gold library, helped to achieve this credit by purchasing manufactured materials consisting of recycled content. These materials included post-consumer recyclables such as recycled carpet, flooring, and furnishings. More than fifty percent of the LEED-certified Portsmouth Public Library's building materials contain significant recycled content.

MR CREDIT 5: REGIONAL MATERIALS
Up to two points are possible

> ***Intent:*** *To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.*

Regional materials are defined as those that are manufactured within five hundred miles of the building site. Using local materials reduces the amount of energy needed to move the materials from the point of harvest to the point of manufacture to the building's location. Using ten percent regional materials results in one point; using twenty percent results in two points.

Demonstration: Over twenty percent of the building products used in Seattle Public Library's Central Library, which achieved LEED Silver, were manufactured within five hundred miles of Seattle, thus helping the local economy and reducing impacts of transporting materials long distances. Ossining Public Library, a LEED-certified library building in New York, also incorporated building materials located within a five-hundred-mile radius. In Arkansas, Fayetteville Public Library's Blair Library, a LEED Silver building, also adopted a "shop local" theme. More than sixty-five percent of the materials used to build the library were made within five hundred miles of the city. Hard sandstone from a local quarry was used for the fireplace in the reading lounge. In all, more than five hundred tons of natural stone were used through the library and the landscape.

Alameda Free Public Library, a LEED Silver library in California, used a minimum of twenty percent of building materials and products that are manufactured regionally. In the renovation and addition to Emory University's Candler Library, a LEED Silver project, forty-three percent of the new raw building materials were manufactured within five hundred miles of the job site, thus reducing transportation costs and supporting the local economy. Over fifty percent of the locally manufactured materials were harvested regionally.

MR CREDIT 6: RAPIDLY RENEWABLE MATERIALS
One point is possible

> ***Intent:*** *To reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.*

Rapidly renewable plants are defined as those that are harvested in a ten-year or shorter cycle. They include such natural, non-petroleum-based building materials such as cork, natural linoleum products (e.g., Marmoleum), wool, wheatboard, and strawboard.

This credit applies to both new construction and schools. It is not applicable to Core and Shell projects.

Demonstration: Fayetteville Public Library's Blair Library, a LEED Silver building in Arkansas, used cork flooring.

MR CREDIT 7: CERTIFIED WOOD
One point is possible

Intent: *To encourage environmentally responsible forest management.*

A point is earned if at least fifty percent of the wood products are *certified* by the Forest Stewardship Council (FSC) as meeting forestry management standards. Libraries traditionally use lots of wood furnishings in their buildings, so this credit can easily be addressed.

Demonstration: South Regional/Broward College Library, a joint-use library of Broward College and Broward County Libraries and a LEED Silver building, used bookshelves and furnishings made from sustainably harvested wood. The Alameda Free Library, a LEED Silver library, also used a minimum of fifty percent of wood-based materials and products that were certified in accordance with the Forest Stewardship Council's principles and criteria.

INDOOR ENVIRONMENTAL QUALITY (IEQ)
The U.S. Environmental Protection Agency estimates that Americans spend about ninety percent of their day indoors, where the air quality can be significantly worse than outside. The Indoor Environmental Quality credit category promotes strategies that can improve indoor air as well as providing access to natural daylight and views and improving acoustics.

It may be surprising to some that the EPA estimates the level of indoor pollutants is two to five times HIGHER than outdoor pollution levels. Recent increases in building-related illnesses (e.g., Legionnaire's disease) and "sick building syndrome" have heightened awareness of indoor air quality. In addition to health and liability concerns, productivity gains also drive indoor environmental quality improvements.

The potential annual savings and productivity gains from improved indoor environmental quality in the U.S. are estimated at six billion to fourteen billion dollars from reduced respiratory disease, one to four billion dollars from reduced allergies and asthma, ten to thirty billion dollars from reduced sick-building-syndrome symptoms, and twenty to one-hundred and sixty billion dollars from direct improvements to worker performance that are unrelated to health.

The bottom line here is that improved indoor air quality increases worker productivity by sixteen percent! Not having to replace missing workers can lead to significant personnel savings.

This category addresses environmental concerns relating to: indoor environmental quality; occupants' health, safety, and comfort; energy consumption; air change effectiveness; and air contaminant management. Here are the strategies used to affect these areas:

- Improving ventilation by providing operable windows. The increased ventilation may require some additional energy use, but it can be offset by taking advantage of the natural environment of the region.
- Managing contaminants in the air by:
  - eliminating cigarette smoking in any indoor area;
  - measuring carbon dioxide levels as an indicator of fresh air replenishment of lack thereof;
  - filtering the air and appliances such as vacuums to reduce putting fine particulates in the air – also seeks to protect using air handling systems during construction and flushing them after completion to rid the system of contaminants.
- Specifying less harmful materials such as those that release fewer harmful chemical compounds. Adhesives, paints, carpets, composite wood products (e.g., chipboard), and furniture all contribute chemicals into the air upon installation. Careful selection of these products can avoid off-gassing entirely.
- Allowing occupants to control desired settings such as heat and lighting. Since working conditions and available light and heat vary dramatically throughout a typical work day, studies have shown that allowing individual control actually saves energy costs. Occupants know that they have control over their environment and dress in ways that minimize extreme temperatures as well as customizing temperatures to individual taste. This factor is consistently shown as the most influential in determining occupant satisfaction with a space.
- Providing daylighting and views. Daylighting refers to the ability to visually

see light reflected from the outdoors in one's workspace. People in buildings need a connection to the outdoors. A variety of methods can be employed to make this work. A direct view is better, but the ability to connect with the changes in natural lighting throughout the day is significant.

One of the central themes of the library's mission is to preserve knowledge so that it can be passed on to future generations. For over a thousand years, books have been the dominant way to do that. While the Internet has become the information medium of choice for many, books still play a very important role in the preservation of knowledge. In order to be preserved, books must be kept away from extreme temperatures, moisture, and sunlight. In contrast, many individuals find sunlight to be the most enjoyable light for reading. Sunlight also plays a major role in green design because it can be used to reduce the reliance on artificial lighting. For a long time, libraries needed to protect the collection from the damaging ultra-violet rays of the sun. New developments in glass technology over the past ten years have given designers more flexibility in their ability to place and protect collections.[2]

Another, often overlooked, challenge the library presents is the weight of the books and periodicals. A common strategy in green design is to raise the floors to increase circulation, but the weight of the stacks can be an impediment to this strategy. To deal with this challenge, many designers have resorted to zoning the library into designated areas, so these strategies can be enacted in certain areas, and alternatives can be used in others.[3]

IEQ PREREQUISITE 1: MINIMUM INDOOR AIR QUALITY
Required

> ***Intent:*** *To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.*

IEQ PREREQUISITE 2: ENVIRONMENTAL TOBACCO SMOKE (ETS) CONTROL
Required

> ***Intent:*** *To prevent, minimize or eliminate exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental tobacco smoke (ETS).*

IEQ PREREQUISITE 3 (SCHOOLS): MINIMAL ACOUSTICAL PERFORMANCE
Required

> ***Intent:*** *To provide classrooms that are quiet so that teachers can speak to the class without straining their voices and students can effectively communicate with each other and with the teacher.*

IEQ CREDIT 1: OUTDOOR AIR DELIVERY MONITORING
One point is possible

> ***Intent:*** *To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being.*

Outdoor air delivery monitoring ensures that the ventilation system, whether natural or mechanical, provides enough fresh air to occupants. The credit requires carbon dioxide (CO2) and outdoor airflow monitors that signal when fresh air is needed according to minimum set points defined by ASHRAE 62.1-2007.

The systems will be designed to generate an alarm when the airflow values or carbon dioxide levels vary by ten percent or more from the design values via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants.

Demonstration: Appaloosa Branch Library in Scottsdale, Arizona, is a LEED Gold building. Several methods led to the clean air in Appaloosa Library. One was to monitor both the carbon dioxide level in various rooms and the quality of outside air. In this way, additional ventilation can be provided to maintain comfort without over ventilating and losing energy. An economizer function also allows air to be passed directly into the building without heating or cooling under certain conditions. A special louver allows this airflow to be controlled automatically.

IEQ CREDIT 2: INCREASED VENTILATION
One point is possible

> ***Intent:*** *To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupational comfort, well-being and productivity.*

Demonstration: Elk River Public Library, a LEED Gold project in Minnesota, used displacement ventilation to meet this credit. This ventilation consists of low-velocity air that is supplied near the floor. When the air contacts a heat source, be it a person or a computer, it heats up and rises, carrying away heat and carbon dioxide. The result is clean, fresh air in the occupied space. With this technique,

superior indoor air quality is achieved and less energy is used compared with traditional systems.

IEQ CREDIT 3.1: CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN DURING CONSTRUCTION
One point is possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or restoration and promote the comfort and well-being of construction workers and building occupants.*

Demonstration: Hillsdale Library, a part of the Multnomah County Library system in Oregon, was awarded LEED Gold in 2004. Filters within the mechanical system were used during construction to prevent contamination from the construction process. The building was "flushed" prior to opening to the public. This process involved running the mechanical system for two weeks following the completion of construction and bringing one hundred percent fresh air into the building. All filters were then replaced to remove construction-related contaminants from the system.

IEQ CREDIT 3.2: CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN – BEFORE OCCUPANCY
One point is possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.*

This credit involves the specification of less harmful materials—such as those that release fewer harmful chemical compounds. Adhesives, paints, carpets, composite wood products (e.g., chipboard), and furniture all contribute chemicals into the air upon installation. Careful selection of these products can avoid off-gassing entirely. Credit 4, in its various aspects, addresses these concerns.

Demonstration: See the description of the filtering system at Hillsdale Library, a LEED Gold building that is part of the Multnomah County Library system in Oregon, under IEQ Credit 3.1.

IEQ (SCHOOLS) CREDIT 4
Regarding Credit 4, school projects may choose from IEQ Credits 4.1-4.6 for a maximum of four points.

IEQ CREDIT 4.1: LOW-EMITTING MATERIALS—ADHESIVES AND SEALANTS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.*

All adhesives and sealants used indoors have to comply with the thresholds established by South Coast Air Quality Management District (SCAQMD) Rule 1168 and Green Seal Standard GS-36 (for aerosol adhesives). In LEED for Schools this is part of a composite point including credits 4.1 through 4.6; all of these except 4.5 reference the California Department of Health Services standard used by the Collaborative for High Performance Schools and the California Department of Resources Recycling and Recovery's Special Environmental Requirements Section 01350.

Demonstration: Candler Library at Emory University, a LEED Silver renovation and addition, used low-volatile organic compounds (low-VOC) paints, carpets, and adhesives. As a result, both outdoor and indoor air quality improved.

Projects using this credit must keep track of all the adhesives and sealants used. All adhesive and sealant products must comply with the VOC limits of the referenced standards for this credit. A summary of all interior adhesive and sealant products must be submitted, along with VOC data for each product, confirming that they comply with the referenced VOC limits.

IEQ CREDIT 4.2: LOW-EMITTING MATERIALS—PAINTS AND COATINGS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.*

Demonstration: The Arabian Library of Scottsdale Public Library, which is a LEED-certified project, used low-VOC paints.

See also Candler Library in Credit 4.1.

IEQ CREDIT 4.3: LOW-EMITTING MATERIALS—FLOORING SYSTEMS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.*

Demonstration: South Regional/Broward College Library, a joint-use public and academic library and the county's first LEED-certified building, used carpet made from recycled fibers, and low-emitting VOC materials. The Central Library at Seattle Public Library, which achieved LEED Silver, also installed low-emitting carpet. See also Candler Library in Credit 4.1.

IEQ CREDIT 4.4: LOW-EMITTING MATERIALS—COMPOSITE WOOD AND AGRIFIBER PRODUCTS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.*

Libraries, which often tend to the traditional, remain partial to wood furnishings. They have not immediately warmed to sustainable composite wood and agrifiber. Few have chosen to use composite wood or agrifiber. Instead, early LEED libraries have chosen to acquire their points on other aspects of the project.

Demonstration: The Georgia Gwinnett College Library, which was granted LEED Gold certification, has departed from that pattern. According the case study published by Potts Construction, the library is using low-emitting materials and agrifiber.

IEQ CREDIT 4.5: LOW-EMITTING MATERIALS—FURNITURE AND FURNISHINGS
One point is possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.*

Of all the IEQc4 credits, IEQc4.5 can be the most straightforward points to earn, especially if you choose to meet the credit by using GREENGUARD Indoor Air Quality certified furniture (Option 1). Teams may find it difficult or costly. However to meet all their furniture needs through GREENGUARD, due to somewhat limited choices.

If you decide to pursue this credit under Option 1, simply review the list of certified furniture manufacturers on the GREENGUIDE product guide site.

Demonstration: The Stony Brook Southampton Library at Stony Brook Southampton University, a LEED-certified library, used furniture that met both met Forest Stewardship Council and GREENGUARD certification.

IEQ CREDIT 4.6: LOW-EMITTING MATERIALS—CEILINGS AND WALL SYSTEMS
One point is possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.*

Various materials manufacturers are attempting to make compliance with these credits easy. For example, the Armstrong World Industries website lists how Armstrong's products comply with LEED. The use of Armstrong's composite wood products for ceilings and walls may contribute toward this credit. The Armstrong WoodWorks® ceiling products meet California Air Resources Board (CARB) phase 1 levels and are available as a no-added formaldehyde composite product to meet LEED requirements.

Unlike most composite wood or traditional millwork products used in interiors, Armstrong WoodWorks Ekos wall systems meet these requirements. In addition, these products meet and exceed the State of Washington and California Section 01350 requirements for low emissions with no detectable formaldehyde emissions.

Demonstration: The Benning/Dorothy I. Height Library of the District of Columbia Public Library system is a LEED Silver library completed in 2010. The project used Armstrong, Knoll, and Panelite walls, which qualified the library for this credit.

IEQ CREDIT 5: INDOOR CHEMICAL AND POLLUTION SOURCE CONTROL
One point is possible

> ***Intent:*** *To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.*

Adding walk-off mats at the entrances is an easy way to earn credit in this category. This simple technique for minimizing indoor pollutants is so common that it is rarely highlighted when citing building features specific to achieving LEED certification.

Demonstration: Other strategies are also used to minimize occupants' exposure to particulates and pollutants. For instance, Oldham County Public's Main Library in LaGrange, Kentucky, a LEED Gold library, addressed this credit by monitoring its air quality.

IEQ CREDIT 6.1: CONTROLLABILITY OF SYSTEMS LIGHTING

One point is possible

> ***Intent:*** *To provide a high level of lighting system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.*

Demonstration: Budlong Woods Branch of the Chicago Public Library, a LEED-certified library, used lighting controls to help achieve this credit.

IEQ CREDIT 6.2: CONTROLLABILITY OF SYSTEMS—THERMAL COMFORT

One point is possible

> ***Intent:*** *To provide a high level of thermal comfort system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity.*

Demonstration: Independence Park Library in Baton Rouge, Louisiana, has been designed to meet LEED standards. Credit 6.2 is one of the credits the design team decided to pursue. The new library building is being built with individual control of thermal comfort.

IEQ CREDIT 7.1: THERMAL COMFORT—DESIGNS

One point is possible

> ***Intent:*** *To provide a comfortable thermal environment that promotes occupant productivity and well-being.*

Demonstration: The West Valley Branch of the San Jose Public Library was the first public building in the City of San José to achieve LEED Certification. According to its LEED scorecard, the library received points for this credit.

IEQ CREDIT 7.2: THERMAL COMFORT—VERIFICATION

One point is possible

Intent: *To provide for the assessment of building occupants' thermal comfort over time.*

Demonstration: The new San Mateo Public Library has received the U.S. Green Building Council's Gold LEED certification. According to the City of San Mateo's website, the library "was designed and built as a green facility in response to strong sentiments from the San Mateo community that the new library be a green building." The library decided to meet the requirements of this credit through a satisfaction survey of occupants regarding thermal performance. The survey was to be administered within six to eighteen months after occupancy. The responses were designed to be anonymous. If twenty percent or more of building occupants were dissatisfied, the library would develop a plan for corrective action. The plan would be in accordance with ASHRAE 55-2004 and its subsequent addenda and editions.

IEQ CREDIT 8.1: DAYLIGHTS AND VIEWS—DAYLIGHT
One point is possible

Intent: *To provide for the building occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.*

Demonstration: Cleveland Public Library's Rice Branch, a LEED Silver building, installed floor-to-ceiling windows maximize the use of natural light. The natural light has not only been proven to enhance people's ability to learn, but it also reduces the need for electricity. A sophisticated daylight harvesting system that allows the overhead lights to automatically dim and brighten based on daylight sensors helps to minimize the use of electricity. In part because of this enhancement, the branch uses 21.4 percent less energy than a typical building, which also contributed to the library's LEED energy credits.

IEQ CREDIT 8.2: DAYLIGHT AND VIEWS—VIEWS
One point is possible

Intent: *To provide building occupants a connection to the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.*

Demonstration: Anythink Brighton, a LEED Gold building in the Rangeview Library District in Colorado, became the first carbon-positive library in the United States

in 2009. The library used solar tubes as one design element that contributed to this credit. The solar tubes capture daylighting and deliver it inside to illuminate interior spaces. The Ossining Public Library (New York), a LEED-certified building, used sunlight to provide up to ninety percent of the light needed. Budlong Woods Branch of the Chicago Public Library, a LEED-certified library, installed windows that keep heat out, but let the light in.

Figure 3.6. Edy Ridge Elementary School, Sherwood, OR. Daylighting and new strategies also make this large school building more 'kid-friendly' by breaking down its scale to more residential-level. Views through the building interior extend to the exterior, contributing to visual connectivity and monitoring by teaching staff. (Photo courtesy of USGBC.)

INNOVATION IN DESIGN (ID)

The Innovation in Design credit category provides bonus points for projects that use new and innovative technologies and strategies to improve a building's performance well beyond what is required by other LEED credits or in green building considerations not specifically addressed elsewhere in LEED. This credit category also rewards projects for including a LEED Accredited Professional on the team to ensure a holistic, integrated approach to the design and construction phase.

Sustainable design strategies and measures are constantly evolving and improving. New technologies are continually being introduced to the marketplace, and up-to-date scientific research influences building design strategies and practices. Occasionally a strategy results in performance that greatly exceeds what is required in an existing LEED credit. Other strategies may not be addressed by any LEED prerequisite or credit but warrant consideration for their sustainability benefits. In addition, LEED is most effectively implemented as part of an integrated design process, and this category addresses the role of the LEED Accredited Professional in facilitating that process.

ID CREDIT 1 INNOVATION IN DESIGN

Up to five points are possible (Schools = 4)

> ***Intent:*** *To provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in green building categories not specifically addressed by the LEED Green Building Rating System.*

Demonstration: An educational program regarding sustainability is a fitting way for a library to garner points in this category. Some version thereof is done by many LEED library projects. Rosemary Garfoot Public Library, a LEED Silver library in Cross Plains, Wisconsin, created a self-guided tour that enables individuals to learn about its green elements, such as rain gardens, cork flooring, waterless urinals, and wheatboard cabinetry. A description of the tour is available online.

The library might also look into the possibility of creating a specific, significant sustainability collection. Housing and highlighting such a collection might also be a way of achieving a credit under this category. The library might also consider a sustainability center within the library. Such a center, again, might garner the library an innovation credit.

Another popular way to meet the requirements of Credit 1 is to develop and use a comprehensive green cleaning plan. A number of libraries have chosen this approach. Almeda Free Library's Castro Valley Library, a LEED Silver library, uses green cleaning with a "less toxic" cleaning program. Darien Library also committed to a green cleaning program as one way to reach its LEED Gold status.

ID CREDIT 2: LEED ACCREDITED PROFESSIONAL
One point is possible

> ***Intent:*** *To support and encourage the design integration required by LEED to streamline the application and certification process.*

Like every other credit, the team needs to choose whether or not to use a LEED Accredited Professional (LEED AP) on the project. Needless to say, although as optional as every other credit, the authors think this one is a must!

In actuality, most projects employ a LEED professional. You need only check a project's scorecard to find out whether it included a LEED AP.

SCHOOLS ID CREDIT 3: THE SCHOOL AS A TEACHING TOOL
One point is possible

> ***Intent:*** *To integrate the sustainable features of a school facility with the school's educational mission.*

REGIONAL PRIORITY (RP)
Regional Priority Credits (RCPs) are not new LEED credits. They are existing credits

that the USGBC chapters and regional councils designated as being particularly important for their specific regions. Therefore, an incentive in the form of a bonus point is given for earning up to four of the six credits identified as relevant in a project's given location.

RP CREDIT 1: REGIONAL PRIORITY
Up to four points are possible

> ***Intent:*** *To provide an incentive for the achievement of credits that address geographically specific environmental priorities.*

The USGBC recognizes that some environmental issues are unique to a locale. The regional councils have identified distinct environmental zones within their areas and allocated six credits to encourage design teams to focus on regional priorities. There may be some distinct areas within your own region that might be worthy of this type of consideration. Beach front sites on the east coast, desert communities, and communities with challenging weather patterns are all examples.

The credits are specific to a project's ZIP code in lists downloadable by state as Microsoft Excel files.

Case Studies

The authors offer three case studies as capstones to this chapter.

1. A LEED Building Design and Construction (BD+C) public library: Lake View Terrace Branch Library (LEED Platinum). Lake View Terrace Library is a branch library and multi-use facility for the City of Los Angeles. It is located in the San Fernando Valley within the Hansen Dam Recreation Area. The building program includes the library, a community room, an environmental display gallery, and an exterior courtyard. CalRecycle features the Lake View Terrace Branch Library as a Sustainable (Green) Building Case Studies. As an early LEED Platinum building, the Lake View Terrace Branch Library is the subject of a USGBC case study. BuildingGreen, Inc., publisher of the online periodical *Environmental Building News*, has also published the case study of the Lake View Terrace Branch building project.

2. *A LEED Building Design and Construction (BD+C) academic library***:** The Richard J. Klarchek Information Commons, Loyola University, Chicago (LEED Silver).

The Loyola University Information Commons is a 69,000 sq. ft. information commons and digital research library that occupies a magnificent site on the shores of Lake

Michigan at the University's Lake Shore Campus. The site is directly between the existing land-marked Madonna Maria Della Strata Chapel and the Cudahy Library. The information commons, completed in 2007, creates a dynamic and transparent eastern edge to a new quadrangle that will be formed once an existing Jesuit residence is demolished. The university has developed on online description of the building's environmental features.

3. A LEED K-12 Facility, including a library: The Sidwell Friends Middle School (LEED Platinum).

The Sidwell Friends School, a day school for students in pre-K through 12th grade, was founded on Quaker philosophy, which includes a dedication to environmental stewardship. The Sidwell Friends Middle School is the first LEED Platinum-rated pre-K-12 school in the United States. The school is featured on Jetson Green, a website promoting sustainability and green design. The USGBC case study of the project is available at the USGBC website. An abbreviated version of the case study is available on FMLink, a website devoted to facilities management.

Questions

1. Have you visited any buildings that have been LEED certified? Was there a difference that you could observe between the building you visited and a non-certified building? What contributed to the difference?

2. Visit a library furniture supplier's website. How do they promote the sustainability of their products? Do you see any themes among the vendors? How have these ideas influenced popular furniture stores (e.g., Ikea)?

3. What unique environmental challenges does your region face? How would the existing LEED categories address them? Which of these environmental challenges do the regional credits address? What other environmental challenges have been left out? Might those not included be worthy of an Innovation in Design credit? If so, how might you accomplish that?

4. Which Innovation in Design credits might be appropriate for a library as an educational institution?

5. Do you intend to engage a LEED AP for your building project? What benefits might such an individual bring to the project? How else might you approach this project in a holistic manner?

Notes

1. U.S. Green Building Council, *LEED Reference Guide for Green Building Design and Construction*, 2009 ed. (N.P.: U.S. Green Building Council, 2009). The credits and intent portions of this chapter are taken directly from the reference guide.
2. Gerard B. McCabe, "New Concepts for Technology in Library Design," in *Planning the Modern Public Library Building* ed. Gerard B. McCabe and James R. Kennedy (Westport, CN: Libraries Unlimited, 2003), 207-208.
3. Alexander P. Lamis, "Greening the Library: An Overview of Sustainable Design," in *Planning the Modern Public Library Building* ed. Gerard B. McCabe and James R. Kennedy (Westport, CN: Libraries Unlimited, 2003), 31-45.

Additional Resources

Carpet and Rug Institute. "Carpet Makes the World Better: Science Makes the Carpet Better." http://www.carpet-rug.org. This site includes information about the Carpet and Rug Institute's Green Label Plus program for low-emitting carpets and adhesives.

Daylighting Collaborative. "Light Every Building Using the Sky." http://www.daylighting.org.

Green Plus Institute for Sustainable Development. "Latest News." http://www.gogreenplus.org

Haselbach, Liv. *The Engineering Guide to LEED-New Construction: Sustainable Construction for Engineers*. 2nd Edition. GreenSource. New York: McGraw Hill, 2010.

McCarthy, Richard C. *Managing Your Library Construction Project: A Step-by-Step Guide*. Chicago: ALA Editions, 2007.

PlantNative. "PlantNative." http:// www.plantnative.org.

Thompson, J. William and Kim Sorvig. *Sustainable Landscape Construction: A Guide to Green Building Outdoors*. 2nd ed. Washington, D.C.: Island Press, 2007.

U.S. Environmental Protection Agency. "Environmentally Preferable Purchasing: Database of Environmental Information for Products and Services. http://yosemite1.epa.gov/oppt/eppstand2.nsf.

CHAPTER 4

LEED® for Existing Buildings: Operations and Maintenance: Category by Category, Point by Point

The historic buildings of our towns and cities embody our personal past—the hospitals where we were born, the schools we attended, the stores where we shopped, the theaters where we cheered and sobbed. They also exemplify our development as a nation—from vernacular farmhouses to industrial buildings, housing to architectural masterpieces. Buildings were traditionally built with pride, with individualized embellishments and solid construction meant to last and proclaim the social position of the owners. We treasure the landmarks of our older neighborhoods, encouraging their rehabilitation and reuse.[1]

—Katherine H. Stevenson
Associate Director, Cultural Resource Stewardship and Partnerships
National Park Service

Figure 4.1. Westover Branch Library, Arlington Public Library, Virginia. The shell of the original school building was retained, as were the window openings. The exterior look and feel remained what the neighborhood was accustomed to; the new modern additions brought the building function, and connected it to the current century. (Photo courtesy of Arlington Public Library.)

The very nature of the library as an institution is to collect. Collections grow and increase in size and breadth. As the contents age, their care grows increasingly complex. Often local laws prohibit the destruction of materials purchased with tax dollars. Needs change as the community changes. Over time, libraries constructed for many purposes and audiences find themselves sacrificing room intended for customers in order to make room for these collections. Systems designed to preserve a certain balance between people and inert materials like books are overwhelmed as that balance is destroyed. Libraries popular with their users occupy locations that have acquired meaning for their customers over time.

The reasons to renovate an existing library are many. Renovation itself is a green act. Reuse of existing materials and maintenance of established vegetation and water runoff are two of many aspects of renovation preferable to abandoning

resources in use and consuming new ones in the construction of a new building. Political and economic realities are often major factors that lead to the decision to renovate or to build new. Often, a new use for an existing building can be identified. The demographic center of a community can shift and make a new location more advantageous, but renovation of the former building, as a part of the entire project, should not be ruled out.

Renovations provide an ideal opportunity for libraries to replace worn finishes and furnishings with those more functional and easier to care for. Floor coverings that do not require the use of chemicals in care and cleaning are now available. Upholstery that resists inking and tearing can be obtained today. Heating and air conditioning systems can be managed at a macro level to reduce costs and increase comfort for users of the building. New fixtures can minimize the risk of infection and consumption of paper goods in restrooms. Shelving can include wheels so that collections can be relocated and shelving re-used without expensive future renovations. These exciting prospects can be included in a renovation design.

Figure 4. 2. Park Library, San Francisco CA. Natural daylighting is integrated throughout the space including the children's section and seating of the Park Library, originally constructed in 1909. (Photo courtesy of USGBC.)

At the same time, data provided to the USGBC and GBCI show that renovation under the LEED® for Existing Buildings: Operations & Maintenance *(LEED EB: O&M)* rating system saves significantly in the costs of operating a facility. According to the USGBC, the "total financial benefits of green design are estimated to be almost $50/sq ft for Certified and Silver level green buildings, and over $75/sq ft for Gold and Platinum level buildings. This is over ten times larger than the average 2% cost premium—about $3-5/sq ft in California—for the 33 green buildings analyzed."

Overview of *LEED EB: O&M*

LEED provides an option to guide building owners in the process of greening your existing building. *LEED EB: O&M* was designed to certify the sustainability of ongoing operations of existing commercial and institutional buildings. LEED for New Construction was covered in Chapter 3 and is designed to assess new commercial or institutional buildings. Once a project is completed under LEED for New Construction, the USGBC encourages building owners and occupants of the building

to certify its ongoing operations under *LEED EB: O&M*. Often, building functionality varies from the intent of the original design. A reassessment under *LEED EB: O&M* can ensure economical and sustainable operations for the long term.

Commercial buildings eligible for certification under *LEED EB: O&M* include offices, retail and service establishments, institutional buildings (e.g., libraries, schools, museums, churches), hotels, and residential buildings of four or more habitable stories. *LEED EB: O&M* provides owners and operators of existing buildings an entry point into the LEED certification process and is applicable to the following types of projects:

- Building operations, processes, systems upgrades, minor space-use changes, and minor facility alterations or additions; and

- Buildings new to LEED certification as well as buildings previously certified under LEED for New Construction, LEED for Schools, or LEED for Core & Shell; these may be either ground-up new construction or existing buildings that have undergone major renovations.

LEED EB: O&M encourages owners and operators of existing buildings to implement sustainable practices and reduce the environmental impacts of buildings over their functional life cycles. Specifically, the rating system addresses exterior building site maintenance programs, water and energy use, environmentally preferred products and practices for cleaning and alterations, sustainable purchasing policies, waste stream management, and ongoing indoor environmental quality. *LEED EB: O&M* is targeted at single buildings, whether owner occupied, multitenant, or multiple-building campus projects. It is a whole-building rating system; individual tenant spaces are ineligible.

To qualify under the *LEED EB: O&M* rating system, certain minimum and maximum changes that affect the usable space must be observed. At a maximum, no more than fifty percent of the total building floor area or alterations that cause relocation of more than fifty percent of the regular occupants are eligible. Above that threshold, LEED for New Construction is applicable. Similarly, the following activities are the minimum eligible for *LEED EB: O&M*:

- Construction activity by more than one trade
- Substantial changes to at least one entire room requiring the isolation of the work site from regular building occupants for the duration of the construction
- Additions that increase the total building floor area by at least five percent

- Additions or alterations below these limits are considered repairs, routine replacements, or minor upgrades.

To earn LEED certification, the applicant project must satisfy all the prerequisites and qualify for a minimum number of points to attain the established project ratings as listed below. Having satisfied the basic prerequisites of the program, applicant projects are then rated according to their degree of compliance within the rating system. Any first-time application for certification to the *LEED EB: O&M* program—whether for a building never certified under LEED or a building previously certified under LEED for New Construction, LEED for Schools, or LEED for Core & Shell—is considered an *initial* LEED for Existing Buildings: O & M certification. Any *LEED EB: O&M* application for a building previously certified using *LEED EB: O&M* is considered a *LEED EB: O&M recertification*. These buildings can apply for recertification as frequently as each year but must file for recertification at least once every five years to maintain their *LEED EB: O&M* certification.

Some prerequisites and credits in LEED 2009 for Existing Buildings: Operations & Maintenance require that operating data and other documentation be submitted for the performance period. For the initial *LEED EB: O&M* certification, the performance period is the most recent period of operations preceding certification application; it must be a minimum of three months for all prerequisites and credits except Energy and Atmosphere (EA) Prerequisite 2 and Credit 1, which have longer minimum durations of one year. At the project team's option, the performance period for any prerequisite or credit may be extended to a maximum of twenty-four months preceding certification application. Consistent start times and durations of the performance periods for each prerequisite and credit are preferred but not strictly necessary. However, all performance periods must overlap and terminate within one week of each other.

LEED 2009 Minimum Program Requirements (MPRs) for Existing Buildings

The LEED 2009 Minimum Program Requirements (MPRs) is a USGBC policy that lists the minimum characteristics that a project must possess in order to be eligible for certification under LEED 2009. These requirements define the categories of buildings that the LEED rating systems were designed to evaluate, and taken together they serve three goals: to give clear guidance to customers, to protect the integrity of the LEED program, and to reduce challenges that occur during the LEED certification process. It is expected that MPRs will evolve over time along with LEED rating system improvements. The MPRs for *LEED EB: O&M* are shown here:

1. Must Comply with Environmental Law

The LEED project building, all other real property within the LEED project boundary, any project work, and all normal building operations occurring within the LEED project building and the LEED project boundary must comply with applicable federal, state, and local building-related environmental laws and regulations in place where the project is located. This condition must be satisfied from the commencement of the LEED project's initial LEED EB: O&M performance period through the expiration date of the LEED certification.

A lapse in a project's compliance with a building-related environmental law or regulation that results from an unforeseen and unavoidable circumstance shall not necessarily result in non-compliance with this MPR. Such lapses shall be excused so long as they are remediated as soon as feasibly possible.

2. Must Be a Complete, Permanent Building or Space
All LEED projects must be designed for, constructed on, and operated on a permanent location on already existing land. LEED projects shall not consist of mobile structures, equipment, or vehicles. No building or space that is designed to move at any point in its lifetime may pursue LEED Certification. LEED projects must include at least one existing commercial, institutional, or high-rise residential building in its entirety.

3. Must use a Reasonable Site Boundary

3.1. The LEED project boundary must include all contiguous land that is associated with and supports normal building operations for the LEED project building, including all land that was or will be disturbed for the purpose of undertaking the LEED project.

3.2. The LEED project boundary may not include land that is owned by a party other than that which owns the LEED project unless that land is associated with and supports normal building operations for the LEED project building.

3.3 LEED projects located on a campus must have project boundaries such that if all the buildings on campus become LEED certified, then one hundred percent of the gross land area on the campus would be included within a LEED boundary. If this requirement is in conflict with MPR 7 (compliance with minimum building area to site area ratio), then MPR 7 takes precedence.

3.4. Any given parcel of real property may only be attributed to a single LEED project building.

3.5. Gerrymandering of a LEED project boundary is prohibited; the boundary may not unreasonably exclude sections of land to create boundaries in unreasonable shapes for the sole purpose of complying with prerequisites or credits.

4. Must Comply with Minimum Floor Area Requirements of New Construction, Core and Shell, Schools, Existing Buildings
The LEED project must include a minimum of one thousand square feet (ninety-three square meters) of gross floor area.

5. Must Comply with Minimum Occupancy Rates
Full-Time Equivalent Occupancy. The LEED project must serve one solitary or more full- time equivalent (FTE) occupant(s), calculated as an annual average in order to use LEED in its entirety. If the project serves less than one annualized FTE, optional credits from the Indoor Environmental Quality (IEQ) category may not be earned. (The IEQ prerequisites must still be earned.)

Minimum Occupancy Rate. The LEED project must be in a state of typical physical occupancy, and all building systems must be operating at a capacity necessary to serve the current occupants, for a period that includes all performance periods as well as at least the twelve continuous months immediately preceding the first submission for a review.

6. Must Commit to Sharing Whole-Building Energy and Water Usage Data
All certified projects must commit to sharing with USGBC and/or GBCI all available actual whole-project energy and water usage data for a period of at least five years. This period starts on the date that the LEED project begins typical physical occupancy if certifying under New Construction, Core & Shell, Schools, or Commercial Interiors, or the date that the building is awarded certification if certifying under Existing Buildings: Operations & Maintenance. Sharing this data includes supplying information on a regular basis in a free, accessible, and secure online tool or, if necessary, taking any action to authorize the collection of information directly from service or utility providers. This commitment must carry forward if the building or space changes

ownership or lessee.

7. Must Comply with a Minimum Building-Area-to-Site-Area Ratio
The gross floor area of the LEED project building must be no less than two percent of the gross land area within the LEED project boundary.

You will observe as we move into the LEED rating system for this category that many of the credits and prerequisites present complex formulas or other concepts that may be unknown to you as a library professional. We hope that you will recognize the value of having a building team so that you can ask questions about these issues and become more knowledgeable instead of accepting what has been proposed in bid or design documents. Your intervention can directly influence the operating costs and the comfort and safety of library staff as they occupy the space.

Credit Categories, Point by Point

The *LEED EB: O&M* rating system will be described in terms of the categories of credits which can be built synergistically to improve the performance of the building. Some of the categories have prerequisites. These prerequisites are considered baseline improvements to qualify the project. Some of the credits build upon one another so that, as performance improves, the number of credits attained increases. The USGBC has found that as green building standards have been more fully embraced, the baseline performance standards have risen accordingly. For example, in earlier versions of the rating systems, compliance with the ENERGY STAR system garnered points. Now, compliance with ENERGY STAR is a prerequisite. These prerequisites, like the Minimum Program Requirements stated earlier in this chapter, must be met before a project will be considered. In this and the chapter following, not all demonstrations will be library examples because the co-authors could not find examples illustrative of each credit.

Figure 4.3. Westover Branch, Arlington Public Library, VA. This view shows the original school building, now the adult reading room in a joint-use public library and public school facility. (Photo courtesy Arlington Public Library.)

Checklists that outline the different ratings systems and the points that can be earned help project teams plan and manage their credits. The USGBC website provides a checklist for *LEED EB: O&M*. LEED also uses an online system to document your project known as LEED Online. Once you register a project for certification, the online system and related submissions forms become available to you.

Once you and your team have ascertained that your building potentially qualifies under the *LEED EB: O&M* rating system, the LEED program allows your building to achieve points toward certification at the desired level. What follows is a detailed examination of the *LEED EB: O&M* credits, point by point. Each is identified with the intent of the credit, as well as a rationale. The options that will qualify your project for a potential credit are described as well. Wherever possible, a reference to a project that demonstrates achievement of the credit is provided. It should be noted these examples are designed to be illustrative and do not constitute an endorsement.

Because the *LEED EB: O&M* rating system has one of the lowest numbers of projects certified, some of the projects demonstrated are not libraries, as might be ideal. The William J. Clinton Presidential Library & Museum and the Burton Barr Central Library of the Phoenix Public Library in Arizona are the two prominent examples of libraries certified under *LEED EB: O&M*. It is also important to note that data about the resources consumed by the building and its occupants must be collected prior to beginning the project. Once available, the owners can determine whether they will be able to achieve the energy reduction requirements as intended.

SUSTAINABLE SITES (SS)

The Sustainable Sites credits address the environmental concerns related to building landscape, hardscape, and exterior building management practices. *LEED EB: O&M* credits promote the following measures:

- Implementing effective grounds management
- Practicing low-impact hardscape strategies
- Planting sustainable landscapes
- Reducing emissions associated with transportation
- Protecting surrounding habitats
- Managing storm water runoff
- Reducing the heat island effect
- Eliminating light pollution.

Environmentally sensitive site-maintenance practices reduce site operation and maintenance costs while creating and maintaining outdoor spaces that are attractive and healthy for both building occupants and local flora and fauna. A total of twenty six points is available.

SS CREDIT 1: LEED-CERTIFIED DESIGN AND CONSTRUCTION

Up to 4 points are possible

> ***Intent:*** *To reward environmentally sensitive building designs and construction, this in turn enables high performance building operations to be more easily achieved.*

It has been documented that buildings constructed and certified using the LEED rating systems realize economic benefits in the costs of operating their facilities. Demonstrating that the building holds an existing certification is documented easily by referring to the scorecard for the project and referencing it in the credit documentation.

> ***Option 1:*** *Demonstrate that the building has been previously certified under LEED for New Construction.*
>
> ***Option 2:*** *Show that the building has been previously certified under LEED for Schools.*
>
> ***Option 3:*** *Show that the building has been previously certified under LEED for Core & Shell and at least seventy-five percent of the floor area has also been certified under LEED® for Commercial Interiors.™*

Figure 4.4. William Jefferson Clinton Library, Little Rock, AR. The Clinton Library was certified under both New Construction (Silver – 2004) and Existing Buildings (Platinum–EBOM–2007) ratings systems. (Image ©Albert Vecerka courtesy of USGBC.)

Demonstration: The William J. Clinton Presidential Library was certified under LEED for New Construction Silver upon completion in 2004. It was since certified LEED for Existing Buildings Platinum. It was eligible for a second certification under the first option. LEED for Existing Buildings was the predecessor of the current 2009 version of *LEED EB: O&M*.

SS CREDIT 2: BUILDING EXTERIOR AND HARDSCAPE MANAGEMENT PLAN

One point is possible

> ***Intent:*** *To encourage environmentally sensitive building exterior and hardscape (i.e., paved areas such as streets, sidewalks, and parking lots) practices that provide a clean, well-maintained, and safe building exterior while supporting high performance building operations.*

We are often unmindful of the practices employed by those who maintain our facilities. The chemicals and equipment they use contribute to the pollution of the local environment. Chemicals used on walkways, painting jams, window cleaning, and the like may introduce pollutants. By proactively controlling and setting standards for building maintenance, we can have an impact on the local environment.

> ***Options:*** *This is a commonly attained credit because it has a low cost and is relevant to any building type. The current version of the rating system requires that twenty percent of the practices put in place must be considered "best practices." These practices include the following areas:*
>
> - *Maintenance. Power equipment often uses fossil fuels, can be noisy, and generates significant emissions. Replace conventional equipment with low-impact alternatives (electric powered or hand operated) that minimize waste.*
> - *Snow and ice removal. Some chemicals used in de-icing produce chemical runoff and can be toxic to vegetation. Use less disruptive chemicals, such as magnesium chloride or the like, for small areas.*
> - *Cleaning of building exterior, sidewalks, and other hardscapes. Clean only as often as necessary to maintain safety and site appearance. Products used should conform to Indoor Environmental Quality (IEQ) Credit 3.3*
> - *Paints and sealants. Follow requirements of Materials and Resources (MR) Credit 3 that restrict the presence of volatile organic compounds (VOCs) in the products used*
> - *Incremental improvement. If the improved practices are not implemented in their entirety at once, demonstrate their significance during the performance period.*

Some of this management plan can be achieved through smart vendor selection, looking at those who comply with sustainable guidelines for their industry. Several best practices are identified in other credits in the rating system, such as in the Materials and Resources (MR) category. Another key to achieving this credit is to identify a staff person to manage and record the results and implementation of the plan. Review contracts now in place and ask vendors or staff how some of the common maintenance tasks are performed.

Demonstration: CB Richard Ellis is a global real estate management company that offers specialized services in reducing energy costs and implementing best practices for sustainability in building operations and management. An example of this

service is the Exterior and Hardscape Management Plan for the Phoenix Plaza, a property in Phoenix, Arizona.

SS CREDIT 3: INTEGRATED PEST MANAGEMENT, EROSION CONTROL, AND LANDSCAPE MANAGEMENT PLAN
One point is possible

> ***Intent:*** *To preserve ecological integrity, enhance natural diversity, and protect wildlife while supporting high-performance building operations and integration into the surrounding landscape.*

Pesticides and fertilizers present hazards to workers during application. Erosion and loss of topsoil prevent successful use of adaptive plant materials in many cases and leave depleted soils that are unable to retain nutrients needed by native vegetation. Conversely, successful landscape plans may greatly reduce the amount of storm water and run-off that needs to be controlled.

> ***Options:*** *A good outdoor integrated pest management (IPM) plan coordinates the exterior control of pests with interior pest management. The plan should focus on keeping pest and insect populations on the site under control and preventing them from infiltrating the building. Invasive plants and fungi are considered part of the plan, so mold abatement should be included. These floras should be managed through non-toxic or least toxic methods. Issuing notice to building occupants is required for the use of certain chemicals. Outdoor landscapes that harbor pests as well as invasive plants and weeds should be eliminated.*

Erosion and sediment control should address landscaping operations and any future construction activity. Identify any existing erosion or sediment problems and develop a plan that resolves them, as well as providing a plan to address these issues in an ongoing way.

Demonstration: The USGBC publication *Green Existing Schools Implementation Workbook* includes a sample integrated pest management, erosion control, and landscape management plan (located on page 18 of the electronic file or page 15 of the printed version).

SS CREDIT 4: ALTERNATIVE COMMUTING TRANSPORTATION
Three to fifteen points are possible.

Intent: *To reduce pollution and land development impacts from the use of automobiles in commuting.*

Almost forty-three percent of America's energy resources are consumed by transportation activities, forty percent by cars. It costs about five dollars per year to maintain a bike rack, and about $850 per year to maintain a parking space in a parking structure.[2] According to a report prepared for the American Public Transportation Association, the cost of owning and operating a vehicle in a city where there are few public transportation options can exceed $6,000.[3] Alternative transportation options can help attract and retain workers. You can leverage existing transportation infrastructure and reduce costs of providing new ones.

Options: *This credit calls for creating incentives for building occupants to use public transportation using strategies such as the following examples:*

- *Provide reliable, secure bicycle storage, and showers and changing rooms for bike commuters (especially employees).*
- *Provide public bicycles for employee use on a campus.*
- *Offer preferred parking for fuel efficient vehicles or car pools.*
- *Provide charging stations for electric, hybrid electric, or compressed gas vehicles (including any the library may own).*
- *Provide regular shuttles to and from transit hubs if ready access is not available.*
- *Promote compressed workweeks, telecommuting and alternative work schedules where possible.*
- *Provide incentives for use of public transportation.*

If the existing building is not close to public transportation, or if no public transportation is available, consider providing library shuttle services using a clean-fuel vehicle. The library could partner with local public transit agency to have special library runs on popular routes. Perhaps the library could consider mobile library service as an alternate to building a new structure in a community. Again, partnering with existing facilities where people gather in your community is a distinct possibility.

Points are awarded based on the demonstrated reduction in conventional commuting trips. The baseline assumes that all regular occupants commute alone in conventional automobiles. The calculations must also account for seasonal variations in the use of alternative commuting methods. There are various options for performing the surveys and calculations needed to earn these points. We should also mention that, even if there is no public transportation option, points can still

be earned under this credit. There is a minimum ten per cent reduction in single car commuting to qualify. For instance, if the library sponsored a daily car pool and offered some incentive to participate, this strategy would qualify.

Demonstration: The USGBC website provides the LEED Occupant Commute Survey, a sample spreadsheet for calculating the reduction in commuting by conventional transportation for this credit. The USGBC's list of certified projects also describes how the William J. Clinton Presidential Center demonstrates ways to reduce automobile use.

Figure 4.5. Bently Reserve, San Francisco CA. With an average daily population of 652 employees and visitors, bike racks and changing rooms provide a crucial amenity for commuters while reducing carbon footprint. (Photo by Bently Holdings, Courtesy of USGBC.)

SS CREDIT 5: SITE DEVELOPMENT—PROTECT OR RESTORE OPEN HABITAT
One point is possible

> ***Intent:*** *To conserve existing natural site areas and restore damaged sites to provide habitat and promote biodiversity.*

Many kinds of development disturb the natural habitat that existed before the development started. Wildlife that formerly lived in these areas is displaced and has increasingly fewer places to go. By restoring as much of the open space and native vegetation as possible, displacement of these species is minimized.

> ***Options:*** *This point is calculated by measuring the total site area and subtracting the area of the building. A minimum of twenty-five percent of the total site area excluding the building footprint must have native or adaptive vegetation in place. Other natural site elements like rocks, water bodies, or other features that are part of the historic natural landscape within the region will count toward this credit as well.*

Demonstration: The Nulhegan Administration Building and Visitor Contact Station (Nulhegan Administration Building) has redeveloped a brownfield site and done extensive restoration of native habitat.

SS CREDIT 6: STORMWATER QUANTITY CONTROL

One point is possible

> ***Intent:*** *To limit the disruption of the natural occurrence of water in the ecosystem by reducing impervious cover (buildings, parking lots, etc.), increasing the site's ability to have water enter the soil naturally, and reducing or eliminating storm water runoff and the contaminants that storm water washes into the water supply.*

Stormwater is a major pollutant for all bodies of water in the United States. Roads and parking lots, when rained upon, wash all the polluted substances from the paved surface into the water body. Streams, especially, have little resistance to these pollutants. The Chesapeake Bay has long been a water body studied for the impacts of farming pollutants (dirt, pesticides, etc.) being washed into the bay in the Susquehanna River. Remedying runoff has up-front costs, but long-term savings occurs on a larger scale through municipal operations savings by reduction of water flowing through overtaxed systems.

> ***Options:*** *To achieve this point, you must develop a storm water management plan that infiltrates, collects, and reuses runoff or allows the runoff to evaporate. The plan will include an annual inspection. Storm water management projects to consider include harvesting storm water for reuse in irrigation and indoor nonpotable water applications (e.g., flushing toilets), designing infiltration ponds and swales, planting vegetation that filters the water, and installing green roofs. The runoff from a typical roof, for example, is ninety-five percent. Typically, the runoff from a green roof ranges from ten to fifty percent, a significant reduction. The point is calculated based on the annual rainfall data for your region, as well as two-year, twenty-four-hour frequency storm data.*

Demonstration: One and Two Potomac Yard, an office complex in Arlington, Virginia, that achieved LEED for Existing Buildings Gold certification in 2008, uses sand filters to treat storm water runoff for each office tower, reducing suspended solids entering the Potomac River by more than eighty percent and total phosphorous by forty percent. A 1,711-square-foot green roof connects the Potomac Yard One and Two buildings.

SS CREDIT 7.1: HEAT ISLAND REDUCTION—NON-ROOF

One point is possible

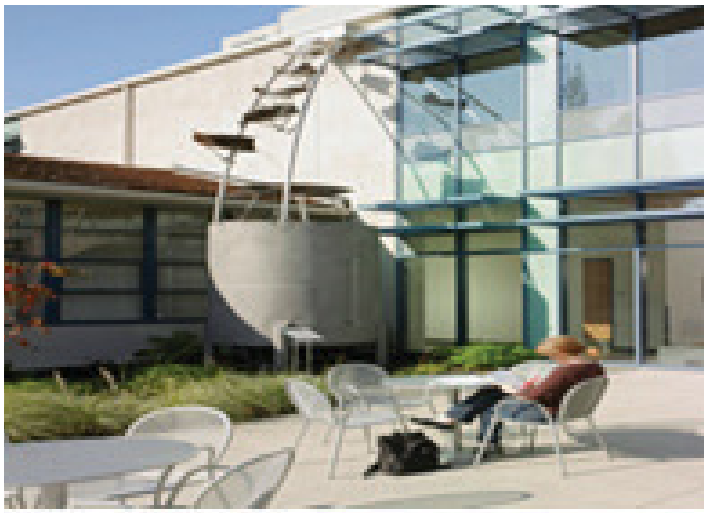

Figure 4.6. Betty Irene Moore Natural Sciences Building, Oakland, CA. The building has an innovative catchment and reuse system that both reduces indoor water use and, as an attractive sculptural element in the exterior courtyard, acts as an important educational opportunity for the generations of students who will occupy and learn in the building. (Photo by Cesar Rubio, courtesy of USGBC.)

Intent: *To reduce the difference between heat absorption of the built environment and the heat absorption of the natural environment at a building site.*

Asphalt and other hardscapes absorb heat to a much higher extent than trees and grasses or other vegetation that might exist around a building, or that existed there previously. This heat absorption is why the temperature is often two to ten degrees higher in cities than in surrounding suburbs. The resulting warmer environment requires greater use of resources in cooling. The greater fluctuation in temperature between evening and daytime has a negative impact on wildlife as well.

Options: *The plan requires at least fifty percent of the site hardscape be treated in one of the following ways:*

- *Provide shade from existing tree canopy within five years.*
- *Provide shade from structures covered by solar panels that produce energy.*
- *Provide shade from architectural devices or structures that can reject solar heat and maintain them.*
- *Use hardscape materials that can reject solar heat and maintain them.*
- *Use an open grid pavement system which is at least fifty percent pervious. You could also opt to place fifty percent of the parking spaces under cover. The parking cover is required to be solar reflective or have similarly improved roofing.*

Demonstration: The town of Gilbert, Arizona, has published a brochure to encourage developers to use cool pavement and other strategies to reduce heat absorption in the hardscape.

SS CREDIT 7.2: HEAT ISLAND REDUCTION—ROOF
One point is possible

> ***Intent:*** *To reduce the difference in heat absorption of the built environment and the heat absorption of the natural environment at a building site by selecting roofing materials that manage this reduction.*

In addition to the reasons shown above in SS Credit 7.1, the use of reflective or vegetative roofs in warm sunny climates has been shown to save residents and building owners in annual cooling energy costs. American Rivers has a calculator that will estimate savings based on your address and roof size.

> ***Options:*** *The design could use roofing materials that reject solar heat over at least seventy-five percent of the roof surface. You could also cover at least fifty percent of the roof with a vegetative or green roof. A combination of the two to cover the entire roof area might also be used.*
>
> *The cost of installing and maintaining green roofs varies but in almost all cases has a short payback period when the savings in energy costs are calculated. Other considerations include some regular maintenance and watering during the first year especially, regular inspections, and the need to provide water in case of fire nearby. Green roofs range from three inches and up in depth. Within the LEED rating systems, a green roof can contribute up to fourteen points.*

Demonstration: The Milwaukee Public Library installed 30,000-foot green roof on the Central Library annex. The library's website also provides a Webcam live feed so that people can watch the roof grow.

SS CREDIT 8: LIGHT POLLUTION REDUCTION
One point is possible

> ***Intent:*** *To minimize the light that "trespasses" from the building and site, to reduce the sky-glow to increase viewing access to the night sky, and to improve night vision by reducing glare. The intent is to also reduce the impact from lighting on nocturnal wildlife patterns and habits.*

While lighting at night is essential for safety, the use of poorly designed lighting fixtures wastes a great deal of energy. In addition, reduction of lighting outside the areas where it is needed allows nocturnal life to flourish without disturbance while still providing safe passage for those using a building.

> ***Options:*** *The first part of this credit requires that all internal lighting with a direct line of sight to windows or doors must be automatically controlled to turn off when the spaces are not in use. These controls must account for more than fifty percent of the night-time hours annually. On the exterior, any fixtures fifty watts and over must be fully or partially shaded so that they do not directly emit light into the night sky. Alternatively, you could perform a series of measurements over the testing period to show that the light on site is not more than twenty percent higher than the same measurements done in the dark.*

Demonstration: While clearly an advocacy group, the International Dark Sky Association provides many valuable definitions of terms related to light pollution and examples of initiatives to reduce light pollution currently underway.

WATER EFFICIENCY (WE)

Our consumption of drinkable water continues to increase (by twelve percent in 2009) and is the third largest use of water in the country behind water used for thermoelectric power and irrigation. Of that water, the majority is used, treated, and discharged into the nation's water bodies. Discharged water pollutes about thirty-three percent of our nation's lakes, streams, and rivers, even though they are fifty percent cleaner today than they were in the mid-1970's.[4] The *LEED EB: O&M* rating system encourages the use of strategies and technologies that reduce the amount of drinkable, or potable, water consumed in buildings. Many of these strategies have no cost. Others provide a quick payback. The credits for water efficiency concentrate on monitoring water consumption, reducing indoor drinkable water consumption, reducing overall water consumption and practicing water efficient landscaping.

WE PREREQUISITE 1: MINIMUM INDOOR PLUMBING FIXTURE AND FITTING EFFICIENCY

Required

> ***Intent:*** *To reduce the drinkable water used by plumbing fixtures and fittings.*

The reduction of indoor water use has a direct impact on the demand for drinkable water on the municipal water supply. In addition to reducing water costs for the building itself, the need to invest in increased water supply capacity at the municipal level can be reduced or eliminated.

The prerequisite is directly related to the types of toilet fixtures and faucets in use in your facility. If they are older, you will most likely need to replace them. Many of these items are familiar—the dual-flush toilet, the hands-free faucet, and the waterless urinal. Each of these fixtures is designed to reduce the water consumed per usage. Your project team's LEED AP, in collaboration with a plumbing specialist, will perform the calculations necessary to document this prerequisite.

Demonstration: WaterSense, a program sponsored by the Environmental Protection Agency, can help your project team identify water saving fixtures.

The University of California has posted the documentation for meeting this prerequisite in its online library of sustainability documents.

WE CREDIT 1: WATER PERFORMANCE MEASUREMENT
Two points are possible

> ***Intent:*** *To measure building and other systems' water use over time to understand consumption patterns and identify opportunities for additional savings.*

Many of the systems that use water in our buildings are seasonal, cyclical, or invisible. Each system, however, has the opportunity to have an impact on our water consumption. By identifying each of these systems, putting meters on them, and recording results, building owners can make conscious changes to the ways in which water is used.

> ***Options:*** *The basic assumption is that the rated project will have a meter that measures all the water consumption. Additional points are available for additional meters that focus on the use of specific water consumers, such as irrigation systems, indoor plumbing fixtures, cooling towers, domestic hot water, and other process water systems, such as dishwashers, clothes washers, etc. Reclaimed water may also be measured if, for example, runoff water is collected and reused for irrigation.*

Demonstration: The U.S. Department of the Interior's Bureau of Reclamation publishes the *Water Measurement Manual*, a guide to water measurement practices for the purpose of better water management. The electronic version is free to download to your computer; the print version can be purchased through the Government Printing Office's bookstore.

WE CREDIT 2: INDOOR PLUMBING FIXTURE AND FITTING EFFICIENCY

One to five points possible

> ***Intent:*** *To maximize indoor plumbing fixture and fitting efficiency within buildings to reduce the use of drinkable water.*

Once again, the rationale for this credit is that by reducing consumption of drinkable water at the point of use, an overall reduction throughout the chain of water supply occurs.

> ***Options:*** *Using the calculations from the WE Prerequisite, further reductions in water use earn additional points. A reduction of an additional thirty percent can earn five points.*

Demonstration: The WaterSense program from the U.S. Environmental Protection Agency features many ideas to improve indoor plumbing fixture and fitting efficiency. Searching "water efficient plumbing fixtures" on the Web will also yield information about possibilities for your library.

Figure 4.7. UC Davis, Brewery Winery and Food, Davis, CA. The landscape is native with low watering needs. This coupled with subsurface irrigation supports minimal irrigation. (Photo by UC Davis, courtesy of USGBC.)

WE CREDIT 3: WATER EFFICIENT LANDSCAPING

One to five points are available

> ***Intent:*** *To limit the use of drinkable water or other natural water sources on site for irrigation.*

Thirty percent of the drinkable water used daily in the United States is used primarily for landscaping.[5] Maintaining or reestablishing native or adaptive plantings can reduce the need for irrigation. Adaptive irrigation systems that use water leftover

from washing hands or dishes, for example, save on water needing treatment and the use of drinkable water.

> ***Options:*** *There are several ways to perform the calculations necessary to earn points for this credit. The basic idea, though, is that you need to demonstrate that you have reduced the water used for irrigation by fifty to one hundred percent of the baseline common for your area. This reduction can be implemented by making smart landscaping choices that reduce the need for frequent watering, by adjusting the timing of existing irrigation systems so that evaporation is reduced and efficiency is improved, by using advanced irrigation systems that measure water need as well as use, and by reusing rainwater or graywater to irrigate the site.*

Demonstration: The Ballard Library and Neighborhood Center in Seattle, Washington, has implemented several strategies for water efficient landscaping. The building's roof is designed to reduce runoff. The building is landscaped with indigenous vegetation with plants selected for their drought tolerance, and its irrigation systems use automatic controls.

WE CREDIT 4: COOLING TOWER WATER MANAGEMENT
One to two points are available

> ***Intent:*** *To reduce drinkable water consumption for cooling tower equipment.*

Cooling towers are usually large steel box-like structures that you might also know as chillers. They use water to absorb heat from air conditioning systems and to cool air that is then returned to the building. An average commercial building requiring five hundred tons of cooling will use more than fifteen hundred gallons of water per minute to cool the entire building.

> ***Options:*** *Points are earned for developing and implementing a water management plan for the cooling tower that addresses the need for chemical treatment, bleeding, biological control, and staff training. An additional point can be awarded if chiller water is comprised of more than fifty percent non-drinkable water from a variety of sources.*

Demonstration: The Green Task Force of the Association of Water Technologies

(AWT), a non-profit trade organization for water treatment companies, has developed a best practices document for this credit.

ENERGY AND ATMOSPHERE (EA)

As mentioned in Chapter 1, annually buildings consume about 36 percent of all energy and 65 percent of all electricity in the United States. Energy, especially electricity, is generated from fossil fuels to a great extent. The use of these fossil fuels generates environmental toxins. Alternative energy sources such as nuclear fission and hydroelectric power also disturb the natural environment and have negative impacts. The United States is one of the largest consumers of electricity and has the greatest potential to reduce the continually increasing demand for new energy sources. The *LEED EB: O&M* rating system addresses these issues by monitoring and improving building performance and decreasing the demand for energy for heating, cooling, and lighting. It also aims to eliminate chlorofluorocarbons (CFCs) from refrigeration equipment. Finally, this section attempts to encourage the use of renewable energy resources as a substitution for energy produced by consuming fossil fuels.

EA PREREQUISITE 1: ENERGY EFFICIENCY BEST MANAGEMENT PRACTICES—PLANNING, DOCUMENTATION, AND OPPORTUNITY ASSESSMENT

Required

> ***Intent:*** *To promote a continuity of information ensuring that energy-efficient operating strategies are maintained and used in analysis of building performance.*

Documenting regular operations and maintenance and assessing these data on a regular basis are considered best management practice. Consider how many of us do nothing more than look at the electric bill and do little else to note the impact of new purchases or different usage patterns on the result. Planning for and documenting regular maintenance of equipment and ensuring that it is performed can significantly extend the life cycle of your equipment. Evaluating the results may reveal opportunities to improve efficiency. If you knew your refrigerator was using an excessive amount of energy, wouldn't you consider replacing it?

You can meet the required task for this credit using staff, outside vendors, or ideally a combination of both. Document the settings for equipment in the building and operations schedule by season. Describe and summarize the systems in the building and how they were designed to operate including performance goals (such as lighting levels, ambient temperature, etc.). Describe the preventive maintenance

schedule designed for the equipment and who performs it. Best practices for energy efficiency also include conducting an energy audit and documenting its results. This practice allows you to compare the intended design parameters with the actual operating results.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), founded in 1894, is an international organization of 51,000 people. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards development, publishing, and continuing education.[6] ASHRAE provides standards that are used throughout the LEED rating systems. The standards for the walk-through analysis required under this prerequisite are published by ASHRAE.

EA PREREQUISITE 2: MINIMUM ENERGY EFFICIENCY PERFORMANCE

Required

> ***Intent:*** *To establish the minimum level of operating energy efficiency performance relative to typical buildings of similar type to reduce environmental and economic impacts associated with excessive energy use.*

This prerequisite cites the U.S. Environmental Protection Agency's ENERGY STAR program. If your building is eligible to receive an energy performance rating using the ENERGY STAR Portfolio Manager tool, you must achieve a rating of at least 69 using the tool. Most public libraries are not eligible, but many academic and school libraries are. If your building is ineligible to use the ENERGY STAR Portfolio Manager, LEED provides an alternate method for calculating compliance that provides similar information.

EA PREREQUISITE 3: FUNDAMENTAL REFRIGERANT MANAGEMENT

Required

> ***Intent:*** *To reduce stratospheric ozone depletion.*

Chlorofluorocarbons (CFCs) have been proven to erode the protective ozone layer in the atmosphere. CFCs are found in refrigerants, and their reduction has been called for as part of the Montreal Protocol on Substances that Erode the Ozone Layer.

Zero use of CFCs must be documented. If elimination is not feasible, a plan for their elimination must be presented along with an economic analysis of the costs

of replacement. Small air conditioning or refrigeration units that contain less than 0.5 pounds of refrigerant are exempt.

EA CREDIT 1: OPTIMIZE ENERGY EFFICIENCY PERFORMANCE
Up to eighteen points are possible

> ***Intent:*** *To achieve increasing levels of operating energy performance relative to buildings of similar type.*

Using tools from the U.S. Environmental Protection Agency's ENERGY STAR website can identify the financial consequences of simple changes in daily use and management of a facility. By using overall similar usage in your region as a baseline, the system raises the bar for performance over time.

> ***Options:*** *The goal is to improve energy performance in a variety of ways—by reducing the demand for power through lighting improvements and other means, by harvesting energy produced on site, by increasing the efficiency of the building, and by recovering waste energy.*

Demonstration: As in the prerequisites, if the ENERGY STAR Portfolio Manager overview can be used for your project, it provides a framework for data gathering. *LEED EB: O&M* will provide a similar framework. The U.S. Department of Energy also has the Federal Energy Management Program to improve operational energy efficiency.

EA CREDIT 2.1: EXISTING BUILDING COMMISSIONING—INVESTIGATION AND ANALYSIS
Two points are possible

> ***Intent:*** *Through a systematic process, to develop an understanding of the operation of a building's major energy consuming systems, options available to optimize their use, and plan to achieve energy savings.*

We've all worked in physically uncomfortable places. We have probably all experienced building personnel giving vague reasons why we couldn't be colder, warmer, drier, or have more fresh air. Only by understanding the way our buildings are equipped and designed can we deal with these issues and make intelligent choices in using heating and cooling resources.

This credit also introduces the process of building commissioning, an important process that has perhaps the most critical impact on our efforts to be sustainable.

Commissioning is the process of measuring the actual results of the building systems and comparing them to the intended results. In this process, building staff receive training on operating the equipment and make recommendations for improvements.

> ***Options:*** *The building can be retrocommissioned, recommissioned, or develop an ongoing commissioning plan. An ASHRAE Level II Energy audit may be substituted. For each, the goal is to measure performance, document how energy is used in the building, and identify measures to improve energy savings. In the case of commissioning, problems that affect the comfort and energy use of the occupants are also analyzed.*

Demonstration: Dickinson College, a liberal arts college in Pennsylvania is committed to sustainability, as evidenced by several initiatives. One example is its Interior Space Temperature Policy that promotes energy efficiency.

EA CREDIT 2.2: EXISTING BUILDING COMMISSIONING—IMPLEMENTATION
Two points are possible

> ***Intent:*** *To implement improvements and identify a capital plan for major upgrades, based on EA Credit 2.1.*

Studying a problem without planning for and implementing changes designed to solve those problems is a waste of resources. The time, effort, and cost that go into studying and analyzing problems are a major consideration. To make sure that improvements occur, specific capital and work plans must be put in place. Several no- and low-cost improvements are likely to be identified that may be implemented right away.

> ***Options:*** *Show a plan based on results of EA Credit 2.1. Perform a financial analysis of all improvements and minor repairs to determine the costs and savings of each. Track all no- or low-cost operational improvements and minor repairs implemented and include the cost savings per improvement. As improvements are made, update the building operations plan to reflect the changes. Summarize the training of management staff and material covered.*

Demonstration: The Building Commissioning Association (BCA) is an international non-profit organization that serves as an authoritative resource for commissioning. The BCA has created a best-practices guide for commissioning an existing building.

EA CREDIT 2.3: EXISTING BUILDING COMMISSIONING—ONGOING COMMISSIONING

Up to two points are possible

> ***Intent:*** *To use commissioning to address changes in occupancy, use, maintenance and repair and to make adjustments based on these changes essential for optimal performance.*

As the lifespan of a building progresses, the building structure often changes. Consider the rearrangement of a library interior, such as moving stack locations, adding or subtracting offices, re-using spaces for different purposes. All of these changes affect the way the systems in the building perform. Only by checking the results of building systems over time can we continuously improve energy efficiency. As we need to replace parts, we can identify highly efficient, cost-effective options that were not previously available and incorporate them into the systems design of the building. These ongoing enhancements continue to drive down energy use over time.

> ***Options:*** *Implement an ongoing commissioning program that includes elements of planning, system testing, performance verification, corrective action response, ongoing measurement, and documentation to address operating problems on a proactive basis.*
>
> *Create a written plan that summarizes the overall commissioning cycle for the building by equipment or by building system group. The ongoing commissioning cycle must not exceed twenty-four months. This plan must include a building equipment list, performance measurement frequency for each equipment item, and steps to respond to deviation from expected performance parameters.*
>
> *Complete at least half of the scope of work in the first commissioning cycle (as indicated by the percentage of the plan's total budget) prior to the date of application for LEED EB: O&M. Only work completed within two years prior to application may be included to show progress in the ongoing commissioning cycle. Update the building operating plan and/or systems narrative as necessary to reflect any changes in the occupancy schedule, equipment run-time schedule, design set points, lighting levels, or system specifications.*

Demonstration: The Cesar Chavez Library in Phoenix, Arizona, was selected by the American Institute of Architects Committee on the Environment as a AIA/COTE

Top Ten Green Projects for 2008. The library had third-party commissioning during the design and prior to opening, and the City of Phoenix monitors the building's performance in an ongoing way.

EA CREDIT 3.1: BUILDING AUTOMATION SYSTEM

One point is possible

> ***Intent:*** *To provide information to support the ongoing accountability and optimization of building energy performance.*

A building automation system (BAS) makes it possible to aggregate performance data from building systems into a single display called a dashboard. A dashboard makes it easy to identify issues and problems in system performance quickly and to take corrective action.

> ***Options:*** *A BAS is basically a computer system that collects and monitors performance data of many or all of the energy consumptive systems in a building. Install a BAS that monitors and controls major building systems, including at a minimum heating, cooling, ventilation, and lighting. Have a preventive maintenance program in place that ensures BAS components are tested and repaired or replaced according to the manufacturers' recommended intervals. Demonstrate that the BAS is being used to inform decisions regarding changes in building operations and energy-saving investments.*

Demonstration: The U.S. Environmental Protection Agency's Science and Technology Center in Kansas City, Kansas, uses building automation to manage many of the components of the building's systems.

EA CREDIT 3.2: SYSTEM LEVEL METERING

Two points are possible

> ***Intent:*** *To provide accurate energy use information to support energy management.*

Using detailed data for discrete systems, building owners and tenants can make informed choices about energy use and quickly identify systems that are inefficient.

> ***Options:*** *Identify major energy subsystems (heating, cooling, office equipment, lighting, ventilation, water heating, refrigeration, cook-*

ing, and other systems). Track usage on an individual system level. Prepare an energy-use breakdown report.

Demonstration: The U.S. Department of Energy's Federal Energy Management Program has published *Operations and Maintenance Best Practices: A Guide to Achieving Operational Efficiency Release 3.0* on its website. Chapter 8, "Metering for Operations and Maintenance," features a case study of the systems metering at the Kastenmeier Federal Courthouse in Madison, Wisconsin (page 15 and following).

EA CREDIT 4: ON-SITE AND OFF-SITE RENEWABLE ENERGY
Up to six points are possible

Intent: *To encourage and recognize increasing levels of renewable energy to reduce reliance on fossil fuels.*

The use of renewable energy products has a dramatic impact on outdoor air quality. By encouraging the use of renewable energy, the demand for this type of energy increases. As investment in renewable sources continues to grow, costs for renewable energy decline, and the pressure to increase energy production from other sources is reduced.

Options: *Meet some or all of the building's energy needs with renewable energy systems. On-site systems that could be implemented include technologies to capture solar, wind, geothermal, water, or bio-based energy. Eligible on-site systems include photovoltaic systems, wind energy systems, solar thermal systems, geothermal energy systems (heat pumps), low-impact hydroelectric power systems, wave- and tidal-power systems. Also, renewable energy can be purchased in accordance with definitions by Green-e, a program of the Center for Resources Solutions. The Green-e website lists renewable energy sources and products.*

Demonstration: The William J. Clinton Presidential Center has a 66,000 kWh photovoltaic array located on the archive roof. The array provides four percent of the center's electricity needs, and the library has contracted for one hundred percent green power for two years.

EA CREDIT 5: ENHANCED REFRIGERANT MANAGEMENT
One point is possible

Intent: *To reduce ozone depletion and support early compliance with the Montreal Protocol .*

As identified earlier, the Montreal Protocol on Substances that Deplete the Ozone Layer was ratified by the U.S. government in 1989. The Protocol requires the elimination of refrigerants that have the potential to deplete the ozone layer (ODPs).

Options: *First, you could eliminate the use of refrigerants in their entirety in your heating, ventilation, air conditioning, or refrigerant systems. If total elimination isn't feasible, equipment must be used to minimize the use of ODPs according to a formula. It should be noted that this credit precludes the use of halon-based fire-suppression systems as well.*

Demonstration: The U.S. Environmental Protection Agency's website provides details on the use and regulation of refrigerants.

EA CREDIT 6: EMISSIONS REDUCTION REPORTING
One point is possible

Intent: *To document the emissions reduction benefits of building efficiency measures.*

By benchmarking the greenhouse gas emissions of similar buildings with similar occupancy types, building managers can set realistic goals and come to understand potential performance for the built environments in which they operate. Much of this information can be buried in budget and building documents. By reporting emissions data more directly and robustly, the benefits of emissions reduction will have a broader impact.

Options: *This credit requires the use of a third-party voluntary reporting or certification program. Programs include the ENERGY STAR Portfolio Manager and the Greenhouse Gas Protocol of the World Resources Institute and the World Business Council for Sustainable Development (WRI/WBSCD).*

Demonstration: The Climate Registry, a nonprofit collaboration among North American states, provinces, territories, and Native Sovereign Nations, publicly reports greenhouse gas emissions in a single registry.

MATERIALS AND RESOURCES (MR)

This category has two primary focuses—the materials brought into a building (supplies, furnishings, etc.) and the materials taken out of a building, mainly as waste. The category promotes several ideas, including selection of sustainable materials, waste reduction, material reuse and recycling, and reduction of mercury pollution.

Perhaps librarians, who manage collections and furnish spaces for work and public use, are most knowledgeable about and comfortable with this functional area. Because of this familiarity, materials are often the focus of library sustainability efforts. This category also represents the intersection of the interests of the library and librarian as a building owner or operator with the interests of the general public and our targeted users.

MR PREREQUISITE 1: SUSTAINABLE PURCHASING POLICY

Required

> ***Intent:*** *To reduce the environmental impacts of materials acquired for use in the operations, maintenance, and upgrades of buildings.*

Every purchase decision has a broad array of consequences across a spectrum of providers and users. The means of sourcing raw materials, the process by which materials are produced, and the impact of these items on the end user have profound implications for library operation. For example, most receipt printers in use in libraries today have paper that is coated with bisphenol A (BPA), which allows for the elimination of printer ribbons. BPA has a myriad of known health implications that can be compounded when a library staff member repeatedly comes in contact with this type of paper. Here, as in many other cases in this section, we rely on vendors to solve production problems, in this case by providing BPA-free paper (now widely available).

To meet this prerequisite, a sustainable purchasing policy (SPP) should be crafted to address the following objectives:

- waste prevention and reduction
- resource use reduction
- pollution and toxin reduction
- reduction of greenhouse gas emissions
- growth of sustainable economy
- biodiversity maintenance
- employee health and safety.

Further, the policy must state its purpose, give relevant definitions, include related or supportive policies, describe best practices, identify third-party products that are

certified to be environmentally sound, explain internal responsibilities for purchasing or disposal by department or job title, and describe any exemptions to the policy.

Demonstration: The City of Portland, Oregon, has developed a sustainable procurement policy that provides a good example for meeting this prerequisite.

MR PREREQUISITE 2: SOLID WASTE MANAGEMENT POLICY

Required

> ***Intent:*** *To facilitate the reduction of waste generated by building occupants and hauled to and disposed of in landfills or incineration facilities.*

A comprehensive solid waste management program policy helps to reduce the economic burden associated with waste disposal, both to the owner/occupant and the municipality charged with destruction or landfill. New materials purchased for a building also contribute to the waste generated by a facility. Packing materials such as polystyrene peanuts add to cost of the product purchase and add costs for disposal. If these sources of waste are eliminated at the point of production, savings throughout the purchasing stream can be realized.

Meet this prerequisite by creating a solid waste management policy and plan that identifies the organization's commitment to minimize waste disposal by using source reduction, reuse, and recycling. The plan also details organizational responsibility for implementing the program, actions to be implemented, and means of monitoring performance.

Demonstration: The Arlington County Board of Arlington, Virginia, developed its Solid Waste Management Plan (SWMP) to meet regulations adopted by the Virginia Department of Environmental Quality. The SWMP establishes Arlington County's policies for solid waste management and serves as a guide for future growth of the county's solid waste management system.

MR CREDIT 1: SUSTAINABLE PURCHASING—ONGOING CONSUMABLE

One point is possible

> ***Intent:*** *To reduce the environmental and air quality impacts of materials acquired for use.*

Because of the frequency of purchase of consumables, the environmental impacts of these purchases can be substantial. Materials made from recycled content or

with other sustainable features help us disseminate information to our users about the benefits of these products.

> ***Options:*** *Implementing the purchasing provisions of the sustainable purchasing policy, make sixty percent of all purchases (by cost) sustainable. Sustainable purchases are defined as meeting one of the following criteria:*
> - *purchases that contain at least ten percent post-consumer materials*
> - *purchases that contain at least fifty percent rapidly renewable materials*
> - *purchases that contain at least fifty percent materials harvested and processed or extracted within five hundred miles of your facility*
> - *purchases that consist of at least fifty percent paper products certified by Forest Stewardship Council (FSC)*
> - *batteries that are rechargeable.*

Purchasers can receive credit for each sustainable criterion met.

Demonstration: The U.S. Environmental Protection Agency originally developed its Environmentally Preferable Purchasing (EPP) program to help the federal government "buy green." The EPP website is now a resource for vendors and consumers as well as government employees.

MR CREDIT 2: SUSTAINABLE PURCHASING—DURABLE GOODS
Two points are possible

> ***Intent:*** *To reduce the environmental and air quality impacts of materials acquired for use (the same as in MR Credit 1).*

Durable goods are items purchased that have a life cycle of use of two years or more. These goods include furniture, audio-visual equipment, and other items that often require a capital investment. Although not purchased with the frequency of consumables, the environmental impact of durable goods purchases can be substantial.

> ***Options:*** *At least forty percent of the purchases made during the two-year period should be sustainable. The second point possible with this credit refers to electric-powered equipment or furniture. Electric-powered equipment should be new or purchased to replace existing gas-operated equipment and must be ENERGY STAR qualified.*

Furniture should meet one or more of the following conditions:

- *contain at least ten percent postconsumer material*
- *contain at least seventy percent material salvaged from off site*
- *contain at least seventy percent materials salvaged on site*
- *contain at least fifty percent rapidly renewable material*
- *Is Forest Stewardship Council* (FSC)-certified wood
- *contain at least fifty percent material harvested or processed within five hundred miles of the building*

Many manufacturers, such as Agati Furniture, will outline their furniture's compliance to make it more appealing to the client.

Demonstration: The editorial staff of the online periodical *Environmental Building News (EBN)*has developed a green product directory called Greenspec. They describe the criteria, and give an overview of the topic in "Building Products: What makes a product green?" It also serves as an overview of this topic. Another green product directory is the EPA's directory of products with the ENERGY STAR rating.

MR CREDIT 3: SUSTAINABLE PURCHASING—FACILITY ALTERNATIONS AND ADDITIONS

One point is possible

Intent: *To reduce the environmental and air quality impacts of base building elements that might not otherwise be considered.*

Options: *Fifty percent of the purchase of materials for base building elements, such as items attached or semi-permanently attached to the building itself, meet one of more of the following criteria:*

- *contain ten percent postconsumer materials*
- *contain seventy percent materials salvaged from off site*
- *contain seventy percent materials salvaged on site*
- *contain fifty percent rapidly renewable material*
- *contain fifty percent* FSC-certified wood
- *adhesives and sealants meet low volatile organic compound (VOC) thresholds*
- *paints and coatings have low VOCs to comply with Green Seal's* Standard GS-11 *requirements*
- *non-carpet-finished flooring is certified under the Resilient Floor Covering Institute's* FloorScore® *program*
- *carpet meets the requirements of the Carpet and Rug Institute's*

Green Label Plus Carpet Testing *program for carpet and adhesive*
- *carpet meets the requirements of the Carpet and Rug Institute's* Green Label Plus Carpet Testing *program for carpet cushion*
- *composite panels (dividers and systems furniture often) contain no added urea-formaldehyde resins.*

Demonstration: The Natural Home and Garden website, "the authority on green lifestyle and design," offers a Green Building: Room Addition Checklist on the site.

MR CREDIT 4: REDUCED MERCURY IN LAMPS

One point is possible

> ***Intent:*** *To reduce the amount of mercury brought into the building in light bulbs (known in the trades as "lamps").*

Mercury is known to cause serious ecological and human health problems. Coal-fired electric plants are the biggest mercury producers in the U.S. Building products that contain mercury—such as fluorescent bulbs, some switches, batteries, and thermostats and thermometers—contribute to this pollution as well.

> ***Options:*** *The Sustainable Purchasing Plan (MR Prerequisite 1) must include provisions for the targeted acquisition of lamps that perform at ninety picograms per lumen hour or less and that have targeted average mercury content. Note that compact fluorescent (CFL) bulbs that screw in are exempt if they comply with the National Electrical Manufacturers Association (NEMA)* Standard LL8 2010 *that limits mercury content to less than 5 milligrams per unit under 25 rated watts. Compliance should be noted on the lamp packaging.*

Demonstration: The National Electrical Manufacturers Association developed LampRecycle.org to provide consumers with a clearinghouse for information about recycling mercury-added lamps. Review the LampRecycle website to learn more about the mercury content of lamps.

MR CREDIT 5: SUSTAINABLE PURCHASING—FOOD

One point is possible

> ***Intent:*** *To reduce the environmental impacts associated with food production and distribution.*

Encouraging local farming can support others, reduce pollution for transportation and packaging, reduce the reliance of pesticide-heavy farm operations, and contribute to lower costs of locally grown food.

> ***Options:*** *Twenty-five percent of all food and beverage purchases made during the performance period must meet one or both of these criteria:*
> - *Purchases are labeled USDA organic, Food Alliance Certified, Rainforest Alliance Certified, Protected Harvest Certified, Fair Trade, or Marine Stewardship Council's Blue Eco-Label.*
> - *Purchases are produced with a hundred mile radius of the site.*

Demonstration: The Yale Sustainable Food Project at Yale University has published the *Sustainable Food Purchasing Guide* to help consumers make changes in purchasing food. The guide is organized by category of food (e.g., "fruits and vegetables," "dairy"), and it includes a glossary of terms associated with sustainable food production.

MR CREDIT 6: WASTE STREAM AUDIT

One point is possible

> ***Intent:*** *To facilitate the reduction of ongoing waste and toxins that are hauled away.*

Building owners and occupants are rarely aware of the actual amounts of waste by type and source. When occupants are more aware of their habits and the potential impacts, they can make more selective choices that affect the waste stream itself.

> ***Options:*** *The waste stream audit consists of determining the percentage of waste categories and amounts. These categories will include the waste directed to disposal by landfill or incineration as well as waste diverted by recycling, reuse, or composting.*

Demonstration: The Commonwealth of Pennsylvania has developed a model for conducting a waste stream audit. It includes the basic steps of the audit and includes sample forms.

MR CREDIT 7: ONGOING CONSUMABLES

One point is possible

Intent: *To create a recycling and waste reduction program for consumable products.*

Recycling and waste-reduction programs divert waste from the landfills and incinerators, thereby reducing costs and environmental impacts.

Options: *Create a recycling program for the following items:*

- *paper*
- *toner cartridges*
- *glass*
- *plastics*
- *cardboard and used corrugated cardboard*
- *food waste*
- *metals*
- *batteries (at least eighty percent diverted).*

Reuse, recycle, or compost fifty percent of the ongoing consumable waste stream.

Demonstration: The EPA's WasteWise program helps organizations reduce municipal waste. The WasteWise website includes useful tools and information resources for implementing recycling and waste reduction programs.

MR CREDIT 8: SOLID WASTE MANAGEMENT—DURABLE GOODS
One point is possible

Intent: *To reduce the amount of waste sent to landfills and incinerators specifically from durable goods. (See MR Credit 2 for a definition of durable goods.)*

Keeping things from the waste stream reduces costs and pollution.

Options: *Reuse or recycle seventy-five percent of the durable goods waste stream. These goods will include office equipment, appliances, external power adapters, televisions, and audio-visual equipment (consistent with the definition as MR Credit 2).*

Demonstration: The University of California, Berkeley, Office of the President, although not a library building, is an LEED: EB O&M Silver building. It met this credit. The documentation of this building is extremely well done and well worth reviewing.

MR CREDIT 9: SOLID WASTE MANAGEMENT—FACILITY ALTERATIONS AND ADDITIONS

One point is possible

> ***Intent:*** *To create a recycling and waste reduction program for solid waste generated by facility alterations and additions.*

Recycling and waste-reduction programs divert waste from the landfills and incinerators, thereby reducing costs and environmental impacts.

> ***Options:*** *Divert at least seventy percent of the waste generated from adding on to or altering your facility. This waste includes building components and structures, attached finishes, carpet and other flooring materials, and paints and sealants. Furniture, fixtures, and equipment are excluded. So are mechanical, electrical, and plumbing components.*

Demonstration: An overview of construction waste management and best practices from the National Institute of Building Sciences can be found at the *Whole Building Design Guide* website.

INDOOR ENVIRONMENTAL QUALITY (IEQ)

Think about how much time people spend indoors every day. If you do the math, you'll probably discover that like most Americans, more than ninety percent of your day is spent indoors.[7] The quality of the air we breathe is of critical importance as we work, live our lives, and seek to thrive. By the quality of the air, we refer to temperature, humidity, and freedom from pollutants and toxins and organic compounds. Each of these factors affects individuals differently. Taken together, however, these factors combine to make one of the most significant differences in productivity, health, and employee and occupant satisfaction.

Inadequacy or failure of the systems in a building is often the driver for renovations. The LEED rating system encourages a renovation planning process to replace those systems in an economically feasible way that produces measurable results that can be shared with occupants and building managers. As you will see, this category also demonstrates that allowing occupants to control aspects of their environment personally causes dramatic shifts in attendance and reported job satisfaction. The potential savings in the U.S. are estimated at from $47 billion to $208 billion from direct improvements in worker performance.

This category promotes the following concepts related to the quality of the indoor environment:

- Improve ventilation. Survey and evaluate building systems to identify potential indoor air quality problems and then implement an ongoing program to prevent these problems and maintain a high level of indoor air quality.
- Manage air contaminants. Air contaminants include tobacco smoke, carbon dioxide, and particulate matter in the air, such as dust, mold, bacteria, and pollens.
- Implement green cleaning. Green cleaning reduces the use of chemicals and volatile organic compounds while maintaining a clean, attractive and safe indoor environment.
- Specify less harmful materials. Furniture and finishes that we use to great extent in renovations need to be chosen carefully to eliminate or reduce the off-gassing or release of fumes and odors that linger in the environment and cause ongoing health problems and risks.
- Allow occupants to control desired settings. The ability to open a window, to reduce or add light to a task, or to manage the temperature contributes to occupant comfort and productivity while saving energy.
- Provide daylighting and views. Being able to view the weather and location of the sun during the day has a subtle but substantial impact on our productivity.

This final concept is especially important for libraries. Renovation projects offer an important opportunity to put those inside a structure in touch with the outside environment. In libraries, we are often quite concerned with the light that the public areas enjoy, but often staff areas are given short shrift and located in dark, isolated areas. Depending on the amount of time an employee spends in her office, this practice can be quite detrimental.

IEQ PREREQUISITE 1: MINIMUM INDOOR AIR QUALITY (IAQ) PERFORMANCE
Required

> ***Intent:*** *To establish minimum indoor air quality performance to enhance indoor air quality in buildings, thus contributing to the health and well-being of the occupants.*

The strategies include limiting potential sources of indoor contaminants, limiting the introduction of outdoor contaminants, and maintaining a scientifically measured balance of fresh air and existing indoor air over time. Even though some of

the methods used to control these environmental factors add costs that are not included in traditional ventilation systems, there are strategies to lessen the costs with associated best practices.

To meet this requirement, some measurements of ventilation rates for the building's air handler units are required. Each air handler will or will not be able to meet the standards set forth by ASHRAE Standard 62.1 2007(Ventilation for Acceptable Indoor Quality). This standard equates roughly to ten cubic feet of outside air per minute per person under normal operating circumstances. If you meet the required standard, you may conduct an audit of your equipment to document its operations. If you do not meet the standards, you will need to perform commissioning of your equipment.

As discussed under EA Credit 2.1, commissioning is an important process to understand, and something that we could all do more of in our homes and in our commercial buildings. Commissioning is a process in which an expert in the type of equipment being commissioned ensures the equipment does what it was designed to do. With regard to ventilating equipment, the commissioning process will test whether the equipment produces cool air at the rate and temperature for which it was designed. Does it adjust the flow of fresh air to react to changes in the indoor environment? Different components of building systems have different purposes. Through commissioning, they are also measured to see how they function as a whole. Part of the process will identify needed repairs, replacements, and adjustments that will have an impact on the process. Simply implementing the recommendations of these commissioning studies can dramatically produce savings and increased satisfaction of occupants. The commissioning agents will also survey occupants to elicit ongoing problems and issues with the existing system (e.g., temperature complaints, glare and lighting issues) are documented and examined for remedies.

Finally, the prerequisite requires that maintenance programs be established or revisited and documented. Exhaust systems are also tested and maintained as part of this process.

IEQ PREREQUISITE 2: ENVIRONMENTAL TOBACCO SMOKE (ETS) CONTROL
Required

> ***Intent:*** *To prevent exposure to environmental tobacco smoke, not only for people, but for the finishes and furnishings that can hold the odors and toxins as well.*

The negative effects of smoking on human health are well documented. The most effective and simple option for meeting this prerequisite is to prohibit smoking in the building and prohibit on-property smoking within twenty-five feet of entries, outdoor air intakes, and operable windows. In the rare instance where smoking is not prohibited legally in your building, there are provisions to contain smoking in designated areas with special exhaust equipment.

IEQ PREREQUISITE 3: GREEN CLEANING POLICY
Required

> ***Intent:*** *To reduce the exposure of building occupants and maintenance personnel to potentially hazardous chemical, biological, and particulate contaminants.*

While it is fairly straightforward that chemical exposure inside most sealed buildings is problematic, the risks of potentially lethal chemical combinations and of consistent human exposure to skin hazards and lung hazards are even greater.

A green cleaning policy with the following specified components is necessary to meet this prerequisite:

- Purchase sustainable cleaning and hard floor and carpet care products as specified by several rating agencies (discussed further in IEQ Credit 3.3).
- Purchase sustainable cleaning equipment.
- Establish standard operating procedures (how the floors should be cleaned, with what, by whom, and how often).
- Promote hand hygiene for customers and employees.
- Establish guidelines for handling and storage of chemicals.
- Develop a safety and training program for maintenance personnel.
- Collect occupant feedback to evaluate new technologies, products, procedures, and processes.

If your library has maintenance services provided by non-library staff, you might require this policy as part of your contractual agreement. The policy is also helpful as a vendor selection tool to identify effective potential partners in your library's sustainability efforts.

Demonstration: ISSA, the Worldwide Cleaning Industry Association, has compiled the *Green Cleaning Product Procurement Policies, Initiatives, and Requirements in the U.S*. This is a comprehensive document, first published in 2006 and updated in 2012.

IEQ CREDIT 1.1: INDOOR AIR QUALITY BEST MANAGEMENT PRACTICES—INDOOR AIR QUALITY MANAGEMENT PROGRAM

One credit is possible

> ***Intent:*** *To enhance practices that will prevent future problems with indoor air quality after baseline performance is met.*

Figure 4.8. Thurgood Marshall Elementary School, Philadelphia PA. The custodial team utilizes an innovative floor scrubber that uses ionized water and zero cleaning chemicals. This scrubber was an important part of the green cleaning program. (Photo courtesy of USGBC.)

Maintaining an ongoing indoor air quality management plan can protect building owners from liability, bad publicity, and costly renovations or repairs associated with air quality problems.

> ***Option:*** *Develop and implement an indoor air quality management program based on the Environmental Protection Agency's* Indoor Air Quality Building Education and Assessment Model (I-BEAM).

Demonstration: The State of Texas has developed very thorough voluntary guidelines for the IAQ in government buildings. The Guilford County School system in Greensboro, North Carolina, has customized an IAQ management plan for schools.

IEQ CREDIT 1.2: INDOOR AIR QUALITY BEST MANAGEMENT PRACTICES—OUTDOOR AIR DELIVERY MONITORING

One credit is possible

> ***Intent:*** *To have systems in place to monitor the volume and quality of the air being taken in.*

Not only is the rate of outside air flow important to the well-being of building occupants, but the measure of carbon dioxide also has an impact on our health. Fluctuations can occur throughout a twenty-four hour span of building use, and intense concentrations of carbon dioxide can lead to headache, dizziness, and increased heart rate.

> ***Options:*** *Depending on the density of occupants in the space being measured and whether you have a mechanical venting system or fresh air ventilation (from windows or doors), the installation of a*

monitoring system that provides feedback on system operations is required. Densely populated spaces and spaces with fresh air ventilation systems also need to have carbon dioxide sensors installed.

Measurements of air volume and quality are needed and should be provided through ongoing building commissioning.

Demonstration: Ebtron, Inc. is a vendor of airflow measurement devices. Its website discusses a ventilation rate procedure to determine whether airflow levels comply with or exceed the requirements of ASHRAE 62.1 2007 (Ventilation for Acceptable Indoor Quality).

IEQ CREDIT 1.3: INDOOR AIR QUALITY BEST MANAGEMENT PRACTICES—INCREASED VENTILATION
One point is possible

Intent: *To provide additional air ventilation to improve indoor air quality.*

Increasing the ventilation beyond minimum standards improves the indoor air quality and directly benefits occupant health and well-being. It should be noted that in some regions of the country, the increase in fresh air increases the need for treatment of the air for temperature and humidity, which can drive up costs and energy use. So this credit should be used creatively to supplement fresh air in measurable ways that also may be seasonally adjusted.

Options: *For mechanically vented spaces, you will need to exceed the ventilation rates that were established in IEQ Prerequisite 1 by thirty percent. For naturally vented spaces, determine whether natural ventilation is an effective strategy for the project by following the flow diagram process in Figure 2.8 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings.*

Demonstration: Some background on increasing natural ventilation might be helpful and inspiring. The *Whole Building Design Guide* website provides a great overview to natural ventilation as well as links to related resources.

IEQ Credit 1.4: Indoor Air Quality Best Management Practices—Reduce Particulates in Air Distribution
One point is possible

Intent: *To reduce potentially harmful particles in the air.*

Airborne particles contribute to asthma, allergies, emphysema and chronic lung disease.

Options: *Air filters are rated according to the minimum efficiency reporting value, or MERV. Use filters that have a filtration rating of MERV 13. Filters with a MERV rating of 13 or greater is required for all air intakes and recirculation sites within air handling systems. The MERV rating is displayed on the packaging of most filters. Some air handling systems will be incompatible with this level of filtration because it disrupts the air flow. Newer types of filters that have this rating can often solve these air flow problems.*

Demonstration: The U.S. Office of Health, Safety and Security website provides information about high-efficiency particulate air (HEPA) filters.

IEQ CREDIT 1.5: INDOOR AIR QUALITY BEST MANAGEMENT PRACTICES—INDOOR AIR QUALITY MANAGEMENT FOR FACILITY ADDITIONS AND ALTERATIONS
One point is possible

Intent: *To remind building owners that construction activity often causes the introduction of harmful elements into the indoor air, and must be managed carefully.*

Indoor air handling systems can be easily overwhelmed and contaminated by the dust and other pollutants that are often introduced into the system during renovation or construction.

Options: *The following strategies can be used to earn this credit:*

- *Meet standards set forth by the Sheet Metal and Air Conditioning National Contractors Association (SMACNA)* Indoor Air Quality Guidelines for Occupied Buildings under Constructions. 2nd edition*, 2007.*
- *Perform a flush-out of the building systems when construction is over before they are re-occupied.*
- *Protect absorptive materials from moisture damage.*
- *Return all lighting and HVAC systems to a regular sequence of operations when the project is completed.*

Demonstration: Harvard Business School has provided documentation from its renovation of Gallatin Hall.

IEQ CREDIT 2.1: OCCUPANT COMFORT—OCCUPANT SURVEY

One point is possible

> ***Intent:*** *To assess the occupant's comfort in the building.*

The survey identifies perceived issues and provides a baseline to compare improvements after renovation is complete.

> ***Options:*** *Collect anonymous data about thermal comfort, acoustics, indoor air quality, lighting levels, building cleanliness, and other comfort issues. The results must be documented. The team should analyze options to address issues as feasible. There must be a thirty percent response rate to qualify the results.*

Demonstration: UCLA students collaborated with Facilities Management to conduct an occupant survey and waste stream audit in Spring 2008 as part of the LEED for Existing Buildings retrofit of the Public Affairs Building. The student team summarized the results and made recommendations in the report "LEED EB for the Public Affairs Building."

IEQ CREDIT 2.2: CONTROLLABILITY OF SYSTEMS—LIGHTING

One point is possible

> ***Intent:*** *To provide a high level of lighting system control by individuals or groups using classrooms and conference areas.*

Lighting makes up twenty-five percent of a building's total energy use. Providing individual controls has been shown to reduce lighting energy use by sixty-five percent.

> ***Options:*** *Provide individual controls for fifty percent of the building occupants including fifty percent of individual workspaces and fifty percent of group workspaces.*

Demonstration: The Lighting Research Center at Rensselaer Polytechnic Institute provides general information and data about different types of lighting controls. Many libraries have successfully used lighting sensors to provide security and reduced usage in non-public areas. San Jose State University won an award in the Lighting

Retrofit category at the 2010 California Higher Education Sustainability conference for the lighting retrofit of the San Jose University Dr. Martin Luther King, Jr. Library.

IEQ CREDIT 2.3: OCCUPANT COMFORT—THERMAL COMFORT MONITORING

One point is possible

> ***Intent:*** *To support systems operations that provides a comfortable temperature in which people can work.*

Case studies have shown increases in productivity from one percent to sixteen percent based on the ability to control the temperature and amount of fresh air in an individual work space, which carries tremendous cost savings.

> ***Options:*** *A system that tracks and optimizes the systems that regulate air temperature, humidity, air speed, and radiant temperature must be in place*

Demonstration: The *Whole Building Design Guide*, a program of the National Institute of Building Sciences, provides an overview to providing comfortable environments.

IEQ Credit 2.4: Daylight and Views

One point is possible

> ***Intent:*** *To connect building occupants with the outdoors.*

Well-designed buildings that have robust daylight can reduce the energy use in a building from fifty to eighty percent. There has been demonstrated improvement in employee performance when daylighting and views are available.[8]

> ***Options:*** *This credit features a technical specification that measures, and demonstrates that fifty percent or more of all regularly occupied spaces achieve daylight illumination levels*

Figure 4.9. Salt River Fields at Talking Stick, Scottsdale, AZ. Interior photograph of the Arizona Diamondbacks clubhouse. Design strategies featured including maximizing the amount of daylight in the perimeter spaces as well as underfloor air vents. (Photo courtesy of USGBC.)

of twenty-five footcandles. There are also options that provide daylighting zones within the building. Views are also specifically defined and must apply to forty-five percent of the building occupants.

Demonstration: The Trinity River Audubon Center in Texas has emphasized daylighting and views in its building design.[9]

IEQ CREDIT 3.1: GREEN CLEANING—HIGH PERFORMANCE CLEANING PROGRAM
One point is possible

Intent: *To reduce exposure to chemicals for building occupants and maintenance personnel.*

This portion of the rating system carries out the plan that is required by IEQ Prerequisite 3.

Options: *You will need a high performance cleaning policy that addresses the following criteria:*

- *an appropriate staffing plan*
- *maintenance staff trained in the use, hazards, maintenance, disposal, and recycling of cleaning chemicals, dispensers, and other equipment*

Demonstration: Harvard Medical School has such a *Clean and Green* green cleaning program in place.

IEQ CREDIT 3.2: GREEN CLEANING—CUSTODIAL EFFECTIVENESS ASSESSMENT
One point is possible

Intent: *To ensure that the green cleaning program and plan are being effectively operationalized.*

Many libraries use third-party vendors to clean our facilities and need a methodology to insure that our plan and program are effectively implemented.

Options: *Conduct an audit in accordance with the Association of Physical Plant Administrators (APPA) custodial staffing guidelines,* Operational Guidelines for Educational Facilities: Custodial Third Edition. *The facility must score three or less.*

Demonstration: The University of Nevada at Las Vegas was the 2010 winner of the APPA Award for Excellence in Facilities Management.

IEQ CREDIT 3.3: GREEN CLEANING—PURCHASE OF SUSTAINABLE CLEANING PRODUCTS AND MATERIALS

One point is possible

> ***Intent:*** *To reduce the environmental impacts of cleaning products and disposable paper products and trash bags used in cleaning.*

All of these products are less toxic to the environment:

- Green cleaning products. Green Seal–certified and EcoLogo–certified products have been tested for toxicity (see options below).
- Recycled content janitorial paper products. Many of these alternatives also avoid the use of chlorine and other bleaching agents in production that can be hazardous.
- Recycled content trash can liners. Liners made from bio-based or renewable materials may also be considered.

> ***Options:*** *Use cleaning products that meet GS-37 the Green Seal™ Standard for Cleaning Products for Industrial and Institutional Use or Environmental Choice's EcoLogo standards for cleaning products.*

Demonstration: Green Seal certifies products in several categories, including industrial cleaning products.

IEQ CREDIT 3.4: GREEN CLEANING—SUSTAINABLE CLEANING EQUIPMENT

One point is possible

> ***Intent:*** *To reduce the exposure of building occupants and maintenance staff to potential hazards from cleaning equipment.*

Cleaning equipment can produce waste and emissions, create noise pollution, damage indoor surfaces, and degrade indoor air quality.

> ***Options:*** *Several options are available toward earning this credit:*
>
> - *Use vacuums certified by the Carpet and Rug Institute's Seal of Approval program (formerly the Green Label program). Carpet extraction equipment is already certified under the Seal of Approval program.*
> - *Powered floor equipment, including buffers and burnishers, should include vacuums, guards, and devices for capturing fine particles and have a noise level less than 70dBA.*

- *Propane-powered floor equipment should have high-efficiency, low-emissions engines that meet California Air Resources Board regulations and Environmental Protection Agency standards and operate with a sound level of less than 90dBA.*
- *Automated scrubbing machines should have variable-speed feed pumps and on-board chemical monitoring to optimize the use of cleaning products. Alternately, scrubbers using only tap water could be used.*
- *Battery-powered equipment should use gel batteries.*
- *Power equipment should be ergonomically designed to minimize vibration, noise, and user fatigue.*
- *Equipment is designed with safeguards, such as rollers or rubber bumpers, to reduce potential damage to building surfaces.*

Demonstration: More information about sustainable cleaning equipment is available at the Carpet and Rug Institute website.

IEQ CREDIT 3.5: GREEN CLEANING—INDOOR CHEMICAL AND POLLUTANT SOURCE CONTROL

One point is possible

> ***Intent:*** *To prevent inadvertent introduction of chemicals brought in on footwear or outerwear.*

Containment of chemicals and dirt at entry into the building offers multiple benefits, such as enhancing the cleanliness of the building and reducing the cleaning load.

> ***Options:*** *Employ permanent entryway systems (grills, grates, or mats) at least ten feet long in the primary direction of travel to capture dirt and particulates at all entry points. The most effective designs have both indoor and outdoor components.*

Demonstration: As we have mentioned elsewhere, vendors can be good sources for learning about sustainability (Note: these examples are not intended as product or service endorsements). The website for Logomats® has a great deal of information on this credit and how it can be applied.

IEQ CREDIT 3.6: GREEN CLEANING—INDOOR INTEGRATED PEST MANAGEMENT

One point is possible

Intent: *To develop an indoor pest management plan that integrates with outdoor protection to provide a safe, unified, and effective program that limits occupant exposure to chemicals often associated with pest management.*

An effective pest management program integrates both indoor and outdoor components. The plan must also address the type, use, and disposal of chemicals employed for pest control.

Option: *Garnering a point here requires a three-part approach. First, the integrated pest management plan must be executed and monitored. Second, situations in which emergency approaches are allowed need to be spelled out. Finally, a communications plan must be established and enacted to notify building tenants of impending applications.*

Demonstration: The City of San Francisco's well regarded Integrated Pest Management (IPM) program includes the IPM policy and implementation plan, outlines notification processes, and identifies exemptions.

INNOVATION IN OPERATIONS (IO)
This section of the rating system allows for new and perhaps previously unavailable strategies and products to be successfully used and adapted to improve building performance.

IO CREDIT 1: INNOVATION IN OPERATIONS
Up to four points are possible

Intent: *To earn credit for ideas and activities that haven't been addressed by the published LEED for Existing Buildings rating system or to allow for excellence in surpassing these criteria.*

Often, during building projects, unique ideas surface that can be demonstrated to be beneficial to other projects or to increase the threshold for a particular credit in a cost-effective manner.

Options: *Achieve significant measurable performance not addressed in LEED EB: O&M. One point (up to four) can be achieved for each innovation achieved. Demonstrate exemplary performance in an existing LEED prerequisite or credit (up to three points).*

Demonstration: USGBC maintains a file of current innovation credits.

IO CREDIT 2: LEED ACCREDITED PROFESSIONAL (LEED AP)
One point is possible

> ***Intent:*** *To support the integration of the building team as required by LEED and to streamline the application and certification process.*

LEED APs have demonstrated through testing and continuing education that they understand the rating process and the certification and application process as well. The LEED AP can help design the project team and make sure it works in the integrated fashion that has been demonstrated to achieve improved operational results in the finished building.

> ***Option:*** *At least one principle participant in the project team is a LEED AP.*

Demonstration: The GBCI website provides more information about LEED APs. You can also search a directory of credentialed professionals.

IO CREDIT 3: DOCUMENTING SUSTAINABLE BUILDING COST IMPACTS
One point is possible

> ***Intent:*** *To document the impacts of the costs of sustainable building.*

The U.S. Green Building Council is committed to documenting and sharing costs and savings data for certified projects. Information provided can be used to measure the costs and benefits of different strategies used to attain credits.

> ***Option:*** *Provide cost data for five years prior to the reporting period. Document the costs of complying with the LEED EB: O&M and the resultant savings.*

Demonstration: The National Institute of Building Sciences provides a description of the Life-Cycle Cost Analysis (LCCA) method of assessing the total cost of facility ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system.

The Christman Building in Lansing, Michigan, is a good example of a renovation of an existing building with a lower cost than constructing a new building and with the additional benefit of generating revenue.

REGIONAL PRIORITY (RP)
Different strategies can be used in regional areas to address problems specific to that area that would be impractical or unnecessary in other regions. This allows for climactic and market differences to be reducing in earning credits.

RP Credit 1: Regional Priority
Up to four points are possible

> ***Intent:*** *To provide an incentive for the achievement of credits that address geographically specific environmental priorities.*

Since natural environments differ significantly by region, some credits are more easily achieved in certain parts of the country. Regions also face local environmental issues that need to be addressed.

> ***Options:*** *The U.S. Green Building Council maintains a database of applicable* regional credits *on its website.*

Case Study
The Clinton Presidential Library, Little Rock, AK—LEED for Existing Buildings Platinum

The Clinton Presidential Library was certified as LEED for New Construction Silver when it opened in 2004. In 2007 it became the first federal building to receive LEED Platinum, the highest level of LEED, under the LEED for Existing Buildings rating system program. The U.S Green Building Council features the Clinton Presidential Library as one of its case studies.

For political balance, the authors would hasten to mention that after the Clinton Library became Platinum, the Bush Presidential Library also achieved LEED Platinum under LEED for New Construction. It would seem that Presidents Clinton and Bush have set a high bar for presidential library buildings.

Question
1. Outline the reasons to include sustainability goals as part of your renovation project. What are the potential benefits?

2. Can you describe why the requirements for a renovation differ from new construction? What unique opportunities does a renovation provide?

3. What existing systems or design features in your existing facility have frustrated

staff the most? Customers? What features do they staff and customers love? Are there opportunities to preserve some of these elements in the project?

Notes

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2. Jim Sinopoli, "Park it Here: Smart and Green Parking Garages," Automated-Buildings.com, July 2009, http://automatedbuildings.com/news/jul09/articles/sinopoli2/090629024707sinopoli.htm.
3. See the American Public Transportation Association at www.apta.com. Look under Resources, Reports and Publications, Energy and Environment for report.
4. American Society of Agronomy (2010, October 21).
5. Amy Vickers, 2001. *Handbook of Water Use and Conservation.* Water Flow Press, Amherst, MA. P. 140.
6. American Society of Heating, Refrigerating and Air-Conditioning Engineers, "ASHRAE and Industry History," http://www.ashrae.org/aboutus/page/150. See also ASHRAE's "Procedures for Commercial Building Energy Audits, 2nd ed."
7. The Inside Story: A Guide to Indoor Air Quality. U.S. EPA/Office of Air and Radiation. Office of radiation and Indoor Air (6609J) Cosponsored with the Consumer Product Safety Commission, EPA 402-K-93-007.
8. Gregg D, Ander "Daylighting Performance and Design" 2003: John Wiley & Sons, New York.
9. National Audubon Society, "Trinity River Audubon Center: Green Building and LEED Certification."

Additional Resources

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Bondanza, Jackie. *How to Design and Build a Green Office Building: A Complete Guide to Making Your New or Existing Building Environmentally Healthy*. Ocala, FL: Atlantic Publishing Group, 2010.

Gelfand, Lisa. *Sustainable Renovation: Strategies for Commercial Building Systems and Envelope*. Hoboken, NJ: John Wiley, 2011.

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CHAPTER 5

LEED® for Commercial Interiors: Category by Category, Point by Point

You wouldn't call Jon Bakhshi, owner of the Chelsea megaclubs Home and Guest House, a tree hugger. The native New Yorker is all business, his rapid-fire patter more fluent in bottle service than in the ecological benefits of bamboo. But two and a half years ago, when Bakhshi was lying on the beach, mulling over new nightlife concepts, he hit upon an idea: build the world's first LEED-certified club. "I saw the ocean, the sand, and the sky, and it just came to me," he says of the inspiration. The result, Greenhouse, a 6,000-square-foot space that opened last November in Soho, teems with earth-friendly technologies and materials. But it also demonstrates how far green design has evolved, from fringe concern to mainstream marketing device.

—Julie Tasaska[1]

The LEED® 2009 for Commercial Interiors rating system has been developed specifically to assist tenants in leased space influence the way they interact with the space they occupy. It is a set of performance standards for certifying the design and construction of tenant spaces for office, restaurant, healthcare, hotel/resort, and education buildings of all sizes, both public and private. The intent is to promote healthful, durable, affordable, and environmentally sound practices in tenant space design and construction. LEED for Commercial Interiors is the rating system that is focused on internal elements and designed primarily for tenants of buildings whose control over their space is primarily limited to portions of the interior of the facility. It enables tenants and designers to work within the confines of a building's interior, encouraging spaces that are healthy for both its occupants and the environment. This rating system covers all interior elements such as floors and walls, finishes, lighting, furniture, mechanical systems, and individual comfort.

LEED 2009 Minimum Program Requirements (MPRs) for Commercial Interiors

The LEED 2009 Minimum Program Requirements (MPRs) is a USGBC policy that lists the minimum characteristics that a project must possess in order to be eligible for certification under LEED 2009. These requirements define the categories of buildings that the LEED rating systems were designed to evaluate, and, taken together,

serve three goals: to give clear guidance to customers, to protect the integrity of the LEED program, and to reduce challenges that occur during the LEED certification process. It is expected that MPRs will evolve over time along with LEED rating system improvements. The MPRs for Commercial Interiors are shown here:

1. Must Comply with Environmental Laws
The LEED project building or space, all other real property within the LEED project boundary, and all project work must comply with applicable federal, state, and local building-related environmental laws and regulations in place where the project is located. This condition must be satisfied from the date of LEED project registration or the commencement of schematic design, whichever comes first, up and until the date that the building receives a certificate of occupancy or similar official indication that it is fit and ready for use.

2. Must be a Complete, Permanent Building or Space
All LEED projects must be designed for, constructed on, and operated on a permanent location on already existing land. LEED projects shall not consist of mobile structures, equipment, or vehicles. No building or space that is designed to move at any point in its lifetime may pursue LEED Certification.

The LEED project scope must include a complete interior space distinct from other spaces within the same building with regards to at least one of the following characteristics: ownership, management, lease, or party wall separation.

3. Must Use a Reasonable Site Boundary
If any land was or will be disturbed for the purpose of undertaking the LEED project, then that land must be included within the LEED project boundary.

4. Must Comply with Minimum Floor Area Requirements
The LEED project must include a minimum of two hundred and fifty square feet (twenty-two square meters) of gross floor area.

5. Must Comply with Minimum Occupancy Rates
The LEED project must serve one or more full-time equivalent (FTE) occupant(s), calculated as an annual average in order to use LEED in its entirety

6. Must Commit To Sharing Whole-Building Energy and Water Usage Data
All certified projects must commit to sharing with the U.S. Green Building Council (USGBC)all available actual whole-building energy and water usage data. The purpose of data collection is for research purposes to aid in improving the LEED

program. USGBC may publish such data; however, any data that is made publicly available shall be presented in an aggregate form with no identifying project-specific characteristics.

7. Must Comply with a Minimum Building Area to Site Area Ratio
The gross floor area of the LEED project building must be no less than two percent of the gross land area within the LEED project boundary.

Credit Categories, Point by Point

As in Chapters 3 and 4, each credit is followed by a demonstration of that credit. It should be noted that the documentation shown does not constitute an endorsement and is designed to be illustrative.

SUSTAINABLE SITES (SS)

SS CREDIT 1: SITE SELECTION
Up to five points are possible

> ***Intent:*** *To encourage tenants to select buildings that employ best practices systems and green strategies.*

Since tenants are usually limited to impacting interior space only, it makes sense that the easiest implementation would be in a building that already was designed with many of the LEED priorities already incorporated. Making use of existing, efficient interior systems minimizes the duplication of resources as well as minimizing expense.

> ***Option 1:*** *By selecting a building that is already LEED certified, a tenant is awarded the full five points.*

> ***Option 2:*** *Locate the tenant space in a building that meets one or more of these criteria:*
> - *Brownfield Redevelopment: A contaminated site that has been "cleaned up" (one point)*
> - *Stormwater Design—Quantity Control: A building that changes the way in which stormwater is managed and documents improvement as specified (one point)*
> - *Stormwater Design—Quality Control: A building that removes at least eighty percent of suspended solids and forty percent of phosphorus from stormwater (one point)*

- *Heat Island Effect—Non-roof: Shading and use of solar reflective material, or underground or covered parking for fifty percent and fifty percent of the parking area has open grid paving (one point)*
- *Heat Island Effect—Roof: Seventy-five percent of rooftop has a solar reflectance index meeting minimums, has a vegetated roof over fifty percent of the roof area, or a building that has both (one point)*
- *Light Pollution Reduction: Reduction of lighting that escapes through windows and doors meets minimum requirements (one point)*
- *Water Efficient Landscaping: Building has improved systems for a fifty percent reduction in water use (two points)*
- *Water Efficient Landscaping: No irrigation or use of potable water (an additional two points)*
- *Innovative Wastewater Technologies: Building reduces wastewater reduction by fifty percent or treats one hundred percent wastewater on-site (two points)*
- *Water Use Reduction: Buildings reducing water usage thirty percent or more (one point)*
- *On-Site Renewable Energy: Building gets two-and-a-half percent or five percent of the total energy use from on-site renewable energy (one or two points)*

Demonstration: The Council Tree Library in Fort Collins, Colorado, is located in an existing retail center which redesigned irrigation and water-thrifty plants for a fifty-five percent reduction in water usage. Harvard University's Griswold Hall installed a high-albedo Sarnafil G410 white membrane roof, which has eighty-two percent reflectance and ninety-two percent emittance to reduce urban heat island effect. The Dexter Library at Northland College employed an onsite stormwater management that reduces the impacts of stormwater runoff (quantity and quality) from the roof. This reduction is achieved through a bio-swale landscaped with native plants. Minimal exterior and site lighting reduces light pollution and improves night sky access.

SS CREDIT 2: DEVELOPMENT DENSITY AND COMMUNITY CONNECTIVITY
Up to six points are possible

> ***Intent:*** *To channel development to urban areas with existing infrastructure, protect greenfields, and preserve habitat and natural resources.*

This credit category encourages tenants to seek spaces in proximity to existing resources where tenants can walk to nearby amenities and access public transportation easily if it's available. Often libraries are located in locations that are available due to some political or financial expediency. Recognizing the proximity of a leased space to a potential audience and easy retail and transportation options, this credit gives credit to tenants seeking such a space.

Option 1: *Development Density. Select space in a building that is located in an established, walkable community with a minimum density of 60,000 square feet per acre net. The density calculation is based on a typical two-story downtown development and must include the area of the project being built.*

Option 2: *Community Connectivity. Select space in a building on a site that meets the following criteria:*

- *is located within a half mile of a residential area or neighborhood with an average density of ten units per acre net*
- *is within a half mile of at least ten basic services*
- *has pedestrian access between the building and the services.*

Examples of basic services include the following:

- *Bank*
- *Place of Worship*
- *Convenience Grocery*
- *Day Care Center*
- *Cleaners*
- *Fire Station*
- *Beauty Salon*
- *Hardware*
- *Laundry*
- *Library*
- *Medical or Dental Office*
- *Senior Care Facility*
- *Park*
- *Pharmacy*
- *Post Office*
- *Restaurant*
- *School*
- *Supermarket*
- *Theater*

- *Community Center*
- *Fitness Center*
- *Museum.*

Proximity is determined by drawing a 1/2-mile radius around a main building entrance on a site map and counting the services within that radius. Greenfield developments and projects that do not use existing infrastructure are not eligible.

Demonstration: Under LEED for Commercial Interiors, Harvard University's McCollum Hall received Gold certification for its renovation in 2007.

SS CREDIT 3.1: ALTERNATIVE TRANSPORTATION—PUBLIC TRANSPORTATION ACCESS
Up to six points are possible

Intent: *To reduce the impacts of automobile usage.*

By locating near to, or providing access to nearby public transportation, the burden on the road system is reduced. Public transportation also tends to use cleaner fuels than automobiles.

Option 1: *Locate within a half mile walking distance of commuter rail, light rail, or subway station.*

Option 2: *Locate the project within a quarter mile walking distance of bus stops for two or more bus lines usable by building tenants.*

Demonstration: While it is certainly desirable to locate close to public transportation, USGBC recognizes that some localities do not provide public transit options. In these cases, it is up to the tenant to devise innovative strategies that mimic public transportation or bring people to existing transit options.

Figure 5.1. California Department of Public Health, Richmond, CA. To encourage employees to use mass transit, CDPH provides a free shuttle service to and from the nearest Bay Area Rapid Transit (BART) station. This in addition to a mass transit fare subsidy provided by CDPH to its employees (Photo by Leon Alevantis, Courtesy USGBC.)

The Council Tree Library in Colorado located near residential and retail communities allowing patrons to walk, bike or ride a bus to the Library.[2] United Parcel Service (UPS) developed a transportation program for its facility in Hodgkins, Illinois (outside of Chicago), to provide transportation options for its employees.

SS CREDIT 3.2: ALTERNATIVE TRANSPORTATION—BICYCLE STORAGE AND CHANGING ROOMS

Up to two points are possible

> ***Intent:*** *To encourage use of bicycles in transportation.*

Employers creating a safe location for bike storage and a place to shower and change after riding to work overcome the obstacles reported by many potential bicyclists.

> ***Option:*** *Provide secure bike racks within two hundred yards of a main building entrance for five percent or more of tenant occupants.*
>
> *Provide shower and changing facilities in the building or within two hundred yards of the building entrance for 0.5% of the full-time equivalent occupants.*

Demonstration: A bike rack comes in many different shapes and forms and doesn't have to be a traditional sidewalk rack. Bikes can be hung in closets from hooks or stored securely in a room in the basement. Racks can be designed to stack bikes or hang bikes from a wall. Several types of bike racks can be seen at the Madrax website.

SS CREDIT 3.3: ALTERNATIVE TRANSPORTATION—PARKING AVAILABILITY

Up to two points are possible

> ***Intent:*** *To reduce the number of parking spaces needed in a project and to provide a disincentive for single automobile transportation.*

By encouraging carpooling, an incentive is created to avoid the use of single automobiles.

> ***Option 1:*** *For a space occupying less than seventy-five percent of the total building area, create preferred parking for carpools or vanpools capable of serving five percent or more of the tenant population and the number of parking spots must not exceed local zoning regulations.*

Alternatively, the tenant could provide no parking for its employees.

Option 2: *For a space occupying seventy-five percent or more of the total building area: Create preferred parking for carpools or vanpools capable of serving five percent or more of the tenant occupants. Existing parking must not exceed local zoning requirements and no new parking can be added.*

Demonstration: Members of the Research Triangle Park in North Carolina have developed a transportation management program called SmartCommute@rtp. Its website provides information and an example of how carpooling and other alternate transportation methods can be coordinated. The Dexter Library at Northland College has designated carpool parking to limit the availability of parking as a means of encouraging ridesharing to and from the library.

WATER EFFICIENCY (WE)

The focus of water efficiency is to make a reduction in the use of water through small behavior changes that can be facilitated by advances in plumbing fixtures and associated technologies. The goal is not to be restrictive, but rather to educate occupants about making better use of water resources.

WE PREREQUISITE 1: WATER USE REDUCTION

Required

Intent: *To increase water efficiency in buildings to reduce the burden on the municipal water supply.*

Reducing the consumption of drinkable water reduces costs for the tenant but also for the municipal entity charged with providing fresh water.

Meeting this prerequisite requires using twenty percent less water than a baseline calculated for the building. Measurements will include toilets, urinals, faucets, and sprayers. Specialty equipment that also uses water is included as well.

Demonstration: At the Mutual Building, the headquarters of the Christman Company in Lansing, Michigan, landscaping was designed to require no potable water irrigation. A forty percent reduction in potable water and sewage use was achieved by careful selection of water efficient plumbing, such as low-flow fixtures, 0.5 gallon-per-minute automatic lavatory faucets with aerators, and dual flush valves throughout the building.

WE CREDIT 1: WATER USE REDUCTION
Six to eleven points are possible

> ***Intent:*** *To improve the performance of the building beyond the baseline of the Water Efficiency prerequisite.*

This credit category provides incentives for additional reductions in water usage.

> ***Options:*** *Employ strategies that in aggregate use less water than the calculated baseline. A thirty-percent reduction in water use earns six points, a thirty-five-percent reduction earns eight points, and a forty-percent reduction earns eleven points.*

Demonstration: The Water Sense website from the U.S. Environmental Protection Agency provides information about water-saving fixtures.

ENERGY AND ATMOSPHERE (EA)
Energy and Atmosphere credits relate to the quality of the mechanical systems in the building and how they affect the use of energy in the building.

EA PREREQUISITE 1: FUNDAMENTAL COMMISSIONING OF BUILDING ENERGY SYSTEMS
Required

> ***Intent:*** *To verify that the project's systems are installed and calibrated to perform at optimum efficiency and as designed.*

The benefits of commissioning include reduced energy use, lower operating costs, fewer contractor callbacks, better building documentation and improved occupant productivity. The *Whole Building Design Guide*, a program of the National Institute of Building Sciences, provides a definition for commissioning:

> ASHRAE Guideline 0, The Commissioning Process, defines commissioning as "a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria." Commissioning is an all-inclusive process for all the planning, delivery, verification, and managing risks to critical functions performed in, or by, facilities. Commissioning ensures building quality using peer review and in-field or on-site verification. Commissioning also accomplishes higher energy efficiency, environmental health, and oc-

> cupant safety and improves indoor air quality by making sure the building components are working correctly and that the plans are implemented with the greatest efficiency. Commissioning is a quality assurance-based process that delivers preventive and predictive maintenance plans, tailored operating manuals and training procedures for all users to follow. Essentially, the commissioning process formalizes review and integration of all project expectations during planning, design, construction, and occupancy phases by inspection and functional performance testing, and oversight of operator training and record documentation.[3]

To meet this prerequisite, the project team must:

- designate an individual as the commissioning authority;
- document the owner's project requirements;
- develop and incorporate commissioning requirements into the construction documents;
- develop and implement a commissioning plan;
- verify the installation and performance of systems to be
- commissioned; and
- complete a summary commissioning report.

Commissioning process activities must be completed at a minimum for the following systems:

- Heating, ventilating, air conditioning, and refrigeration
- Lighting and daylighting controls
- Domestic hot water systems
- Renewable energy systems.

Demonstration: The Building Commissioning Association has developed a best-practices document that defines and outlines the process of commissioning for existing buildings.

EA PREREQUISITE 2: MINIMUM ENERGY PERFORMANCE
Required

> ***Intent:*** *To refer the tenant to applicable standards that will assist in reducing energy use in the building.*

By referencing existing standards into the construction documents and design, the tenant has some assurance that proposed fittings and furnishings will reduce the energy requirements.

The meet this prerequisite, the project team has to:

- design portions of the building within the tenant's scope of work to comply with ANSI/ASHRAE/IESNA Standard 90.1-2007;
- comply with the mandatory provisions;
- achieve the prescriptive or performance requirements;
- reduce connected lighting power density ten percent below requirements; and
- install ENERGY STAR qualified equipment for fifty percent of ENERGY STAR-eligible equipment installed as part of the tenant's scope of work.

Demonstration: Information about compliance with the ASHRAE standard is available in the ASHRAE Advanced Energy Design Guide series. Information about the ENERGY STAR program and resources is available at the ENERGY STAR website.

EA PREREQUISITE 3: FUNDAMENTAL REFRIGERANT MANAGEMENT

Required

> ***Intent:*** *To reduce stratospheric ozone depletion.*

Chlorofluorocarbons (CFCs) have been shown to cause ozone depletion and other climactic problems.

To meet this prerequisite, the LEED project must have zero use of CFC-based refrigerants in tenant heating, ventilating, air conditioning, and refrigeration (HVAC&R) systems used within its scope of work.

Demonstration: The Significant New Alternatives Policy (SNAP) Program of the U.S. Environmental Protection Agency identifies alternatives to CFCs.

EA CREDIT 1.1: OPTIMIZE ENERGY PERFORMANCE—LIGHTING POWER

From one to five points are possible

> ***Intent:*** *To achieve increasing levels of energy conservation beyond the referenced standard to reduce environmental and economic impacts associated with excessive energy use.*

The demand for energy requires increased power production which increases the demand for and use of fossil fuels.

> ***Options:*** *Reduce connected lighting power density below that allowed by ANSI/ASHRAE/IESNA Standard 90.1-2007. A minimum fifteen-percent reduction result in one point, while a thirty-five-percent reduction results in five points.*

Demonstration: The ASHRAE standard is available for purchase at the ASHRAE website.

EA CREDIT 1.2: OPTIMIZE ENERGY PERFORMANCE—LIGHTING CONTROLS
From one to three points are available

> ***Intent:*** *To achieve increasing levels of energy conservation beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.*

Power usage of bulbs and fixtures is just one component of the electricity used for lighting. The controls can contribute a great deal of savings in this area as well, especially when tenant occupants can control their own lighting levels.

> ***Option:*** *Design the project to include one or more of the following independent strategies:*
> - *Daylight controls for day lit areas (One point). Install daylight responsive controls in all regularly occupied day lit spaces within 15 feet of windows and under skylights. Daylight controls must switch or dim electric lights in response to the presence or absence of daylight illumination in the space.*
> - *Daylight controls for fifty percent of the lighting load (One point). Install daylight responsive controls for fifty percent or more of the connected lighting load and demonstrate that fifty percent of the connected lighting load is daylight responsive. Daylight controls must switch or dim electric lights in response to the presence or absence of daylight illumination in the space.*
> - *Occupancy sensors (One point). Install occupancy sensors for seventy-five percent of the connected lighting load.*

Demonstration: The Sequoya Branch of the Madison Public Library, Madison, Wisconsin, used electrical systems include high efficiency light fixtures, occupancy sensors, ambient sensors for daylighting control, and window shading devices with ambient sensors.

EA CREDIT 1.3: OPTIMIZE ENERGY PERFORMANCE—HVAC

Up to ten points are possible

Intent: *To achieve increasing levels of energy conservation beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.*

Most conventional forms of energy production have a negative impact on the environment. Besides being a major energy consumer, the heating, air conditioning, and ventilation (HVAC) systems also are one of the biggest sources of employee complaints in the work environment. With an emphasis on reduction of energy use and the ability of an individual to control their immediate environment, this credit is an important one.

Figure 5.2. California Department of Public Health, Richmond, CA. Occupant controlled shades on the south side of the building (shown here) help minimize glare. In addition, controls on the south and the north sides of the building turn off overhead lighting when the light levels are sufficient. Task lighting at all the workstations also help reduce general lighting levels elsewhere in the building. (Photo by Leon Alevantis, courtesy of USGBC).

Option 1: *Implement one or both of the following strategies:*

- *Equipment Efficiency (Five points). Install heating, ventilation and air conditioning (HVAC) systems that comply with the efficiency requirements outlined in the New Building Institute's Advanced Buildings™ Core Performance™ Guide Sections 1.4: Mechanical System Design, 2.9: Mechanical Equipment Efficiency, and 3.10: Variable Speed Control.*
- *Appropriate Zoning and Controls (Five points). Zone tenant fit out of spaces to meet the following requirements:*
  - *Every solar exposure must have a separate control zone.*
  - *Interior spaces must be separately zoned.*
  - *Private offices and special occupancies (e.g., conference rooms, kitchens) must have active controls capable of sensing space use and modulating the HVAC system in response to space demand.*

Option 2: *Reduce design energy cost compared with the energy cost budget for regulated energy components described in the requirements of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda1)*

AND choose one of the following two paths:

- *PATH 1 (Five points). Demonstrate that HVAC system component performance criteria used for tenant space are fifteen percent better than a system in minimum compliance with ANSI/ASHRAE/IESNA Standard 90.1-2007.*
- *PATH 2 (Ten points). Demonstrate that HVAC system component performance criteria used for tenant space are thirty percent better than a system that is in minimum compliance with ANSI/ASHRAE/IESNA Standard 90.1-2007*

Demonstration: SL Green Realty, New York City's largest office landlord, prepared these tenant *Guidelines for Energy Efficiency & Sustainability* for commercial occupants. This credit is addressed on page 7 of the guidelines.

EA CREDIT 1.4: OPTIMIZE ENERGY PERFORMANCE—EQUIPMENT AND APPLIANCES
Up to four points are possible.

> ***Intent:*** *To achieve increasing levels of energy conservation beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.*

This credit category provides an incentive for going beyond the basics. Since many commercial interior projects will use all new equipment, this credit assists in ensuring that these new purchases are made using energy reducing selections.

Options: For all appliances and equipment purchased for the project that qualify for an ENERGY STAR rating, make purchases of up to ninety percent of these items for maximum points.

Demonstration: View the ENERGY STAR website for information about qualified equipment and appliances appropriate to small businesses.

EA Credit 2: Enhanced Commissioning
Up to five points are possible

> ***Intent:*** *To verify and ensure that the tenant space is designed, constructed, and calibrated to operate as intended.*

All equipment installed for a project can experience deviations in its performance

after it's put in. Dust and other dirt from construction can minimize effective performance, as can other problems with the equipment itself.

Option: *Implement, or have a contract in place to implement, the following additional commissioning process activities in addition to the requirements of EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems:*

- *Prior to the start of the construction documents phase, designate an independent commissioning authority (CxA) to lead, review and oversee the completion of all commissioning process activities.*
- *The CxA must have documented commissioning authority experience in at least two building projects.*
- *The individual serving as the CxA:*
  - *must be independent of the work of design and construction;*
  - *must not be an employee of the design firm, though he or she may be contracted through them;*
  - *must not be an employee of, or contracted through, a contractor or construction manager holding construction contracts;*
  - *may be a qualified employee or consultant of the owner.*
- *The CxA must report results, findings and recommendations directly to the owner.*
- *The CxA must conduct, at a minimum, 1 commissioning design review of the owner's project requirements; basis of design and design documents prior to the mid-construction documents phase and must back-check the review comments in the subsequent design submission.*
- *The CxA must review contractor submittals applicable to systems being commissioned for compliance with the owner's project requirements and basis of design. This review must be concurrent with the reviews of the architect or engineer of record and submitted to the design team and the owner.*
- *The CxA or other project team members must develop a systems manual that gives future operating staff the information needed to understand and optimally operate the project's commissioned systems.*
- *The CxA or other project team members must verify that the requirements for training operating personnel and building occupants have been completed.*
- *The CxA must be involved in reviewing the operation of the tenant space with operations and maintenance (O&M) staff and occu-*

pants within eight to ten months after substantial completion. A plan for resolving outstanding commissioning-related issues must be included.

Demonstration: A paper presented at the National Conference on Building Commissioning in 2005 provides a meta-analysis of the cost-effectiveness of the commissioning process for two hundred twenty-four buildings.

EA CREDIT 3: MEASUREMENT AND VERIFICATION
Two to five points are possible

Intent: *To provide for the ongoing accountability and optimization of tenant energy and water consumption performance over time.*

The lifespan of a building can be well over fifty years. During this time, personnel change, tenants change, and the original documentation about the systems design and operation are lost. This credit provides an incentive to record this information so that the energy used in the facility is optimal during its lifespan.

Options: *The options for this credit category are based on the proportion of the project to the total building area:*

CASE 1. Projects less than seventy-five percent of the total building area (Two to three points). Complete one or more of the following:
- *Install submetering equipment to measure and record energy use within the tenant space. (Two points)*
- *Negotiate a lease whereby energy costs are paid by the tenant and not included in the base rent. (Three points)*

OR

CASE 2. Projects seventy-five percent or more of the total building area (Five points). Install continuous metering equipment for the following end uses: (Five points)
- *Lighting systems and controls*
- *Constant and variable motor loads*
- *Variable frequency drive operation.*
- *Chiller efficiency at variable loads (kW/ton)*
- *Cooling load*
- *Air and water economizer and heat recovery cycles*

- *Air distribution static pressures and ventilation air volumes*
- *Boiler efficiencies*
- *Building-related process energy systems and equipment*
- *Indoor water riser and outdoor irrigation systems*

Develop and implement a measurement-and-verification (M&V) plan that incorporates the monitoring information from the above end uses and is consistent with Option B, C, or D of the 2001 International Performance Measurement & Verification Protocol (IPMVP) Volume I: Concepts and Options for Determining Energy and Water Savings.

Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

Demonstration: The US Department of Energy has published guidelines for the M&V plan for federal projects.

EA CREDIT 4: GREEN POWER
Five points are possible

> ***Intent:*** *To encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis. This means that a building acquires power that is produced in a non-polluting.*

Energy production is a source of pollution. By encouraging the purchase of energy purchased from sources that are non-polluting, we can contribute significantly to the overall reduction of atmospheric pollutants.

> ***Option 1:*** *Engage in at least a two-year renewable energy contract to provide at least fifty percent of the tenant's electricity from renewable sources, as defined by the Center for Resource Solutions (CRS) Green-e program's energy product certification requirements.*
>
> *All purchases of green power must be based on the quantity of energy consumed, not the cost, as determined by the annual electricity consumption results of EA Credit 1, Optimize Energy Performance.*
>
> ***Option 2:*** *Engage in at least a two-year renewable energy contract to purchase at least eight kilowatt hours per square foot per year from renewable electricity sources as defined by the Center for Resource Solutions (CRS) Green-e program's product certification requirements.*

All purchases of green power must be based on the quantity of energy consumed, not the cost.

Demonstration: The U.S. Department of Energy's Green Power Network provides information on the sources of green power and on the green power market.

MATERIALS AND RESOURCES
This section focuses on the environmental impact of materials brought into the project building, and the minimization of landfill and incinerator disposal for materials that leave the project building. A sustainable commercial interiors project requires strategies for construction, materials selection, and waste management.

MR PREREQUISITE 1: STORAGE AND COLLECTION OF RECYCLABLES
Required

> ***Intent:*** *To facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.*

Recycling functions can consume large portions of floor space. These functions contribute greatly to the reduction in costs of maintaining community landfills, and encourage the active participation and education of building tenants.

In order to meet this prerequisite, the project must provide an easily accessible dedicated area or areas for the collection and storage of materials for recycling for the tenant space. Materials must include at a minimum paper, corrugated cardboard, glass, plastics, and metals.

Demonstration: First, investigate the recycling options that the building and the community provide. If these options prove inadequate, consider establishing employee-managed recycling. A variety of equipment is available at all price points to accept recycling. For information on recycling in your community, consult earth911.com. The City of Santa Monica, California provides guidance for the design of a recycling storage area.

MR CREDIT 1.1: TENANT SPACE, LONG-TERM COMMITMENT
One point is possible

> ***Intent:*** *To encourage choices that will conserve resources, reduce waste, and reduce the environmental impacts of tenancy as they relate to materials, manufacturing, and transport.*

Moving requires the consumption of resources in terms of packing materials and transportation. It also has documented effects on the morale of the workforce. Community improvements, such as the documented need for additional public transportation or for cultural amenities, also take time to develop. Staying in a space for a longer period reduces the consequences of more frequent moves.

> ***Option:*** *The occupant or tenant must commit to remain in the same location for a minimum of ten years.*

Demonstration: The Congress for the New Urbanism has resources that support the concentration of use in well-defined areas. The presence of well-established existing tenants is an attraction for additional lessors in an area.

MR CREDIT 1.2: MAINTAIN INTERIOR NONSTRUCTURAL COMPONENTS

Up to two points are possible

> ***Intent:*** *To extend the life cycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.*

Building reuse is a very effective strategy in reducing the overall environmental impact of construction. Often, spaces are gutted without an examination of the existing building components (e.g., ceiling grids, plumbing fixtures).

> ***Option:*** *Maintain at least forty or sixty percent by area of the existing non-shell, nonstructural components (e.g., walls, flooring, and ceiling systems). The minimum percentage interior component reuse for each point threshold is as follows: forty percent interior component re-use equals one point; sixty percent interior component re-use equals two points.*

Demonstration: The Zhuang Lab Renovation at Harvard University, which achieved

Figure 5.3. Bently Reserve, San Francisco, CA. Special attention was paid to preserving the original Beaux Arts style of the building, while applying modern technologies and sustainable design. New flooring was selected from Forest Stewardship Council certified resources. (Photo by Bently Holdings, Courtesy of USGBC.)

LEED for Commercial Interiors Gold in 2009, retained forty-one percent of the interior nonstructural components.

MR CREDIT 2: CONSTRUCTION WASTE MANAGEMENT
Up to two points are possible

> ***Intent:*** *To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.*

The EPA estimates that construction debris generates between 2 and 2.5 pounds of solid waste per square foot, the majority of which could be recycled.

> ***Option:*** *Recycle and/or salvage nonhazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or comingled. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but they must be consistent throughout. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows: fifty percent salvaged or recycled equals one point; seventy-five percent salvaged or recycled equals two points.*

Demonstration: The U.S. Environmental Protection Agency provides information on options that could be used to achieve enhanced recycling and salvage of building waste.

MR CREDIT 3.1: MATERIALS REUSE
Up to two points are possible

> ***Intent:*** *To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.*

Many communities have provided means and incentives to acquire recycled building materials. The reduction of the manufacture of new materials affects the supply chain significantly.

> ***Options:*** *Use salvaged, refurbished or reused materials, the sum of which constitutes at least five percent or ten percent, based on cost, of building (construction) materials, excluding furniture and furnishings. The minimum percentage materials reused for each point threshold is as follows: five percent equals one point; ten percent equals two points.*

Demonstration: Planet ReUse is a company that matches the need for recycled building materials with available resources. It also makes the case quite eloquently about using recycled building materials.

MR CREDIT 3.2: MATERIALS REUSE: FURNITURE AND FURNISHINGS
One point is possible

> ***Intent:*** *To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.*

Again, reduction of the demand for new furniture has a profound impact in the use of resources, waste, and pollution. Forty percent of office furniture purchased in the United States was supplied by Canada and China each. An increasingly diminished percentage of furniture used in the U. S. is manufactured here.[4]

> ***Option:*** *Use salvaged, refurbished, or used furniture and furnishings for thirty percent of the total furniture and furnishings budget.*

Demonstration: Books for Libraries is a company based in California that provides recycled library shelving.

MR CREDIT 4: RECYCLED CONTENT
Up to two points are possible

> ***Intent:*** *To increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.*

Products using recycled content reduce the use of raw materials and provide a market for post recycled consumer waste.

> ***Options:*** *Use materials, including furniture and furnishings, with recycled content such that the sum of postconsumer recycled content*

plus half of the pre-consumer content constitutes at least ten percent or twenty percent based on cost of the total value of the materials in the project. The minimum percentage materials recycled for each point threshold is as follows: ten percent equals one point; twenty percent equals two points.

The recycled content value of a material or furnishing is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

Demonstration: Many library furniture manufacturers and suppliers have responded to this requirement and interest in recycled materials by making them a routine part of their manufacturing cycle. The website for Brodart Contract Furnishings outlines their LEED point contribution potential.

MR CREDIT 5: REGIONAL MATERIALS
Up to two points are possible

Intent: *To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.*

Reducing the import of materials from great distances decreased transportation pollution. On another scale, this credit helps concentrate economic vitality in the region of the project, contributing to a healthier local economy.

Option 1: *(One point): Use a minimum of twenty percent of the combined value of construction and Division 12 (Furniture) materials and products that are manufactured regionally within a radius of five hundred miles.*

Option 2: *(Two points): Meet the requirements for Option 1. Use a minimum of ten percent of the combined value of construction and Division 12 (furniture) materials and products extracted, harvested, or recovered, as well as manufactured, within five hundred miles of the project.*

Demonstration: Alberici Corporation renovated a circa-1950s office building as its corporate headquarters, achieving LEED Platinum in the process. The project man-

aged to include twenty percent of its furnishings from within a five hundred mile radius. More information about their corporate headquarters building in available in an online brochure.

MR CREDIT 6: RAPIDLY RENEWABLE MATERIALS
One point is possible

> ***Intent:*** *To reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials. Rapidly renewable materials are defined by USGBC as those that take ten years or less to complete a regrowth cycle.*

Rapidly renewable materials require fewer natural resources in their production. The emergence of bamboo flooring is probably the most familiar example of a raw material whose production is less destructive to the environment than traditional hardwoods that are harvested in non-sustainable manners.

> ***Options:*** *Use rapidly renewable construction and Division 12 (Furniture and Furnishings) materials and products for five percent of the total value of all materials and products used in the project, based on cost.*

Demonstration: A great article from *Buildings* online magazine provides an overview of rapidly renewable resources and their uses.

MR CREDIT 7: CERTIFIED WOOD
One point is possible

> ***Intent:*** *To encourage environmentally responsible forest management.*

The negative consequences of irresponsible forestry practices have a deleterious effect on the environment. The Forest Sustainability Council (FSC) certifies forestry practices that meet standards of production and replenishment.

> ***Options:*** *When using new wood-based products and materials, use a minimum of fifty percent that are certified in accordance with the Forest Stewardship Council's principles and criteria. Division 12 (Furniture) material value is included in the determination of the certified wood content.*

Demonstration: There is considerable controversy surrounding this standard in a number of ways. Primarily, the rigidity and costs of becoming FSC-certified make it difficult for many manufacturers to obtain certification. Additionally, since many custom library furniture manufacturers have many lines, each variation needs to be certified and tested at considerable expense. These costs are of course passed on to libraries as consumers.

SectionZ, an online magazine published by the Ecotrust organization, has an entire issue devoted to information about the Forest Stewardship Council and sustainable forestry. It includes an article on the impacts on actual forestry practices in California.

Our recommendation is to pursue the intent of this point by including FSC certification as a desirable element of your furniture bid documents. By making it optional, you might be able to find a compliant manufacturer, or one who will work with you to realize the benefits of using sustainably harvested wood products.

INDOOR ENVIRONMENTAL QUALITY (IEQ)
Because Americans spend on average ninety per cent of their time indoors, the quality of the indoor environment has a profound impact on our health, happiness and productivity.

IEQ PREREQUISITE 1: MINIMUM INDOOR AIR QUALITY PERFORMANCE
Required

> ***Intent:*** *To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants*

Indoor air quality provides building owners the biggest opportunity to affect the quality of the interaction between the health of the user and the building itself.

Meet the minimum requirements of Section 4 through 7 of ASHRAE Standard 62.1-2007 Ventilation for Acceptable Indoor Air Quality (with errata but without addenda). Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

> *CASE 1. Mechanically Ventilated Spaces*

Mechanical ventilation systems must perform according to the ventilation rate procedure.

Modify or maintain existing building outside-air ventilation distribution system to supply at least the outdoor air ventilation rate required by ASHRAE Standard 62.1-2007 (with errata but without addenda).

If the project team cannot meet the outside air requirements of ASHRAE Standard 62.1-2007 (with errata but without addenda), document the space and system constraints that make it impossible, complete an engineering assessment of the system's maximum cubic feet per minute (cfm) capability toward meeting the requirements of ASHRAE Standard 62.1-2007 (with errata but without addenda), and achieve those levels, with a minimum of ten cfm per person. All other requirements must be met.

CASE 2. Naturally ventilated buildings must comply with ASHRAE Standard 62.1-2007 Section 5.1 (with errata but without addenda).

Demonstration: The Adam Joseph Lewis Center at Oberlin College in Ohio has made its energy use dashboard available on the Internet.

IEQ PREREQUISITE 2: ENVIRONMENTAL TOBACCO SMOKE CONTROL
Required

Intent: *To prevent or minimize exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental tobacco smoke (ETS).*

The most effective way to avoid health problems associated with ETS is to prohibit smoking indoors completely.

Option 1: *Locate tenant space in a building that prohibits smoking by all occupants and users, within twenty-five feet of entries, outdoor air intakes and operable windows.*

Option 2: *Confirm that smoking is prohibited in the portions of the tenant space not designated as a smoking space, all other building areas served by the same heating, ventilation, and air-conditioning (HVAC) system and the common areas used by occupants. Ensure*

that ETS cannot migrate by either mechanical or natural ventilation from other areas of the building.

If the occupants are permitted to smoke, provide one or more designated smoking rooms designed to contain, capture and remove ETS from the building. At a minimum, each smoking room must be directly exhausted to the outdoors, with no recirculation of ETS-containing air to nonsmoking areas, enclosed with impermeable deck-to-deck partitions, and operated at a negative pressure compared with surrounding spaces of at least an average of five Pa (0.02 inches of water gauge) and with a minimum of one Pa (0.004 inches of water gauge) when the doors to the smoking rooms are closed.

Verify performance of the smoking rooms differential air pressure by conducting fifteen minutes of measurement, with a minimum of one measurement every ten seconds, of the differential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking rooms closed. Conduct the testing with each space configured for worst case conditions of transport of air from the smoking rooms (with doors closed) to adjacent spaces.

Demonstration: The Americans for Nonsmokers' Rights website provides resources and data to enable indoor smoking bans.

IEQ CREDIT 1: OUTDOOR AIR DELIVERY MONITORING
One point is possible

Intent: *To provide capacity for ventilation system monitoring to promote occupant comfort and well-being.*

The amount of outdoor air introduced into the indoor environment has many positive benefits to the occupants. Monitoring the quantity of this air is essential to managing the performance of the HVAC systems of the building.

Options: *Install permanent monitoring systems to ensure that ventilation systems maintain design minimum requirements. Configure all monitoring equipment to generate an alarm when the airflow values or carbon dioxide (CO2) levels vary by ten percent or more from the design values, via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants, AND meet requirements of Case 1 or Case 2:*

CASE 1. Mechanically Ventilated Spaces (One point)

- *Monitor CO2 concentrations within all densely occupied spaces (those with a design occupant density of twenty-five people or more per one thousand square feet). CO2 monitors must be between three and six feet above the floor.*
- *Provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow with an accuracy of plus or minus fifteen percent of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2007 (with errata but without addenda) for mechanical ventilation systems where twenty percent or more of the design supply airflow serves non-densely occupied spaces.*

OR

CASE 2. Naturally Ventilated Spaces (One point)
Monitor CO2 concentrations within all naturally ventilated spaces. CO2 monitors must be between three feet and six feet above the floor. One CO2 sensor may be used to monitor multiple non-densely occupied spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants.

Demonstration: *The William J. Clinton Presidential Library has carbon dioxide monitors integrated with the building-management system ensure that adequate ventilation is supplied.*

IEQ CREDIT 2: INCREASED VENTILATION
One point is possible

Intent: *To provide additional air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.*

Increasing ventilation above minimum standards improves the indoor air quality of a building's occupied spaces and directly benefits the occupants' health and well-being.

Options: *Meet the requirements of Case 1 or Case 2 (One point):*

CASE 1. Mechanically Ventilated Spaces (One point)

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least thirty percent above the minimum rates required by ASHRAE 62.1-2007 (with errata but without addenda) as determined by IEQ Prerequisite 1: Minimum Indoor Air Quality Performance. Project teams wishing to use ASHRAE-approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits

OR

CASE 2. Naturally Ventilated Spaces (One point)
Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 2.8 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10: 2005, Natural Ventilation in Non-Domestic Buildings,

AND meet Option 1 or Option 2 below:

***Option 1:** Show that the natural ventilation systems design meets the recommendations set forth in the CIBSE manuals appropriate to the project space (Path 1 or Path 2).*

PATH 1. CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-Domestic Buildings.

PATH 2. CIBSE Applications Manual 13: 2000 Mixed Mode Ventilation.

OR

***Option 2:** Use a macroscopic, multi-zone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing minimum ventilation rates required by ASHRAE 62.1-2007 Chapter 6 (with errata but without addenda), for at least ninety percent of occupied spaces.*

Demonstration: This credit was attained by the CBF Merrill Environmental Center, a LEED for New Construction Platinum project.

IEQ CREDIT 3.1: CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN—DURING CONSTRUCTION

One point is possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.*

The construction project itself creates many airborne pollutants that find their way into the air handling and HVAC systems, to be later blown into the finished environment when the systems are turned on. Clean ventilation systems work longer and as designed.

> ***Options:*** *Develop and implement an IAQ management plan for the construction and preoccupancy phases of the tenant space as follows:*
> - *During construction, meet or exceed the recommended design approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA)* IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007*, ANSI/SMACNA 008-2008 (Chapter 3).*
> - *Protect stored on-site and installed absorptive materials from moisture damage.*
> - *If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of eight must be used at each return air grille, as determined by* ASHRAE 52.2-1999 *(with errata but without addenda). Replace all filtration media immediately prior to occupancy.*

Demonstration: The Centers for Disease Control and Prevention has a website on Maintaining Indoor Environmental Quality (IEQ) during Construction and Renovation.

IEQ CREDIT 3.2: CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN—BEFORE OCCUPANCY

One point possible

> ***Intent:*** *To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of workers and occupants.*

The treatment of the systems in the building to eliminate the intrusion of waste and airborne particles is critical to the workings of the building systems and their operation.

Options: *Using Option 1 or Option 2, develop an IAQ management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.*

Option 1: *Flush-Out (One point using Path 1 or Path 2)*

PATH 1. After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and flush-out the building by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot of floor area while maintaining an internal temperature of at least 60° F and, where mechanical cooling is operated, relative humidity no higher than sixty percent.

OR

PATH 2. If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot of outside air or the design minimum outside air rate determined in EQ Prerequisite 1: Minimum IAQ Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot of outside air has been delivered to the space.

Option 2: *Air Testing (One point)*

Conduct baseline IAQ testing after construction ends and prior to occupancy, using testing protocols consistent with the U.S. Environmental Protection Agency's Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED 2009 for Commercial Interiors.

Demonstrate that the contaminant maximum concentration levels listed below are not exceeded:

- *Formaldehyde – twenty-seven parts per billion*
- *Particulates – fifty micrograms per cubic meter*
- *Total Volatile Organic compounds – five hundred micrograms*

per cubic meter
- *4-Phenylcyclohexene (4-PCH) – 6.5 micrograms per cubic meter*
- *Carbon monoxide – nine parts per million and no greater than two parts per million above outdoor levels.*

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements have been met. When retesting noncompliant building areas, take samples from the same locations as in the first test to ensure accurate comparisons.

Conduct the air sample testing as follows:
- *All measurements must be conducted prior to occupancy, but during normal occupied hours, with the building ventilation system started at the normal daily start time and operated at the minimum outside air-flow rate for the occupied mode throughout the test.*
- *All interior finishes, including but not limited to millwork, doors, paint, carpet and acoustic tiles, must be installed. Movable furnishings such as workstations and partitions must be in place.*
- *The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than one per 25,000 square feet or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.*

Air samples must be collected between three and six feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

Demonstration: A fact sheet to help area contractors meet this credit category has been developed by ResourceVenture, a Seattle-based partnership of the Greater Seattle Chamber of Commerce and Seattle Public Utilities. Although written for LEED 2.1, you will still find this fact sheet useful.

IEQ CREDIT 4.1: LOW-EMITTING MATERIALS—ADHESIVES AND SEALANTS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, potentially irritating and/or harmful to the comfort and well-being of installers and occupants.*

Many adhesives and sealants off-gas, or release toxic odors and chemicals into the air, long after their initial use. These form one of the most common adverse reactions from occupants of renovated or new spaces.

> ***Options:*** *All adhesives and sealants used on the interior of the building (i.e. inside of the weatherproofing system and applied on-site) must comply with the requirements as applicable to the project scope:*
> - *Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule 1168. Volatile organic compound (VOC) limits listed in Rule 1168 were effective July 1, 2005 with a rule amendment date of January 7, 2005. (To access the table listing VOC limits, see the Demonstration below.)*
> - *Aerosol Adhesives must comply with Green Seal Standard for Adhesives for Commercial Use requirement in effect on September 1, 2011.*

Demonstration: Rule 1168 from the South Coast Air Quality Management District documents the various specifications.

IEQ CREDIT 4.2: LOW-EMITTING MATERIALS—PAINTS AND COATINGS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that is odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.*

We are aware from our experience as homeowners of the effect of paint fumes from painting projects we have performed. Typical paints used in commercial settings often have more volatile organic compounds as part of their design to increase longevity. Recent advances in paint composition have developed long-lasting paint finishes that do not have long-term odors associated with their VOC content.

> ***Options:*** *Paints and coatings used on the interior of the building (i.e. inside the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope:*

- *Architectural paints and coatings applied to interior walls and ceilings — must not exceed the volatile organic compound (VOC) content limits established in GS-11, Green Seal Standard for Paints and Coatings, 3rd edition, August 17, 2011.*
- *Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L established in Green Seal GC-03 Environmental Criteria for Anti-Corrosive Paints, 2nd Edition, January 7, 1997.*
- *Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements: must not exceed the VOC content limits established for those coating types in South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, amended June 3, 2011.*

Demonstration: The Christman Building in Lansing, MI achieved LEED for Commercial Interiors Platinum and used no or low- VOC paints, sealants and furnishings throughout.

IEQ CREDIT 4.3: LOW-EMITTING MATERIALS—FLOORING SYSTEMS
One point is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.*

Flooring products have adhesives and finishes that emit toxic and odorous compounds long after installation.

> ***Option 1:*** *All flooring must comply with the following as applicable to the project scope:*
> - *All carpet installed in the building interior must meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus program.*
> - *All carpet cushion installed in the building interior must meet the requirements of the Carpet and Rug Institute's Green Label Plus program.*
> - *All carpet adhesive must have less than 50 g/L VOC.*
> - *All hard surface flooring must meet the requirements of the Resilient Floor Covering Institute's FloorScore standard (current as of the date of this rating system, or more stringent version) as shown with testing by an independent third-party. Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone*

without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any indoor air quality testing requirements. However, associated site-applied adhesives, grouts, finishes, and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.

- *Concrete, wood, bamboo, and cork floor finishes such as sealer, stain and finish must meet the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, amended June 3, 2011.*
- *Tile setting adhesives and grout must meet South Coast Air Quality Management District (SCAQMD) Rule 1168. VOC limits correspond to an effective date of July 1, 2005 and rule amendment date of January 7, 2005.*

***Option 2:** All flooring products must meet the testing and product requirements of the California Department of Health's Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda. Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit.*

Demonstration: The Resilient Floor Covering Institute has a program that rates floor covering products called FloorScore.

IEQ CREDIT 4.4: LOW-EMITTING MATERIALS—COMPOSITE WOOD AND AGRIFIBER PRODUCTS

One point is possible

***Intent:** To reduce the quantity of indoor air contaminants that is odorous, irritating, and/or harmful to the comfort and well-being of installers and occupants.*

Agrifiber board is a composite material made from recovered agricultural waste. It is typically found in door cores and panels. Composite wood consists of wood

or plant fibers bonded together by a synthetic resin. Examples include plywood, particle board, oriented strand board (OSB) and medium-density fiberboard (MDF).

> ***Options:*** *Composite wood and agrifiber products used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins. Laminate adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.*
>
> *Composite wood and agrifiber products are defined as: particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores. Materials considered fixtures, furniture, and equipment (FF&E) are not considered base building elements and are not included.*
>
> *Products covered by IEQ Credit 4.5: Low-Emitting Materials—Systems Furniture and Seating are excluded from these requirements.*

Demonstration: The U.S. Consumer Product Safety Commission provides information on formaldehyde.

IEQ CREDIT 4.5: LOW-EMITTING MATERIALS—SYSTEMS FURNITURE AND SEATING
One credit is possible

> ***Intent:*** *To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.*

Systems furniture is the generic term for a collection of panel or partitions, desk surfaces, drawers, cabinets, lighting, and wiring that make up most office cubicles that we are familiar with today. The manufacture of these systems can introduce many of the toxic adhesives and insulating materials that we are trying to avoid.

> ***Options:*** *All systems furniture and seating that was manufactured, refurbished or refinished within one year prior to occupancy must meet one of the options below.*
>
> ***Option 1:*** *Furniture and seating are Greenguard Indoor Air Quality certified.*

Option 2: *Calculated indoor air concentrations that are less than or equal to those listed in Table 1 for furniture systems and seating determined by a procedure based on ANSI/BIFMA M7.1-2007 and ANSI/BIFMA X7.1-2007 testing protocol conducted in an independent third-party air quality testing laboratory.*

The requirement in Section 5 of ANSI/BIFMA X7.1-2007 is waived for LEED purposes. Section 5 requires that laboratories used to perform the emissions testing and/or provide analytical results must be independently accredited to ISO/IEC 17025, "General Requirements for the Competence of Testing and Calibration Laboratories."

Demonstration: The Greenguard Environmental Institute maintains a listing of manufacturers and products that meet these specifications.

Figure 5.4. P-1100 Wounded Warrior Hope and Care Center, Camp Pendleton, CA. Green Guard certified furniture systems, formaldehyde free and FSC wood components, low-VOC paints, and increased ventilation rates maximize the indoor environmental quality of the interior spaces. (Photo courtesy of USGBC.)

IEQ CREDIT 5: INDOOR CHEMICAL AND POLLUTANT SOURCE CONTROL
One point is possible

Intent: *To minimize building occupant exposure to potentially hazardous particulates, biological contaminants and chemical pollutants that degrades air and water quality.*

We use chemicals in the office and library environment regularly. Copier toner, printer toners and inks, cleaning supplies—all have chemical properties that might irritate skin or breathing. Identifying ways to contain and manage these chemicals is important to maintaining the indoor environmental quality.

Options: *Design to minimize and control the entry of pollutants into the tenant space and later cross-contamination of regularly occupied areas through the following strategies:*

- *Employ permanent entryway systems at least ten feet long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entryways. Acceptable*

entryway systems include permanently installed grates, grills and slotted systems that allow for cleaning underneath. Roll-out mats are acceptable only when maintained on a weekly basis by a contracted service organization.

- *Sufficiently exhaust each space where hazardous gases or chemicals may be present or used (e.g., garages, housekeeping and laundry areas, copying and printing rooms) to create negative pressure with respect to adjacent spaces when the doors to the room are closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard-lid ceiling. The exhaust rate must be at least 0.50 cubic feet per minute (cfm) per square foot, with no air recirculation. The pressure differential with the surrounding spaces must be at least five Pascals (Pa) (0.02 inches of water gauge) on average and one Pa (0.004 inches of water) at a minimum when the doors to the rooms are closed.*
- *In mechanically ventilated buildings, each ventilations system that supplies outdoor air shall comply with the following:*
  * *Particle filters or air cleaning devices shall be provided to clean the outdoor air at any location prior to its introduction to occupied spaces.*
  * *These filters or devices shall be rated a minimum efficiency reporting value (MERV) of thirteen or better in accordance with ASHRAE Standard 52.2.*
  * *Clean air filtration media shall be installed in all air systems after completion of construction and prior to occupancy*

Demonstration: The MattingExperts.com website provides useful information regarding the design and equipment for effective entryways.

IEQ CREDIT 6.1: CONTROLLABILITY OF SYSTEMS—LIGHTING

One point is possible

> ***Intent:*** *To provide a high level of lighting system control for individual occupants or groups in multi-occupant areas (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.*[5]

The controllability of systems in a building is directly related to occupant satisfaction and enhanced productivity. Lighting is especially essential in a library setting where a variety of types and uses of lighting exist.

Options: *Provide individual lighting controls for ninety percent (minimum) of the tenant space occupants to enable adjustments to suit individual task needs and preferences.*

Provide lighting system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Demonstration: *Library Journal* 's article on lighting design for libraries, "Light Done Right," includes information on lighting controls such as occupant sensors.

IEQ CREDIT 6.2: CONTROLLABILITY OF SYSTEMS—THERMAL COMFORT
One point is possible

Intent: *To provide a high level of thermal comfort system control for individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.*

Systems that allow office occupants the ability to maintain temperatures of their own choosing are the highest indicator for occupant satisfaction.

Options: *Provide individual controls for fifty percent (minimum) of the tenant occupants to enable adjustment to suit individual needs and preferences, Operable windows may be used in lieu of individual controls for occupants located twenty feet inside and ten feet to either side of the operable part of the window. The areas of operable window must meet the requirements of ASHRAE Standard 62.1-2007 paragraph 5.1 Natural Ventilation (with errata but without addenda).*

Provide comfort system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences. Conditions for thermal comfort are described in ASHRAE Standard 55-2004 (with errata but without addenda) and include air temperature, radiant temperature, air speed and humidity.

Demonstration: A section of the Lighting Controls Association website addresses current research and information about personal controls

IEQ CREDIT 7.1: THERMAL COMFORT—DESIGN
One point is possible

Intent: *To provide a comfortable thermal environment that promotes occupant productivity and well-being.*

Meeting or exceeding standards for thermal comfort has been documented to increase occupant satisfaction and productivity.

Options: *Design heating, ventilating, and air-conditioning (HVAC) systems to meet the requirements of ASHRAE Standard 55- 2004, Thermal Comfort Conditions for Human Occupancy (with errata but without addenda). Demonstrate design compliance in accordance with the Section 6.1.1 documentation.*

Demonstration: The Canadian Centre for Occupational Health and Safety provides information about ASHRAE Standard 55 and what it means.

IEQ CREDIT 7.2: THERMAL COMFORT—VERIFICATION
One point is possible if IEQ Credit 7.1 is met as well

Intent: *To provide for the assessment of occupant thermal comfort over time.*

For many facilities, the HVAC systems are the biggest consumer of energy. A successful green building should minimize the energy use associated with building conditioning while maintaining thermal comfort conditions that enhance occupant well-being.

Options: *Achieve IEQ Credit 7.1: Thermal Comfort—Design.*
Provide a permanent monitoring system and process for corrective action to ensure that building performance meets the desired comfort criteria as determined by IEQ Credit 7.1: Thermal Comfort—Design.

Agree to conduct a thermal comfort survey of tenant space occupants within six to eighteen months after occupancy. This survey should collect anonymous responses about thermal comfort in the tenant space including an assessment of overall satisfaction with thermal performance and identification of thermal comfort problems. Agree to develop a plan for corrective action if the survey results indicate that more than twenty percent of occupants are dissatisfied with thermal comfort in the tenant space This plan should include measurement of relevant environmental variables in problem areas in

accordance with ASHRAE Standard 55-2004 (with errata but without addenda).

Demonstration: A sample comfort survey used by the University of California at Davis Medical Center, Davis, CA, can be found at Center for the Built Environment's website.

IEQ CREDIT 8.1: DAYLIGHTING AND VIEWS—DAYLIGHT
Up to two points are possible

Intent: *To provide occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the tenant space.*

Daylighting reduces the need for electric lighting in buildings and creates a connection with the natural environment which increases occupant productivity and comfort and enhanced job satisfaction and worker retention.

Options: *For any of the following options, seventy-five percent daylighting earns one credit and ninety percent earns two credits.*

Option 1: *Simulation (One to two points)*
Demonstrate through computer simulations that seventy-five percent (one point) or ninety percent (two points) or more of all regularly occupied spaces areas achieve daylight illuminance levels of a minimum of twenty-five footcandle (fc) and a maximum of five hundred fc in a clear sky condition on September 21 at 9:00 A.M. and 3:00 P.M. Areas with illuminance levels below or above the range do not comply. However, designs that incorporate view-preserving automated shades for glare control may demonstrate compliance for only the minimum twenty-five fc illuminance level.

Option 2: *Prescriptive (One to two points)*
Use a combination of side-lighting and/or top-lighting to achieve a total daylighting zone that is at least seventy-five percent (one point) or ninety percent (two points) of all the regularly occupied spaces.

Option 3: *Measurement (One to two points)*
Demonstrate, through records of indoor light measurements that a minimum daylight illumination level of twenty-five fc has been

achieved in at least seventy-five percent (one point) or ninety percent (two points) of all regularly occupied areas. Measurements must be taken on a ten-foot grid for all occupied spaces and recorded on building floor plans. Only the square footage associated with the portions of rooms or spaces meeting the minimum illumination requirements may be counted in the calculations.

For all projects pursuing this option, provide daylight redirection and/or glare control devices to avoid high contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by daylight will be considered on their merits.

***Option 4:** Combination (One to two points)*
Any of the above calculation methods may be combined to document the minimum daylight illumination in at least seventy-five percent (one point) or ninety percent (two points) of all regularly occupied spaces. The different methods used in each space must be clearly recorded on all building plans. In all cases, only the square footage associated with the portions of rooms or spaces meeting the requirements may be applied toward the seventy-five percent (one point) or ninety percent (two points) of total area calculation required to qualify for this credit.

In all cases, provide glare control devices to avoid high-contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by the use of daylight will be considered on their merits.

Demonstration: An excellent case study has been created by Rensselaer Polytechnic Institute about the Smith Middle School in Chapel Hill, North Carolina.

IEQ CREDIT 8.2: DAYLIGHT AND VIEWS—VIEWS FOR SEATED SPACES
One point is possible

***Intent:** To provide the building occupants a connection to the outdoors through the introduction of daylight and views into the regularly occupied areas of the tenant space.*

***Options:** Achieve a direct line of sight to the outdoor environment via vision glazing between thirty inches and ninety inches above the finish floor for building occupants in ninety percent of all regularly*

occupied areas. Determine the area with a direct line of sight by totaling the regularly occupied square footage that meets the following criteria:

- *In plan view, the area is within sight lines drawn from perimeter vision glazing.*
- *In section view, a direct sight line can be drawn from a point forty-two inches above the floor (typical seated eye height) to perimeter vision glazing.*

The line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office may be counted if seventy-five percent or more of the area has a direct line of sight to perimeter vision glazing. If less than seventy-five percent of the area has a direct line of sight, only the area with the direct line of sight count toward meeting the credit requirement. For multi-occupant spaces, the actual square footage with a direct line of sight to perimeter vision glazing is counted.

Demonstration: Freeland Rees Roberts, an architecture firm in the United Kingdom, have posted a case study of the types and impacts of lighting at the Malmö Public Library in Malmö, Sweden.

INNOVATION IN DESIGN (ID)
As new strategies for improving the sustainability of commercial interiors and occupant uses occur, these innovation credits have been designed to allow their application and recognition.

ID CREDIT 1: INNOVATION IN DESIGN
Up to five points are possible

Intent: *To provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the LEED green building certification program and/or innovative performance in green building categories not specifically addressed by the LEED green building certification program.*

Options: *This credit category can be achieved by one of three paths:*

PATH 1. Innovation in Design
One to five points

Credit can be achieved through any combination of the Innovation in Design and Exemplary Performance paths as described below:

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED 2009 for Commercial Interiors Rating System. One point is awarded for each innovation achieved. No more than 5 points under IDc1 may be earned through PATH 1—Innovation in Design.

Identify the following elements in writing:
- *The intent of the proposed innovation credit*
- *The proposed requirement for compliance*
- *The proposed submittals to demonstrate compliance*
- *The design approach (strategies) used to meet the requirements*

PATH 2. Exemplary Performance
One to three points

Achieve exemplary performance in an existing LEED 2009 for Commercial Interiors prerequisite or credit that allows exemplary performance as specified in the LEED Reference Guide for Green Building Design & Construction, 2009 edition. An exemplary performance point may be earned for achieving double the credit requirements and/or achieving the next incremental percentage threshold of an existing credit in LEED.

One point is awarded for each exemplary performance achieved. No more than three points under IDc1 may be earned through PATH 2— Exemplary Performance.

PATH 3. Pilot Credit
One Point

Attempt a pilot credit available in the Pilot Credit Library. Register as a pilot credit participant and complete the required documentation. Projects may pursue more than one pilot credit; however, a maximum of one point will be awarded.

Demonstration: The Pilot Credit Library is the repository for successfully proposed innovations that have been awarded credits in other projects. It's a great place to look for ideas and validate your own theories.

ID CREDIT 2: LEED ACCREDITED PROFESSIONAL
One point is possible

> ***Intent:*** *To support and encourage the design integration required by LEED to streamline the application and certification process.*

By definition, LEED APs have project experience, have passed examinations in their specialty or specialties, and earn additional credits through continuing education in order to maintain their credential.

> ***Option:*** *At least one principal participant of the project team shall be a LEED Accredited Professional (AP).*

Demonstration: The Green Building Certification Institute maintains a directory of LEED APs.

REGIONAL PRIORITY (RP)
The U.S. Green Building Council recognizes that projects in different parts of the country and the world have different needs and issues to address as part of the project's design. Regional prioritization assists in providing credits for unique situations that arise that are successfully addressed by regional designers.

RP CREDIT 1: REGIONAL PRIORITY
Up to four points are possible

> ***Intent:*** *To provide an incentive for the achievement of credits that address geographically specific environmental priorities.*

Different regions of the country face different constraints and circumstances when applying tenets of green building. Some extreme climates force builders to be more creative in attaining optimal building performance.

> ***Options:*** *Earn one to four of the six Regional Priority credits identified by USGBC regional councils and chapters as having environmental importance for a project's region.*
>
> *One point is awarded for each Regional Priority credit achieved; no more than four credits identified as Regional Priority credits may be earned. USGBC has prioritized credits for projects located in the U.S., Puerto Rico, the U.S. Virgin Islands, and Guam. All other international*

projects should check the database for eligible Regional Priority credits.

Demonstration: A database of Regional Priority credits and their geographic applicability is available on USGBC's website.

Case Study

The Council Tree Library of the Poudre River Public Library District in Fort Collins, Colorado, was awarded LEED Platinum certification under the LEED for Commercial Interiors rating system. Council Tree is the second library to receive the Platinum designation, and the first to receive the Platinum designation for Commercial Interiors. The Council Tree Library is located on the second floor of a retail building in the Front Range Village shopping complex.

Because the Council Tree Library was built in an existing shell of a retail center (LEED Silver), it was registered under the LEED for Commercial Interiors program. Front Range Village was registered under the LEED for New Construction program. The article "The Council Tree Library Goes Platinum!" from the Poudre River Library District's e-news archive covers its distinguished LEED certification. The article is a good overview of the project. Design Balance, the project's architectural firm, presents a case study of the project on its website.

Questions

1. Given the time it takes to find suitable property to rent, how could one insure that the initial investments in sustainability extend through the life of the library's occupation of the space?

2. What factors would be important in choosing a landlord? What questions would you ask of other tenants to see how "green" the landlord might be?

Notes

1. Julie Taraska, "Virtue in Vice," *Metropolismag.com*, March 18, 2009. http://www.metropolismag.com/March-2009/Virtue-in-Vice/.
2. Poudre River Public Library District, "Case Study: Your Council Tree Library Is Designed for Sustainability," http://www.poudrelibraries.org/news/pdf/leeds.pdf.
3. National Institute of Building Sciences, "Building Commissioning," WBDG Project Management Committee, http://www.wbdg.org/project/buildingcomm.php.
4. Andreja Pirc and Richard Vlosky, "A Brief Overview of the U.S. Furniture Industry," Louisiana Forest Products Development Center, Working Paper #89, 2010, http://www.lfpdc.lsu.edu/publications/working_papers/wp89.pdf
5. BuildingGreen Inc., "LEEDuser: Glossary: Multi-occupant Spaces," http://www.leeduser.com/glossary/term/4906.

Additional Resources

Bonda, Penny, and Katie Sosnowchik. *Sustainable Commercial Interiors.* New York: Wiley, 2006.

Tobias, Leanne, *Retrofitting Office Buildings to Be Green and Energy-Efficient: Optimizing Building Pe rformance, Tenant Satisfaction, and Financial Return.* Washington, D.C.: Urban Land Institute, 2010.

U. S. Green Building Council. *Green Office Guide: Integrating LEED into Your Leasing Process.* Washington, D.C.: U. S. Green Building Council, 2009.

CHAPTER 6

Green Information Technology (IT)

"Saving the earth one byte at a time."

—Anonymous

Given the library's growing reliance on e-resources of all kinds, green information technology (IT) deserves a chapter by itself. Yes, it is a part—a large part—of the resource and energy use, but it is a type of use unto itself. Whether you are designing a new facility, renovating an older facility, or just trying to reduce costs and curb your current library's carbon footprint, it is important to consider how your technology needs are affecting your overall resource and energy use. Furthermore, what is your use of e-resources doing to and for the planet?

It is often stated, as in the World Watch Institute's *The State of Consumption Today*, that the United States represents five percent of the world's population, but uses twenty-five percent of the world's resources. A growing part of those resources are e-resources. In fact, the statistics on e-resource consumption and e-waste are sobering:

According to the U.S. Environmental Protection Agency (EPA) in 2009:

- 438 million new consumer electronics were sold
- 5 million tons of electronics were in storage
- 237 million tons of electronics were ready for end-of-life management
- 25% of these tons were collected for recycling, and
- About 27 million TVs were taken out of service.

There are other equally startling statistics provided by a 2009 EPA study. The U.S. discarded 3.1 million tons (six billion pounds) of consumer electronics, or approximately 1.3 percent of the known municipal solid waste stream.

Even in 2008, Americans own twenty-four electronic devices per household, as reported by the EPA. Now, four to five years later, it is likely that the number has risen even higher. According to the UN Environment Programme, the worldwide total for e-waste could be forty million tons per year. No matter the particulars and specific numbers, the message is clear. We need to find a way to deal with our e-waste, lest the e-waste begin to "deal" with us.

The History of Green IT

The much respected Gartner, Inc., an information technology research and advisory company, did about as much as any other consulting group on the matter of green IT. Gartner attempted to define "green IT" and, by doing so, to legitimize it as an area of study and expertise. The 2007 Gartner report, "Green IT: The New Industry Shock Wave," by Simon Mingay attempts to articulate just what "green IT" means in a jargon-rich definition: "[Green IT is] the optimal use of information and communication technology for managing the environmental sustainability of enterprise operations and the supply chain, as well as that of its products, services, and resources, throughout their life cycles."

To this the co-authors would add the *fiscally responsible decisions regarding the procurement and management of IT components such as software, hardware, policies, and processes*. These processes include analyses such as life-cycle analysis (initial cost vs. cost of operation and disposal), carbon emissions, energy use, recycling, use of supplies, etc.

In the first decade of the twenty-first century, people questioned whether or not green IT was real? Or, was it just a fad? As with all else green, there were proponents and opponents of green IT, and still are. Some believed—and hoped—if we ignore the phrase "green IT" long enough, it would go away. Meanwhile, the phrase appeared regularly in the IT sustainability planning literature.

In 2008, Gartner predicted that green IT would be the number one strategic technology, accelerating and expanding the focus that came to the forefront in 2007. In December 2008, Gartner surveyed 620 organizations about whether the economy was dampening organizational efforts toward green IT. Based on the survey results published in April 2009, Gartner predicted the recession would have little effect on the organizations' green initiatives. They intend to maintain their efforts and direction on Green IT. And here's another indicator of interest in green IT. In 2008, "green IT" hits on Google reached two million. Certainly that statistic signals a marked increase in interest in the topic.

According to Gartner, Inc., the trend toward green IT continues. Gartner analysts included green IT among the top ten strategic technologies and trends in 2010. In its press release about the 2010 report, Gartner provides a rationale for this trend:

> IT can enable many green initiatives. The use of IT, particularly among the white collar staff, can greatly enhance an enterprise's green credentials. Common green initiatives include the use of e-documents, reducing travel

and teleworking. IT can also provide the analytic tools that others in the enterprise may use to reduce energy consumption in the transportation of goods or other carbon management activities.

Clearly, according to Gartner, green IT is here and has made its mark.

Others have been debating whether green IT is just hype. When *CIO* magazine began its "Man on the Street" video series, the first video was *Green IT: Hype or Happening?* The video features the chief information officers of technology companies offering their response to the "hype or happening?" question. Although many of them offer comments that mirror Gartner's recognition of green IT as a real trend, there are others who think green IT is no more than hype. Here are some of the typical arguments against green IT:

- *"Green IT" is a marketing ploy*. It is a great way to sell you stuff whether you need it or not. Technology vendors want to look like a green front runner so they can sell you more gear. Of course, consultants—like Gartner possibly—want to help you figure out your green strategy. From a purely bottom-line perspective, some critics say that whatever you may save in power costs, you may spend on consultants.
- *Software is the real fix for IT energy savings.* The technology vendors that should be doing the most talking are software vendors. You want to save power? Shut down your PCs when you go home. Throttle back the number of running servers at night. Virtualization and automated server management will do more than any smaller, more efficient box.

"Green IT" is just another guilt trip. Gartner analysts regularly note that social responsibility will become a bigger issue for companies. That might be true, but some American technology managers traditionally have not cared. One technology manager noted that a return-on-investment (ROI) case for green IT would have more legs than presentations about how the green movement is changing technology. Author Corey McKenna addresses this issue: "Electronic waste is a global issue communities can't continue to ignore as discarded electronics swamp the developing world." Shell Culp, chief information officer at the California Department of Toxic Substances, summarized the negative effects of information technology on the environment. "We're expecting the information communications technology sector will increase its [greenhouse gas] emissions by 150 percent—that's business as usual if we don't do anything." Culp further noted, "If we increase our activity in technology, we're actually putting more planes in the air, essentially, from a global CO_2 emissions standpoint." And that doesn't include the energy used in manufacturing the technology. "So we're not as green as we would like to think we are."[1]

Information technology's great contribution is helping to reduce or eliminate the environmental footprint in other parts of the economy. But in order to make this contribution effectively without creating an unsustainable footprint of its own, information technology must find a way to be green, reducing or eliminating its own footprint.

Green IT Today

The Green IT debate has subsided. Articles written in the last several years no longer reflect debate, but instead talk about how green IT must be a large part of a larger organization sustainability plan. In fact, in 2011 Gartner suggested that

> …sustainable business practices will be a top five priority for more than 60 percent of Western European and North America chief executive officers in the year to come. The concern isn't just about risk management or compliance; it is about spurring innovation, driving productivity and enabling the business to perform differently than in the past.[2]

It is clear that IT runs on energy, and the reduction in the use of energy is pivotal in meeting an organization's sustainability goals. As noted in Chapter 1, buildings account for thirty-six percent of all energy consumption and sixty-five percent of all electricity use in the United States. Information technology is an increasingly significant part of a building's energy consumption. Conservation of the energy used to drive information technology can significantly reduce total energy consumption in a building.

Figure 6.1. Facebook Data Center. (Photo courtesy USGBC.).

Green IT is a big issue in organizations and libraries are no exception. Libraries increasingly depend on information technology to do work and to provide services. How IT is configured and used can make a significant difference to library energy consumption.

Library collections have become more e-focused, whatever type of resources your library has licensed or purchased (e.g., electronic databases, e-books, e-films, and e-audio) and whatever types of devices are purchased to read or watch, or listen to those resources (e.g., e-readers, iPads, computers). Information technology has also allowed libraries to extend their services beyond the building through services such as virtual reference, reducing our carbon footprint since patrons don't actually have to come to the library to access information or to receive services. E-resources and services also save materials such as paper. Clearly, how IT is configured and how it is used can make a significant difference to library energy consumption.

Demonstrating ROI, as was argued in the early days of green IT is still the real issue with merit. In fact, ROI has a basis in sustainability. If you recall the three pillars of sustainability from Chapter 1, one pillar is economics. Even if economics is the most persuasive (or only) argument, many green IT measures make sense. Considering the times we live in, ROI may speak louder than arguments that rely on either social responsibility or the environment.

Green IT/Sustainability Planning

Just as you need to plan carefully before you start to build, renovate, or green your library, you need to plan a green approach to your information technology infrastructure. Green IT and green IT planning won't become a priority unless you make it one. You can start by assigning green IT planning to a person or, better yet, to a "green team." The library needs someone who is on point for tracking initiatives, purchases, and the particular performance objectives and evaluation mechanisms. Circumstances are different from place to place: buildings are different, equipment is different, demands on facilities and equipment vary, and individuals use equipment differently. One size does not fit all.

Differences aside, this section suggests green IT elements that might be incorporated into your library's strategic plan, including:

- A library policy statement on green IT
- Energy use monitoring/management for IT (including renewable energy when feasible)
- Waste stream management of electronics
- Green IT procurement

- Realistic goals for IT (Reduce, reuse, recycle)
- Environmental improvement opportunities
- e-disposal
- Ways to track progress
- Ways to celebrate successes

We hope this information will be a starting point for implementing green IT at your library.

A LIBRARY POLICY STATEMENT ON GREEN IT

The library policy statement might address green IT or it may be broader to encompass all aspects of sustainability. Here is an example of a policy statement from Birbeck Library, University of London. It seems to encompass the various elements of a green IT plan, as enumerated above.

> The Library is committed to promoting an awareness of environmental and sustainability issues amongst staff and students. We have a dedicated Green Group and all Library staff are encouraged to be environmentally aware through initiatives such as recycling, energy efficiency, and the purchase of environmentally friendly products. We welcome any suggestions that would help us to make the Library and the College a greener place.

ENERGY USE MONITORING/MANAGEMENT FOR IT

Consider your library's carbon footprint. What is it now? What might it be if green and general sustainability measures were adopted? How might changes in your IT configuration and use contribute to reducing your library's footprint? How can a computer monitoring system assist in your conservation of energy use?

To know the answers to these questions, the library must begin with benchmarking. You can't know where you're going, until you know where you've been, to borrow a well-worn phrase. Here are several organizations that will guide you in benchmarking your use, and finding ways to reduce your energy costs and your library's greenhouse gas emissions:

International Council for Local Environmental Initiatives: Local Governments for Sustainability. If you work in a public or a school library, your city or county is likely to be a member of ICLEI and to use the ICLEI database to measure its greenhouse gas emissions. If you are part of city or county government, find out what your governmental entity is doing in regards to measuring your carbon footprint.

Association for the Advancement of Sustainability in Higher Education (AASHE). If you are an academic library, likely your institution is a member of AASHE. AASHE is an association of colleges and universities that are working to create a sustainable future. Its mission is to empower higher education to lead the sustainability transformation. It does this by providing resources, professional development, and a network of support to enable institutions of higher education to model and advance sustainability in everything they do, from governance and operations to education and research. It uses the Sustainability Tracking Assessment and Rating System known as STARS. STARS quickly became the higher education standard.

One of the ways to reduce carbon emissions is to maximize renewable energy usage when feasible. Renewable energy (e.g., wind, solar, geothermal) offers affordable promise, but only with carefully planned, strategic deployments. The reduction of greenhouse gas emissions can be done at a savings and does not have to be a financial liability.

Carbon Footprint Ltd. If you need to monitor energy use as an individual organization and not as part of a larger entity, go to Carbon Footprint Ltd, a leading provider of carbon management services. It enables organizations around the world to understand and reduce their emissions. Carbon Footprints Ltd solutions provide real business benefits including increased brand value & marketing advantages, in addition to energy & travel cost savings.

WASTE STREAM MANAGEMENT FOR ELECTRONICS

Waste stream monitoring is also an essential element of green IT equipment, software, and auxiliary items? When you purchase a product, is there as little packaging as it practicable? What happens to the library's equipment at the end of its useful life? What happens to the cardboard, packaging of your IT equipment? What is being recycled? Reused? What *can* be recycled and reused, but is not? What can be eliminated? These are just some of the questions that need to be addressed as you implement waste stream management of IT resources.

As part of a comprehensive green IT/sustainability plan, your library should include a waste stream management plan that at minimum identifies the type and estimated volumes of waste that the library will generate and determines the appropriate disposal path for each waste stream (e.g., recycling, reuse or landfill disposal.) Begin in the here and now. Survey what is currently entering the solid waste stream. What can be done immediately to eliminate the waste or to divert it from the municipal waste stream?

Additionally, specifying minimal waste within your library's green procurement plan reduces library waste at the source. If the library specifies minimal packaging materials, and/or packaging that is recyclable, this practice will cut down on the library's waste stream. (For more information, see the discussion of green procurement following this section.) Consumable items can be purchased with a recycling option. For instance, toner cartridges can be purchased from a company that offers a recycling program. Some building materials, like rugs, can be purchased with the option for the company to recycle the materials when they are removed from the building. Equipment might be re-purposed. Doing so avoids the purchase of another piece of equipment, thus reducing the number of pieces of equipment that eventually must face disposal. Those are just a few examples of the many ways to minimize the amount of waste that the library must process.

Progress in waste stream management is slow, but there is progress nonetheless. About half the states now have e-waste laws. On the federal level, there are numerous efforts in the form of bills and commissions. One way to track the efforts nationally is to stay connected to the Electronics Takeback Coalition, which is tracking progress on e-waste recycling. Notably, the Coalition has helped to sponsor sustainability proponent Annie Leonard's projects, the now-famous *The Story of Stuff* and its companion *The Story of Electronics*. Employing her characteristic style, Leonard explores the high-tech revolution's collateral damage.

GREEN PROCUREMENT

Green procurement is an approach to purchasing in which environmental impacts play an important role in purchasing decisions. Procurement officers are concerned about more than just price and quality. Libraries that pride themselves on environmental stewardship, and thus consider the entire life-cycle of a product and the packaging in which the product comes, find it helpful to use green procurement and other strategies to ensure that they do business in an environmentally responsible way. In fact, given the jurisdiction and how carefully the procurement practices are followed, it might be imperative to have an adopted green procurement plan in order to act with the environment in mind.

Considering the complexities of purchasing individual items, you may find that a number of aspects of your current procurement process may be adjusted to meet a mission of environmental sustainability. Libraries purchase many things which other city offices, businesses, institutions of higher education, and K-12 schools purchase. They also purchase items that are fairly unique to their mission as information service providers. Start by finding out if the entity within which you exist (e.g., city, county, college or university, school system) has a green procurement plan. If it does, adopt it.

If you were not part of the development of the procurement guidelines, you may find that it is missing elements that are specific to libraries, such as the procurement of databases, library materials, book-edged copiers, and other purchases that are unique to libraries. If your jurisdiction or campus has no such plan, look around. Many entities already have a green procurement plan. Ask to borrow one from an entity similar to yours, and don't "reinvent the wheel." Instead read the plan from your library's perspective and modify to fit your circumstances. Understand that such a plan will likely need to be amended once adopted and "test driven." Be prepared to review the document within the first six months to a year and to revise and amend as needed.

REALISTIC GOALS AND INDIVIDUAL STRATEGIES

It is not possible for the authors of this work to enumerate goals for an individual library. That being said, a number of individual IT strategies that are frequently discussed in the literature are likely to apply to a library setting. These are strategies that can be used to reduce the carbon footprint as measured by an agreed upon standard, such as those suggested above. In fact, all strategies will fit into the one of three categories, reduce, reuse, or recycle.

Right-sizing. The phrase "reduce, reuse, recycle" applies to IT, as much or more than to the use of other resources, given how pervasive technology is. Right-sizing your computer equipment is another way of saying "reduce." So is using the right amount of cabling and wiring.

Data Center Design and Operation. Consider potential regulations and rethink plans for your data center and capacity growth. Regulations are multiplying and have the potential to constrain companies and institutions in building data centers because the impact on power grids, carbon emissions from increased use, and other environmental impacts are under scrutiny. Some organizations are emphasizing their social responsibility, which might result in vendor preferences and policies that affect IT decisions. Others are simply looking at ROI issues.

In the past, design principles for data centers were simple. Institutions would figure out existing resources, estimate growth for fifteen to twenty years, and then build to suit. Newly built data centers often opened with huge areas of white floor space, fully powered, and backed by an uninterruptible power supply (UPS), water- and air-cooled, and mostly empty. However, costs are actually lower if enterprises adopt a pod-based approach to data center construction and expansion. If you expect to need nine thousand feet during the life of a data center, then design the site to support it—but only build what's needed for five to seven years. Cutting

operational expenses, which are not a trivial part of the overall IT expense for most clients, frees up money to apply to other projects or investments, either in IT or in the business itself.

Here are a number of things to consider when configuring, or reconfiguring, a data center or computer room:

- ***Virtualization.*** According to a recent McKinsey and Company report, data centers emit 0.3 percent of the world's carbon dioxide emissions. Virtualization is the creation of a virtual computing component—such as a desktop computer, a server, an operating system, or a network resource—instead of the actual component. As the use of virtualization in data centers becomes more prevalent, the green benefits including the significant savings on cooling and power are becoming more well-known. While organizations continue to adopt server virtualization for data center consolidation, virtualization technologies are being leveraged in broader IT beyond just the server. Desktop virtualization is seen as one of the strongest areas of growth. Tim Greene of Network World cites Gartner's recent statistics: 40% of servers overall have been virtualized, but that the penetration will grow to 75% in 2015 and it's for more than just costs; virtualization is a strategic asset that can improve business efficiency. Traditional PC desktops certainly represent a far larger cost center—from initial acquisition and maintenance costs to the green impact—than the datacenter. Moreover, a 2008 study from The Climate Group approximates that PCs consume around three times as much power as the data center.
- ***Cloud Computing.*** Cloud computing is a model in which IT is delivered as a service rather than as a product. Cloud-based services can be exploited in a variety of ways to develop an application or a solution. Using cloud resources does not eliminate the costs of IT solutions, but it does re-arrange some and reduce others. In addition, enterprises that consume cloud services will increasingly act as cloud providers and deliver application, information, or business-process services to customers and partners.
- ***Consortial Sharing.*** Libraries are no strangers to the idea of consortial sharing of IT-related equipment, software, and databases. Libraries could have invented it! Since the inception of IT applications in libraries, libraries have found ways to share. Scant monetary resources have always been an impetus for sharing. Costly energy and environmental impacts are simply additional reasons to investigate ways to extend and strengthen consortial agreements. An integrated library system (ILS) is one of the more obvious applications of consortial sharing.

- ***Server Size.*** It is important to right-size your platform. This process can take two forms. One possibility is to work closely with server manufacturers to optimize their designs and remove items you don't use, such as more memory slots and input/output (I/O) slots than you need, and focus on high efficiency power supplies and advanced power management features. Hopefully, your server manufacturer will be open to meeting these requests as well as to partnering with the library to drive innovation into the server space in order to reduce resource consumption even further.

Another way to right-size is to be disciplined about developing the exact specifications that the library needs and then not buying servers that exceed specifications. In determining server size, it is also important to be sure that you de-duplicate data for maximum efficiency. It's often tempting to buy the latest and greatest technology, but the library should only do so after it has evaluated and quantified whether the promised gains provide an acceptable return on investment (ROI). Remember that the library may not need the latest features server vendors are selling. Understand your workload and then pick the right platform. Conventional wisdom has been to buy something bigger than current needs demand so the library can protect its investment. But with today's rapid advances in technology, this can lead to rapid obsolescence. The library may find that a better alternative is to buy for today's needs and then add more capacity as and when it is needed. Of course, there is no single answer. Again, analyze your needs and evaluate your alternatives.

- ***Halon Alternatives***. The Clean Air Act Amendments of 1990 require the United States to phase out production and use of ozone-depleting chemicals including halons, which were the fire suppressants of choice for data centers. As part of its rulemaking efforts, the Environmental Protection Agency (EPA) was also required to evaluate the potential hazards to human health and the environment that could result from exposure to compounds that may substitute for halons. If you are renovating or building a data center, take the time to learn a bit about halon alternatives. The EPA has made this easy to do by providing a detailed fact sheet on ozone depletion and how to prevent it.

  Systems Cabling. Cabling is very much an environmental concern. Modern commercial buildings contain large amounts of cable and wiring used for electrical power distribution, building control, and IT systems. The amount of IT cabling in buildings has increased exponentially since the near universal adoption of desktop PCs and the

client/server computing model. The precise data on this building element is somewhat dated. Only recently has the federal government funded a new Commercial Building Energy Consumption Survey. The most recent was published in 2003; the new one is due out in 2014. Therefore the data regarding the growing averages for commercial building square footage and the amount of cabling per person is dated. Green IT: Sustainable Information Technology, published in 2005 reported some aggregated cabling statistics that showed the significant growth of cable use in the commercial buildings. In 1991 there were approximately 5 billion feet of plenum cable in place. In 1997 the estimated length was 30 billion feet of plenum cable, and by 2000 the estimated growth showed the potential of 45 billion feet (in 739,000 office buildings at 60,000+ feet per building), or approximately 1,323 feet of cable per office worker. Now, one might suspect that the number of feet per worker is even greater.
The Toxics Use Reduction Institute at University of Massachusetts Lowell has identified the primary environmental concerns about IT cabling systems in buildings:

- Material consumption, notably virgin mined copper
- Production and use of polyvinyl chlorides (PVCs) for wire coatings
- Lead in wire coatings
- Indoor environmental hazards from lead dust
- Fire and smoke hazards in buildings
- Disposal of old cable.

Cable is mentioned in the U.S. Green Building Council's LEED® Pilot Credit Library. The LEED Pilot Credit Library is intended to facilitate the introduction of new prerequisites and credits to LEED. This process will allow USGBC to test and refine credits through project evaluations before they are sent through the balloting process for introduction into LEED. The pilot credit in which cable is mentioned is Pilot Credit 2: PBT Source Reduction: Dioxins and Halogenated Organic Compounds.

The pilot credit's intent is "to reduce the release of persistent bioaccumulative toxic chemicals (PBTs) associated with the life cycle of building materials." In order to gain credit, an organization must "use materials manufactured without added halogenated organic compounds for at least 75%, by cost, of the material totals in a minimum of three of the following four groups. The groups include exterior 1) components, 2) interior finishes, 3) piping, conduit and electrical boxes, and 4) building-installed electrical cable and wire jacketing." Although

communication cables are not yet mentioned, it would be a safe bet to assume that once the pilot credit is fully vetted, the types of cabling will be expanded.

This pilot credit addresses the issue of toxicity of chemicals. Also of particular concern are both the consumption of copper and the eventual disposal of the cabling and wires, whether when remodeling or when the building is demolished. Copper production is extremely energy intensive and leads to emissions and environmental degradation. Production processes include smelting, processing, packaging, transport, and distribution. Copper prices have skyrocketed, with theft of copper rain gutters and spouts becoming commonplace.

At the end of its useful life, cable must be disposed of properly. Today most IT cable cores of copper or glass are jacketed in polyvinyl chloride (PVC), a petroleum-derived plastic. According to a fact sheet by the Center for Health, Environment and Justice, PVC production, use, and disposal result in the creation and release of large amounts of toxic chemicals, hazardous gases, endocrine-disruptive chemicals, and organochlorines. Many organochlorines have established links to cancer, birth defects, immune-system suppression, diabetes, impaired neurological development, and reproductive disorders in both humans and animals. As pointed out by the Toxics Use Reduction Institute, because of the persistent nature of the chemicals used to make PVC, any attempt to treat the waste products of production only creates other toxic by-products.

According to Joe Thorton in his briefing paper, PVC production, use and incineration, together, represent the largest single source of dioxins, a group of powerful carcinogenic endocrine disrupters. PVC manufacturing also releases chlorine and vinyl chloride monomer gases—these are highly toxic and explosive greenhouse gases that pose hazards to workers and fire crews while driving global warming and climate change.

While the toxicity of pure PVC production, use, and disposal alone is ample cause for concern, as was pointed out in a GreenIT™ report, IT cable manufacturing requires further additives for plasticity, heat and fire resistance, and color. The most significant of these additives is lead, which is added to PVC as a heat stabilizer and plasticizer. Like the constituents of PVC, lead is a persistent, bioaccumulative, toxic

chemical. It can cause severe developmental disorders at even low exposures and is associated with brain and kidney damage, blood and central nervous system disorders, and gastrointestinal distress. The U.S. Environmental Protection Agency limits lead exposure to 220 parts per million.

Repurposing. The other parts of that mantra "reduce, reuse, recycle" are equally as important. Reuse or repurpose whenever possible. This process requires some creativity, which should pose no problem for libraries. Creativity and finding ways to do something for less are standard tools in most libraries' "bag of tricks." Often because money is an issue, libraries look at creative ways to repurpose equipment. A staff computer that no longer has adequate performance for the latest Microsoft Office suite may instead be used at the circulation desk to simply read and record bar codes as library materials are charged or discharged. Your library may also be able to find a second life for its servers, rather than purchasing a new one.

The repurposing process is easier if you formalize the library's equipment rotation and replacement schedule. As you consider which pieces of equipment to purchase, repurpose, or retire from service, ask yourself, "What are the biggest energy hogs? What should be replaced first, or used least frequently, or retired given the monetary and energy resources available?" If you are uncertain about the amount of energy a particular piece of equipment uses, test it with a tool that measures amperage and wattage, such as the Kill A Watt™ usage meter. Use that information to compare your equipment's energy use to that of other models. It will help you determine that equipment's proper place in the rotation and replacement schedule.

ENVIRONMENTAL IMPROVEMENT OPPORTUNITIES

All the planning and goal-setting in the world does not preclude your library from taking advantage of environmental improvement opportunities that might present themselves. These opportunities may come when a community partner approaches you. Or, you may be asked to join with your city, or county, or college in a wider environmental effort. In such cases, the previously determined goals may need to be reassessed and perhaps given lower priorities. Whatever you do to reduce, reuse, and recycle all leads to less use of energy and lesser waste stream. So, do what is possible when it is possible.

E-DISPOSAL

Finally, in the life cycle of all equipment there comes a time for disposal. This phase is where recycling comes into play. Recycling will be part of your waste management plan referred to above. It could also be an explicit goal of your plan. For more

information, the website for Resource Recycling Systems, an environmental consulting and engineering company, provides a good general overview of recycling. In addition many online resources provide equipment-specific disposal information. Here is a list of some such sites:

Computers, Servers, and Other Electronics. More computer vendors are offering a disposal plan that can be purchased at the time the equipment is acquired. The company's service includes picking up the piece of equipment (for a fee), erasing any data, recycling the machine or selling its parts, so that the machine won't end up in a landfill. Companies usually credit back any money recovered by the sale of the parts.

For instance, Dell has an asset recovery department. In an interview with the Mother Nature Network, Joe Strathmann, head of the program at Dell, says, "We sell the hardware, we sell the installation of the hardware, we sell consulting services during their use. At the end of the lifecycle, we sell the retirement offers." Dell sells this service with a dual goal in mind: to be environmentally responsible and provide a suite of services for the customer in a way that ensures data security. "The number one element of why companies outsource to third parties is data security," Strathmann said. "A close, close second is the environmentally responsible disposition of the assets." Dell is just one of many that offer such a service. Indeed, there is a burgeoning need among companies to dispose of old computers in a safe and efficient way.

The website for Earth911.com, an environmental services company, includes a search feature to find a recycling center by product type, a valuable resource when determining how best to dispose of e-waste and electronics. Basel Action Network (BAN) is another resource for finding responsible recyclers for computers and electronics.

Printers. Keep the plastic from ink cartridges out of landfills longer by refilling your ink cartridges. According to RecyclePlace, an ink cartridge and toner recycling company, over twenty-five million cartridges go to landfills each month, while cartridges take over one thousand years to decompose. Take the environment into consideration when purchasing a printer, including its energy efficiency rating and repair history.

Phones. Phone recycling is well established and easy to do. Flipswap makes it simple for people to give mobile phones a second shot at life by offering fast, free, and eco-friendly ways to trade them in. Flipswap not only gives consumers

and businesses instant credit towards another device or cash back, but it will also plant a tree for every device recycled. The EPA provides a comprehensive look at cell phone collection programs demonstrating that cell phone recycling can be accessed from almost anywhere in the United States.

Batteries. Battery Solutions is a company that provides battery recycling services to businesses, organizations, municipalities, and other government agencies.

Cardboard and Foam Packing. After you have unpacked your new energy-efficient equipment, you can recycle your cardboard and those pesky packing peanuts too. Cardboard Recycling is an organization dedicated to informing consumers about cardboard recycling alternatives. You can also find out where to recycle cardboard in your area at Earth911.

Your local pack-and-ship store will likely accept foam packing peanuts for reuse. Alternately, you can contact the Plastic Loose Fill Producers Council to find a drop-off site online or by phone at (800)828-2214. For places to drop off foam blocks for recycling, contact the Alliance of Foam Packaging Recyclers online or by phone at (410) 451-8340.

Cabling. At the end of its useful life, cable must be disposed of properly. Check with your local computer recycler, who is likely to take any cablings that you need to recycle.

Copiers. The EPA has an entire guide on the purchase of environmentally friendly copiers, which are also less detrimental to human health. The guide includes a list of reasons to green your copier(s). They are:

- The ENERGY STAR feature in a typical medium- to high-speed copier can reduce that machine's annual electricity costs by as much as 60 percent.
- Using ENERGY STAR-labeled equipment helps reduce the air pollution associated with energy generation.
- Equipment will produce less heat when powering down, contributing to a cooler, more comfortable workspace; lowering air-conditioning costs; and helping reduce equipment failure, which helps increase the copier's life.
- A copier with fast and reliable duplexing (double-sided copying) can reduce office paper use by 25 percent or more, saving money in the process. Also, reducing paper use can contribute to reduction in natural resource consumption as well as in energy used to create paper.

- If all copiers sold in the United States were ENERGY STAR labeled and set to automatically default to duplex, the amount of paper used could be reduced by more than 200 billion sheets. This adds up to a savings of 1 million tons of paper, enough to save an estimated 20 million trees!!

Appliances and Miscellaneous Equipment. Purchase appliances and equipment qualified through the EPA's ENERGY STAR program. ENERGY STAR is the trusted, government-backed symbol for energy efficiency helping us all save money and protect the environment through energy-efficient products and practices.

The ENERGY STAR program was established to meet the following goals:

- Reduce greenhouse gas emissions and other pollutants caused by the inefficient use of energy; and
- Make it easy for consumers to identify and purchase energy-efficient products that offer savings on energy bills without sacrificing performance, features, and comfort.

Products can earn the ENERGY STAR label by meeting the energy-efficiency requirements set forth in ENERGY STAR product specifications. The website has information about qualified computers, monitors, and printers, as well as appliances and other pieces of equipment. The site also includes the criteria for and lists of qualifying products.

WAYS TO TRACK PROGRESS

Your library's IT technology plan should indicate how energy efficiency of IT will be measured. Performance measures need to be quantitative, which by definition requires the library to build a timeline into the plan to accompany benchmarking efforts (e.g., where will IT energy efficiency be in one year, two years, etc.?).

The plan may define which performance indicators you will measure as a baseline and at regular intervals. The authors suggest that you measure your library's ever smaller carbon footprint. Other options include measuring your library's ever dwindling waste stream or its reduced need for energy. Or, you may choose to measure all three performance indicators. Again, these are just suggested ways to ensure that your efforts are moving the library in the right direction and that you are making a difference.

WAYS TO CELEBRATE SUCCESS

Whatever difference you make, however small or large, it is important to stop and mark the moment. Of course (would you think otherwise?), the Celebrate Green blog exists to help you consider your celebratory options.

One way that the University of Mississippi celebrates is through sharing its success. The University decided, as a component of its effort to reduce power consumption in its campus buildings, to make its progress toward reducing its energy consumption public in real time through popular social media outlets. Of course, its library is a part of this effort. Certainly such a transparent celebration helps keeps the University real and moving forward.

Other Green IT Practices for Your Library

Whether planning for greening your IT or practicing it, there are many ways to reduce your library's environmental impact. What follows are a number of suggestions to consider:

EQUIPMENT

Workstations. A number of easy strategies can be implemented to save energy at workstations. Power down your workstation when not in use and use smart power strips for the workstation and peripherals. This strategy includes desktop computers, laptops, video monitors, and printers. (See the explanation of smart power strips under Electrical Systems below.)

Printers and Printing. According to Laura Bruzas, a former blogger for *American Libraries* magazine, printer hardware was expected to contribute 1 million tons of solid waste in this country alone in 2007. The printing industry now commonly uses a non-renewable source—petroleum—as a base for inks. These inks release volatile organic compounds (VOCs). Used cartridges end up in our landfills. Additionally, Bruzas stated that the pulp and paper companies are the fourth-largest toxic polluters of water.

Given the environmental impact, let alone the cost of printer cartridges, Bruzas recommends several strategies to cut down on the amount of resources used in printing:

- Print only when necessary. If you need to print, double-side whenever possible.
- Use an attractive, copyright-free image in your signature file that serves as a reminder that you should print only when necessary.
- Network your printers whenever possible.
- Use your printer's "draft" or "eco" setting whenever possible to save ink and printer wear-and-tear.
- Switch your computer's default font (most often Arial) to Century Gothic, which, as mentioned above, uses thirty percent less ink.
- Consider using soy-based or vegetable-based inks. They contain mostly

renewable resources. (Vegetable-based inks were used for printing presses prior to WWII. It's time to return to the past.)
- Check your ink manufacturer's material-safety data sheet to determine its VOC level. (While most petroleum-based inks produce approximately thirty percent VOCs, some eco-friendly inks produce a VOC of five percent or less.)

When your cartridge is no longer usable, recycle it. For information on where you can recycle your library's cartridges, go to Earth911—an environmental services company that offers end-of-life product solutions. RecyclePlace is another avenue for recycling ink jet, laser and toner cartridges. They also pay for cell phones.

According to Matthew Wheeland, managing editor of *GreenBiz.com*, even the font you choose has an impact of resources. The University of Wisconsin has become known as an expert in fonts. As featured on National Public Radio and in numerous articles (including Wheeland's), the University changed from Arial to Century Gothic for all university publications and correspondence in 2010. The school's study predicted that it would use about thirty percent less ink, being the most eco-friendly font by its analysis. Hence the authors chose Century Gothic for this work. If you decide to print the publication, you will use less ink to do so. Also, a new font called Ecofont incorporates tiny holes in each character, using about twenty-five percent less ink than traditional fonts. Of course, the greenest font is one you don't print.

With regard to e-mail, use an attractive, copyright free image in your signature file that serves as a reminder that you should print only when necessary. Set your font default to an eco-friendly style, like Century Gothic, as the authors have done with this text. Finally, if you must print, use recycled paper. Please remember to recycle the paper yet again.

Lease vs. Purchase. Many IT manufacturers provide leasing options for their products. Leasing may ultimately extend the useful life of equipment. If your library leases, be sure the company you lease from is eco-friendly and will dispose of the equipment appropriately when its useful life is over.

As they say, "It takes money to make money." In part, that is true in green purchases as well. For instance, newer, more energy efficient IT equipment will mean less energy use, but first it is necessary to acquire the new equipment.

If you purchase IT equipment, adopt green procurement specifications. Green purchasing involves buying products (in this case, electronics) based on their

environmental impact. This impact includes various aspects of the product's life cycle, such as energy consumption or the materials used in production, shipping, and packaging. Disposal is also a consideration.

Alameda County's StopWaste.org is a treasure trove of information about environmentally preferable purchasing, including the purchasing of computers. This site references the Northwest Product Stewardship Council which, among other things, has good coverage regarding the purchase and recycling of electronics.

Work-Area Power Management. Know how much power your various appliances and equipment will use before you buy them. Test what you have already with tools that measure amperage, wattage, etc. Kill A Watt is one such tool that allows you to connect individual pieces of equipment to find out how energy efficient they may or may not be. The watts up? AC power meter also measures plug load, and it records data. Some models are Internet enabled. Both of these tools stop the idle current drawn from outlets when electronics are not in use, though they go about it in different ways. The plug load controls are receptacle surge protectors with occupancy sensors in most receptacles. The smart strip monitors power consumption and can sense the difference between when computers and other devices are on or off. Upon figuring this out, it shuts off the power, eliminating the idle current drawn from the equipment.

Other power management tips include unplugging your cell phone charger when not in use. Turning lights off or implementing motion detectors to turn lights off automatically, and turning off or enabling energy-saving modes on general-purpose and consumer products also offer a significant benefit.

LIBRARY RESOURCES AND SERVICES

Collections. The library should also investigate IT solutions as they relate to collection management. This concept probably doesn't need much elaboration. While not a specifically IT issue, the shift to digital collections can help in reducing energy and other resource consumption. Where possible, use digital information, whether available through databases, e-books, or e-reserves. Such resources usually extend the access for patrons while minimizing the square footage needed. And, fewer trees need to give their lives.

Do whatever possible to promote the printing of books on one hundred percent recycled Forest Stewardship Council (FCS) certified paper. It is important to remember that over thirty million trees are cut down annually for virgin paper used for the production of books sold in the United States, according to Eco-Libris, a

company dedicated to sustainable reading. Per the Eco-Libris website, "Every book you read was once a tree. Now you can plant a tree for every book you read." Eco-Libris will plant a tree for every book read. The cost to plant a tree is roughly one dollar. That's why libraries, library associations, library vendors, and others need to team up with Eco-Libris or similar organizations. While most publicly funded libraries won't be able to purchase trees for books, many libraries have foundations or "friends" groups that have the authority and prerogative to support an entity such as Eco-Libris.

Information Assistance. Use e-reference when possible, a service which may be staffed from any location and therefore may save resources by reducing staff travel. It saves energy,

Teleworking. Consider teleworking or working from a different location (such as home). Clearly, this option will not work for individuals who staff service desks, or who are expected to be (physically) at meetings, or who perform other "location-specific duties. Most libraries are places that need to be staffed, after all. Yet, teleworking should be considered (or reconsidered) seriously and creatively. When not doing front-line work, an employee may be able to provide services and to perform desk work at a distance. If schedules were revised, staff might work from home one day and come in the next. Does your information literacy program need to be face-to-face, or can it be delivered via a course management system? Teleworking usually means that staff members agree to work at service desks for more consecutive hours, but it might also mean that staff could find more uninterrupted time to work on projects and other things that take more focus and concentration. Telecommuting will save energy.

Digital Branches. David Lee King, librarian at the Topeka and Shawnee County Public Library in Kansas and blogger about library websites and emerging technologies, has recently introduced the idea of a digital library branch in *Building the Digital Branch: Guidelines for Transforming Your Library website*, a publication in the Library Technology Reports series. According to King a "digital branch is a branch library, delivered digitally, on the Web. It offers much more than a traditional library website in many ways, because a digital branch has real staff, a real building, a real collection, and real community happening on and around it." Should digital branches catch on, as we are sure they will, they would provide libraries with one more way to use technology to serve the needs of patrons while reducing the library's carbon footprint. If you wish to find out more about digital branches, check out David King's "Managing the Digital Branch" slide presentation.

***Recycling Library Materials and Supplies*:** Printed materials are not usually referred to as technology. After all, printed materials are a given. That said, books are produced with technology, and in Gutenberg's day, the technology was amazing. So, recycling library materials and supplies is included here because they were produced with technology, however mudane we consider it in this day and age. Discarded library materials often find second homes through library book sales. Alternately, if the books, periodicals, video tapes, and other materials are not able to find a second home, there are ways to recycle these materials too. Earth911 is a comprehensive site that can assist in finding local centers for library materials, as well as paints and other institutional supplies that the library might need to recycle or dispose of with as little impact on the environment as possible. Although not strictly a green IT strategy, it is a strategy that conserves energy.

Conclusion

The United States needs to lower its energy consumption and find a way to deal with its e-waste effectively. This chapter has presented strategies to begin to do both. The United States has only begun to address its energy issues. We all need to do more. Libraries educate and inspire. They also lead by example. Modeling energy efficiency will not only show your community how to lower the total cost of energy, it will do wonders for your energy bill.

The United States has made even less progress on the problem of e-waste. It has no e-waste export laws. As a result, according to Sunita Sohrabji's article, more than eighty percent of used electronics collected in United States recycling drives ends up in the developing world, where it is disposed of by the poor who unknowingly expose themselves to toxins. We are only beginning to figure out ways to avoid that from occurring.

It is not unusual that technology precedes our ability to address and deal with its very real consequences. Each of us as individuals, and as libraries, must do our best to reduce, reuse and recycle. We also need to support legislation and regulation that will begin to address effectively irresponsible e-disposal.

Questions

1. What elements have you addressed in your green IT plan?

2. What is missing and might be included in your next revision?

3. How might your services and collections change if you green your IT?

4. How might your services be augmented by the effective use of IT?

Notes

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2. Heather Clancy, "Gartner Urges IT Leaders: Think Beyond 'Green IT' to Sustainability Strategy Support," *ZDNet.com*, accessed December 6, 2012, http://www.zdnet.com/blog/green/gartner-urges-it-leaders-think-beyond-green-it-to-sustainability-strategy-support/18184.

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CHAPTER 7

Stakeholder Involvement: Service Design and Planning—Requisites to LEED® and Green Building

Planning is bringing the future into the present so that you can do something about it now.

—Alan Lakein

When planning for a year, plant corn. When planning for a decade, plant trees. When planning for life, train and educate people.

—Chinese proverb

As librarians, we are often called upon by our boards, presidents, provosts, vice-presidents, deans, directors, students, and the public to plan for the future. And, certainly, our professional lives revolve around serving and educating people. In this chapter we will consider several elements of service design and planning. Understanding these fundamentals will make a positive difference when it comes to planning for a major renovation, a new building, or greening our existing library. After all, the library building is a tool, a way to assist in delivering service and facilitating life-long learning. Whatever goal or goals you are attempting to achieve, planning for excellent service is a process—and one that must be effective if you wish to achieve your desired outcomes. Since architects and designers plan spaces based on the functions that take place therein, the nature of the functions we perform in our offices, service desks, and public/student spaces must be designed effectively. Furthermore, we are challenged to envision how these functions might change in the future.

The emergence of self-service as a commonplace library service model is a good example. Retrofitting circulation desks for self-service technology has proven challenging for many libraries. Imagine if you decided that self-sorting check-in was a desirable technology in your library. One particular vendor describes its standard five-bin automated return and sorter system to use a space of eleven feet by thirteen feet. For many of us, identifying the needed space and electrical and data requirements for these types of systems would be challenging. The majority of our

circulation areas were designed before such equipment existed. Many public libraries had similar challenges when they moved to self-service hold pick-up for reserved and held materials.

We advocate a planning process that begins with an analysis of the functions and services that your library provides and would like to provide in the future. It also begins with a realization that the spaces must be flexible to be able to accommodate functions that are not even dreamt of when the facility is built or remodeled.

Service design planning is the province of the librarian. Librarians are the experts in service planning. Therefore, a team of librarians should be appointed to determine what services there are or will be and how these services need to be designed and delivered. Visiting other libraries is a helpful and recommended step in the process. Reviewing published studies is also recommended. The service goals you establish for your green (or greener) library will drive and inform much of the process. The creation of a team that pursues this path ensures a holistic approach to the process. The outcome is reflected in the appearance and operational characteristics of the library. The holistic approach in service design and intent is one important aspect that differentiates green libraries from those designed in a more traditional fashion. It is the questions that come from a consideration of the 3Ps or 3Es (People, Planet and profit, or Equity, Ecology and Economy. See Chapter One, page 9 for a refresher on what these represent), both asked and answered, that promote the sustainability of your building, services, and community.

Service Design

The first step in the green library process is to evaluate the services that we currently provide and to look at opportunities to change and improve the way they are delivered, eliminating some services and adding others. These changes are based on input from the community we serve and from the responses of the library team to this input. One way to address the design of services and library functions effectively is the science of service design. The concepts described here were first discussed in the 1980s, but they have only recently been recognized in academia as a potentially potent and broad area of study related to business, management, and innovation.

Since personnel costs are often the largest portion of our budgets, we need to be sure that these dollars are being used effectively. People themselves are the biggest consumer of our resources in another significant way, and that represents the expenditure of time. The time spent in hiring, record-keeping, payroll, evaluation, and training to bring our staff members to an acceptable level of service com-

petency are examples of the costs of time. By using service design, by giving staff the opportunity to deliver truly excellent service to their customers, we have the opportunity to enhance employee satisfaction. This satisfaction, in turn, reduces sick time and wasted time and saves the library money. Moreover, studies confirm that people respond to their environment. Having a library building that adheres to green principles, such as heating, cooling, lighting and indoor air quality, also affect employee wellness, job satisfaction, and productivity. Most important in the long run, it means that we can connect satisfied employees with satisfied customers, and satisfied customers and employees to healthy environments. Such is the nature of an integrated, holistic approach to successful library services.

Failure to understand customer needs and the inability to make changes in an agile way impede the creation of the best possible staff and user experience. It is important that we ask our customers to be part of the process of designing a service or procedure. Key drivers for good service design are market research and a clear understanding of customer requirements. Increasingly, communities and student populations have many pockets of disparate demographics, making it harder to generalize the needs and interests in a community. How does the college or university library cope with an unseen e-learning population? Services that work in person rarely translate directly for a student who is many states away. Other drivers include changing laws and legislation. Consider some school districts' inclusion of requirements that students perform community service to graduate. This requirement has caused many libraries to create a category of jobs for such students. Consider a state requirement to lower green-house gas emissions. These and many other drivers of change require us to approach planning in a more deliberate and holistic manner.

The primary model of planning good library service in a space has been, for the most part, predictive. Library staff applies our understanding of how customers use the library and what they use when in our facilities. The advent of social media, however, gives us an unprecedented opportunity to access current and potential customers alike and solicit their input in a more facile and timely manner. In many of our communities and campuses, there are subject matter experts that are in a position to share information with us. Service design asks us to make connections between users and services. Services designed in this way often result in workflows that differ markedly from what we do in our current facilitiesy. The services offered are the drivers for the efficient and sustainable design of our library spaces. In other words, planning requires service design by librarians, followed by a librarian who is the owner and essential stakeholder in your building team that will include architects, contractors, landscape architects, engineers, a LEED® AP, and others.

Effective Ways to Embrace Service Design

As librarians, we have been inundated with declarations about the end of the printed book and of the dominance of the digital format in the future. Books will go away; everything we need is on the Internet. We also know from our own usage data that this scenario is not quite as cut-and-dried as pundits would have us believe.

Public library usage continues to grow in the United States. Meanwhile, academic libraries look toward return-on-investment models tied to information literacy and assessment strategies. As this shift happens, library stacks shrink and digital offerings grow. The stack space has been converted to a variety of service points, including information commons, collaborative study spaces, and various sorts of learning centers. In order to understand and to meet the changing needs of library users, we can turn to tools such as surveys, user studies, and strategic planning to inform the service-design process. These are essential components in the design process that are necessary to ensure flexibility in the resulting building. Buildings are designed around space, which is designed around functionality. It is essential to get the spaces right to make sure that our sustainability goals can be achieved.

USER STUDIES

Another information industry that has been affected by the change in acquisition of information is the newspaper industry. Newspapers in America are disappearing. The financial foundation of the industry has been advertising and classified revenue. As more people turn to the Internet for news and rely on Internet services such as eBay and Craigslist instead of traditional classified services, newspapers find themselves without sufficient revenue to survive.

Figure 7.1. (Photo courtesy Francesco Marino / FreeDigitalPhotos.net.)

In response, the American Press Institute (API) endeavored to look into this growing problem. *Newspaper Next (N²)*, API's groundbreaking research initiative, provides the industry with new business models, non-traditional ways to see opportunities that produce sustainable growth and ways to reshape organizations for consistent innovation. Since its launch in September 2006, *N²* projects have explored and discovered strategic and practical guidance for an industry that's struggling to create

a brighter future. Because of *N²*, API has become a leading catalyst for industry-wide change by investing in new research, special conferences, seminars, white papers, and regional workshops that address the most critical issues facing the industry.

Essentially, *N²* advocated pursuing service-design principles to save the industry. Let's look at the *Washington Post* as an example. In the early nineties, the paper realized that classified revenue was falling precipitously. The editors used service-design principles to solve their problem. First, they identified potential newspaper readers and those who had subscribed in the past, but no longer did so. They asked them to describe their problems with the traditional newspaper, and they developed an extensive list. They found that a large potential audience existed among Washington Metro (subway) riders. They had a consistent trip every weekday and the desire to use the time constructively. The traditional newspaper, however, presented a few problems:

1. Customers had to have money to buy it, some would need change, and all needed time to complete the transaction.
2. The paper itself was too large to open in the typical subway seat.
3. The paper was too long—customers couldn't finish it on a typical ride to work.
4. Customers had to take their newspapers to work with them so they wouldn't "waste" their investment.
5. Readers pressed for time didn't like having to browse through news that didn't interest them to find their desired content.

Washington Post staffers reviewed these issues and created something remarkable—a new newspaper. This paper, known as the *express,* is given away free at the entrance to Metro stations. It is a smaller size than the usual paper. Articles are briefer and are focused on the interests of the particular demographic that rides the Metro. It is short enough that the contents can be consumed in one trip. The greatest benefit to the *Post,* however, is the advertising revenue. Since the paper could demonstrate a clear and particularly attractive demographic, advertisers were easily attracted. The advertising revenue from the free newspaper has sustained the publication.

Notice that the process did not ask users to tell the paper what they wanted in a newspaper. Instead, it asked former users and potential users about how their lives functioned. Potential users were asked to describe something about which they had considerable expertise—their own lives. The process asked for data and then allowed the newspaper staff to exercise their expertise and design solutions that would satisfy the needs of these potential clients. Contrast this approach with typical library user surveys that ask what customers would like to find in the library. The answer is usually "more"—more of whatever the customers use when they are in the library.

The previous example uses a survey to address user needs for a changing medium format. User studies are another way to address changing user needs. The Association of College & Research Libraries (ACRL) and the Library Leadership and Management Association (LLAMA), two divisions of the American Library Association, have partnered to on the the ACRL/LLAMA Academic Library Building Design: Resources for Planning wiki. The following four studies of how library users use libraries are available on the wiki. Although several years old, these studies reveal user trends that bear consideration. The studies consider changing student demographics, changing perceptions and preferences, new ways of teaching and learning, and the role of technology.

1. *College Students' Perceptions of Libraries and Information Resources*. This major study conducted by OCLC in 2010 contains data on user needs, preferences, uses of technology, and behaviors.
2. Learning Spaces. This freely available e-book published by EDUCAUSE, a nonprofit organization that promotes the intelligent use of information technology in higher education, has chapters on many aspects of learning space design, emphasizing learning principles, student needs and behaviors, technology, and case studies. Chapters 1-13 are particularly useful for libraries.
3. The ALA website has resources relating to the library as place in a section entitled: *Library as Place*.
4. *Studying Students: The Undergraduate Research Project at the University of Rochester.* This 2007 study uses anthropological methods to answer the question, "What do students *really* do when they write their research papers?" The electronic version is freely available for download from ACRL Publications.

A review of applicable user studies and of current trends is a good place to begin. However, it will also be important to study your own users and to analyze their needs and use patterns.

LIBRARY USERS' STORIES

Library facilities are too costly an investment to be based on predictions. Construction estimates begin over $130 per square foot for new public library construction and that estimate does not include furnishings. Library building projects are very complex and often outside the expertise of library staff, so tweaking and continuous improvement of the built environment is not the norm.

Typically, what gets designed gets built, and changes are rarely made. We have seen, however, that solving the problems that potential and current customers have accessing our services results in increased facility usage. Sustainable design aims to

meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. If the facility design encompasses only the space we need today, based on the way we perform tasks today, our facility will ultimately fail the test of longevity and sustainability.

Like user surveys and user studies, local statistics and customer stories are ways to gather input for planning service design and developing products and services. User stories can be significant when we are planning a service design or redesign. For example, a typical library request for proposal (RFP) for a new library system may include the following library-generated element to describe a process:

- Customer can renew material based on library-defined parameters.

The element, while accurate, provides little context. Compare it with user stories that describe the renewal process:

- A customer whose card is blocked wants to renew a DVD from home.
- A customer whose book is overdue wants to renew it at the library.
- A senior citizen without a computer calls and wants to renew the book she is reading.

You can see that even these brief user stories are much more richly descriptive than the RFP requirement and that they define actual situations encountered by real people in a library. Imagine how much richer they might be if recounted by actual library customers. The user story also allows the interaction to be designed by library staff in specific yet non-technical terminology. This process of writing user stories bridges the gap between the technical language of the building community and the experience of the library staff. Paying particular attention to even one aspect of the design process, especially the critical customer input piece, can be highly effective. It has the additional benefit of enhancing collaboration among the design professionals in a project who often work in isolation without a great deal of knowledge of the underlying needs which have evolved into the current design. This also saves money and improves the customer experience a great deal.

STRATEGIC PLANNING

Several planning guides for public libraries have been published by the Public Library Association since 1980, but the first in PLA's "…*for Results*" series appeared in 1998, written by Sandra Nelson and Diane Mayo. The authors are particularly impressed by *Strategic Planning for Results* (2008) by consultant Sandra Nelson. This work is a concrete example of the application of service design principles.

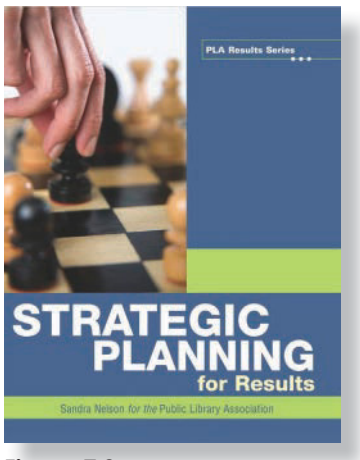

Figure 7.2.

The introduction to *Strategic Planning for Results* states that the process is based on three assumptions which coincide with what's been said about service design so far:

1. Excellence must be defined locally. It results when library services match community needs, interests and priorities
2. Excellence is possible for both small and large libraries. It rests more on commitment than on unlimited resources
3. Excellence is a moving target. Even when achieved, excellence must be continually maintained.[1]

Excellence has been substituted for quality as the goal of Planning for Results, but the basic assumptions are the same: reduce the gap between expectation and experience, do what you say you will do, and keep evaluating.

Nelson's planning approach is one of many planning approaches that libraries can use. The *Strategic Planning for Results* process encompasses the following stages:

1. Plan to plan—We often joke about how much time we spend planning to plan the plan, but pre-planning the process is important. This involves deciding who will be involved, the tools and techniques you will use, and the process by which the planning effort will be conducted.
2. Identify service priorities—Identify customer and staff groups to involve in the process and to perform service-design functions to learn about problems and needs in your particular service community.
3. Set the stage—Identify where the organization is right now and assess its readiness to change and embrace new services. What are the highly held values of library staff, and how will they help or impede progress on change?
4. Describe the future—Describing and designing the vision
5. Write goals and objectives and identify metrics that will help measure success, failure, or satisfaction with services. We recommend that the user story be the format used here. However this information is used, it will allow users and planners to see themselves and others clearly.
6. Implement the plan—assign goals and objectives to key individuals who will execute the plan and comprise the project team
7. Communicate the plan—Write the strategic plan itself and develop channels to communicate with all of the various stakeholders, again with user stories as the vehicle.

The key to using strategic planning as a tool for service design is the underlying and critical act of setting strategic priorities. Libraries cannot be all things to all people. Library leaders must decide what the library's priorities are, what can be afforded, and what the library can do well. Nelson's conceptualization of library resources and their finite nature enhances our definition of service design and makes it more useful in a library setting:

> Library resources fall into four categories: staff, collections, facilities and technology. On the surface these resources seem very different, but they share two common traits:
>
> *Library resources are finite*. No library has access to unlimited resources, and no library can expect all of the resources required to implement the plan to come from new appropriations.
>
> *Library resources are fully allocated to supporting current activities.* Few libraries have reservoirs of staff, space, collection dollars, or technology support stashed away to be used at some future time. The situation for most is better described as "what you see is what you have."[2]

The possible services that libraries can offer are known as service responses. An example of how a library prioritizes its needs using service responses can be found at the City of Casa Grande Public Library. Although the terminology used by Casa Grande might be different, the concepts are the same. They've used, for example, Basic literacy, Lifelong Learning and Commons as their service responses, prioritized as a result of their strategic planning process.

LEED: Bringing Service Design and Planning to Your Building Project

Service design is the prerequisite to good facilities planning. Service design clarifies the intentions of the library in moving forward in building a new or renovated space. Planning is the process by which these intentions are clearly articulated so that they have the chance to be realized. Both planning and design require a broad set of participants, but the participants differ. Planning describes *how* we are going to reach our building goals; design describes *what* the library will look like and perform like when we are done. Even more critical is the vision of the library professional as part of the process. Visioning is really the *why* of the building—why is it necessary? Why should it function in a certain way? Without envisioning the final product in its functionality, we cannot communicate with the building professionals who have the expertise to realize these goals with us.

Planning is requisite for LEED. LEED is designed purposely that way. Planning in an integrated fashion and thinking of your building, your staff, your services and your patrons in a holistic way leads to a better building. Planning is also required for LEED certification as prerequisites in each category must be successfully completed before the owner can earn any credits in that category. Furthermore, credits in one category affect credits in another. These features are not accidental, but part of the standards' design, requiring the building team to look at the building from the perspective of the users and the building specialty trades together. LEED acknowledges the strong impact that the lighting design has, for example, on the heating, ventilating, and air conditioning systems and the heat load of the building. By bringing these design experts together, the needs of both can be met in a symbiotic fashion not attainable in traditional building design, where these trade designs would be done in isolation from one another. This integrated approach requires that the librarian be familiar with the LEED standard in order to be full contributor to the process.

LEED Pilot Credit for Integrated Design

In the building environment, acquiring customer input is complex. Most people cannot understand the language of the trade, e.g., blueprints, schematics, and the like. Most people have difficulty envisioning the built environment from a floor plan. To encourage comments and make the concepts accessible, many building professionals use the charrette process, the use of an intensive workshop in which various stakeholders and experts are brought together to address a particular design issue. Basic design concepts are sketched in three dimensions. The goal is always to make the design and plan comprehensible by the largest number of stakeholders. For this reason, many projects employ LEED Accredited Professionals to help interpret and define the requirements that a building needs to have in place to accommodate successful library service.

Future versions of LEED will contain requirements for integrating the design process as we've outlined here. Recently, the concept has been introduced as Pilot Credit 42: Integrated Process. This pilot credit is available for the three LEED rating systems we've detailed in this book: LEED for New Construction and Large Renovation: Building Design & Construction; *LEED EB: O&M*; and LEED for Commercial Interiors. The pilot credit has specific requirements for each rating system, which are excerpted below. We will discuss the requirements and selected options for meeting the credit, followed by demonstration data from a LEED library project.

Pilot Credit 42: Integrated Process

Intent: *Develop an early understanding of the relationships between technical systems, natural systems and occupants within a building*

project, its site, its context, and its intended use. Engage all key project team members for the purpose of making cost- and environmentally-effective integrated decisions throughout the design and construction process.

BUILDING DESIGN & CONSTRUCTION
Requirement *(Applies to: LEED for New Construction; LEED for Core & Shell; LEED for Schools; LEED for Retail: New Construction; LEED for Data Centers, Warehouse & Distribution Centers; Hospitality): Demonstrate that key systems interactions are explored and analyzed in a way that informs basic building massing, envelope, and site-related design and operations decisions before establishing building form. Demonstrate that the project team uses results of these analyses and continues to identify and consider interactions and synergies among systems and strategies throughout the design and construction process.*

Option 2: *Concept Design Integrated Workshop*
Prior to the schematic design phase, conduct at least one full-day (or two half-day) integrated design workshop(s) with the project team for the purpose of integrating green strategies across all aspects of the building and site design, drawing on the expertise of all key participants. The purpose of this workshop is to identify synergies between building elements/systems and align project team members around integrated design strategies. Expertise of attendees at the workshop must include at least four of the following skill sets, along with at least one key owner's representative:

- *Architecture*
- *Mechanical, Electrical, Plumbing (MEP) engineering*
- *Energy analysis*
- *Green building or sustainable design*
- *Civil engineering, landscape architecture, habitat restoration, or land-use planning*
- *Building operations and maintenance*
- *Building construction*

Tasks and activities during this workshop should include:

- *Introduce participants to the fundamentals of integrated design and systems thinking.*
- *Align project team around project purpose and goals.*
- *Establish initial metrics, benchmarks, and performance targets*

for the LEED credits being pursued.
- *Generate potential strategies for achieving identified LEED performance targets.*
- *Develop a Process Road Map that identifies initial responsibilities, deliverables, and dates for managing the project scope by defining: what, when, and by whom outputs need to be produced.*
- *Initiate documentation of the Owner's Project Requirements (OPR) for Commissioning.*

Outcomes should include a demonstration of how initial project design decisions were informed by preliminary analyses. An Initial Commissioning Owner's Project Requirements (OPR) narrative can be utilized to demonstrate the development of the project's performance targets and potential solutions as the design progresses.

Submittal Requirements include the following:
- *Workshop agenda, including date and location*
- *Workshop attendee list, including role/discipline for each attendee*
- *Summary report of workshop activities and results, including a clear statement of the project's purpose and goals around which the team has aligned*
- *An integration process schedule ("roadmap") that identifies initial responsibilities, deliverables, and dates for managing the project scope by defining: what, when, and by whom outputs need to be produced through Schematic Design.*
- *Initial OPR document, including highlighted input from the workshop*

***Option 3:** Design Phase Integrated Workshop(s)*
- *In addition to the Conceptual Design Integrated Workshop above, conduct at least one full-day (or two half-day) integrated design workshop(s) with the project team no later than the end of the schematic design phase, for the purpose of identifying increasing opportunities for synergies between green strategies and systems across all aspects of the building and site design, drawing on the expertise of all participants. Expertise of attendees at the workshop must include at least four of the following skill sets, along with at least one key Owner's representative:*
- *Architecture*
- *Mechanical, Electrical, Plumbing (MEP) engineering*

- *Energy analysis*
- *Green building or sustainable design*
- *Civil engineering, landscape architecture, habitat restoration, or land-use planning*
- *Building operations and maintenance*
- *Building construction*

Tasks and activities during this workshop should include:

- *Present conceptual design analyses and subsequent research findings*
- *Identify and assess opportunities for synergies between all key systems based upon the above research and analysis.*
- *Identify additional analysis tasks that are needed to improve and refine systems performance and synergies.*
- *Confirm metrics, benchmarks, and performance targets for the LEED credits being pursued.*
- *Review and adjust the Process Road Map that identifies responsibilities, deliverables, and dates for managing the next stages of the project design by defining: what, when, and by whom outputs need to be produced.*
- *Review and adjust the Owner's Project Requirements (OPR) for Commissioning.*

Outcomes should include:

- *Integrated Cost Estimating (showing how total building cost was informed by bundling interrelated systems costs).*
- *Demonstration of how the project design improvements were based on preliminary analyses.*
- *Updated Commissioning Owner's Project Requirements (OPR) narrative that continues to document the development of the project's performance targets and potential solutions as the design progresses.*

Submittal Requirements include the following:

- *Workshop agenda, including date and location*
- *Workshop attendee list, including role/discipline for each attendee*
- *Summary report of workshop activities and results*
- *A one or two page narrative from a representative of each the four required disciplines identifying how the systems under their design control will function and are integrated with other systems*

in the project, in layman's language, in order to clearly communicate the performance and integration of their system with other disciplines. Include a description of how costs were affected by bundling interrelated systems costs.

- *Updated version of the project's OPR document, including highlighted input from the Workshop*

INTERIOR DESIGN AND CONSTRUCTION

Requirements (Apply to LEED for Commercial Interiors, LEED for Retail, and LEED for Hospitality): Demonstrate that key building and site conditions and systems interactions are explored and analyzed in a way that informs and ensures alignment with interior design, construction and operations decisions that improve the human condition in interior spaces.

***Option 3:** Concept Design Integrated Workshop*

This option is the same as Option 2 under Building Design and Construction (above), with the following change: the expertise of workshop attendees may include skill sets in Interior Design, Acoustical Engineering, Occupants, Real Estate Leasing agent/broker in addition to the skill sets listed except Civil Engineering, Landscape Architecture, Habitat Restoration, or Land-Use Planning.

***Option 4:** Design Phase Integrated Workshop(s)*

This option is the same as Option 3 under Building Design and Construction (above), with the following change: the expertise of workshop attendees may include skill sets in Interior Design, Acoustical Engineering, Occupants, Real Estate Leasing agent/broker in addition to the skill sets listed except Civil Engineering, Landscape Architecture, Habitat Restoration, or Land-Use Planning.

Existing Buildings: Operations and Maintenance (EBOM)

Requirements (apply to EBOM for Schools, Retail, Data Centers, and Hospitality): Demonstrate that key systems interactions are explored and analyzed in a way that informs basic building renovation/reconfiguration, envelope modifications, site-related modifications, technical systems operations, and maintenance decisions while determining EBOM credits to pursue, by implementing the following:

***Option 1:** Water Synergies*

Develop an implementation plan (roadmap) that schedules tasks

and activities to identify and analyze cost and performance synergies between systems relative to water use and water quality. This analysis must identify interactions between no less than five credits across no less than three credit categories (SS, WE, EA, MR, IEQ). Document projected cost and performance benefits for at least 8 years of future operations relative to the benchmarks established for each of the germane credits.

AND Implement the above Water Synergies Plan over the performance period (no less than two years) and document resultant quantified cost and performance benefits by utilizing ongoing performance data and integrated cost bundling to analyze the effectiveness of the plan.

Submittal Requirements:

- *Provide a Water Synergies Implementation Plan: a roadmap that schedules tasks and activities to identify and analyze cost and performance synergies between no less than five credits across no less than three credit categories (SS, WE, EA, MR, IEQ).*
- *Document projected cost and performance benefits for at least eight years of future operations relative to the benchmarks established for each of the germane credits.*
- *Provide an analysis matrix containing data from the performance period, including the dates of performance tracking, quantified cost and performance benefits, and any other relevant data.*

***Option 2:** Energy Synergies*
Develop an implementation plan (roadmap) that schedules tasks and activities to identify and analyze cost and performance synergies between systems relative to energy use. This analysis must identify interactions between no less than five credits across no less than three credit categories (SS, WE, EA, MR, IEQ). Document projected cost and performance benefits for at least 8 years of future operations relative to the benchmarks established for each of the germane credits.

AND Implement the above Energy Synergies Plan over the performance period (no less than two years) and document resultant quantified cost and performance benefits by utilizing ongoing performance data and integrated cost bundling to analyze the effectiveness of the plan.

Submittal Requirements:

- *Provide an Energy Synergies Implementation Plan: a roadmap that schedules tasks and activities to identify and analyze cost and performance synergies between no less than five credits across no less than three credit categories (SS, WE, EA, MR, IEQ).*
- *Document projected cost and performance benefits for at least eight years of future operations relative to the benchmarks established for each of the germane credits.*
- *Provide an analysis matrix containing data from the performance period, including the dates of performance tracking, quantified cost and performance benefits, and any other relevant data.*

Demonstration: When Arlington County, Virginia, gave the green light to the Reed School/Westover Library project, much planning had already gone into the project. The project called for replacing two buildings--a neighborhood elementary school that had been closed in the 1980's and was only used for specialized school services and the public library up the street—and combining them into a new, shared facility on the same site. It took seven years of community dialogue to reach that point. In addition to combining the two properties owned by two separate legal entities, what had also changed over the long history of revamping the neighborhood's school and public library was the introduction of green building standards. The combination and expansion of the facilities (the size of the public library tripled) was accomplished in a facility that was only two percent larger than the old school building. A Memorandum of Understanding allowed the school district to maintain ownership of the property; in exchange for paying for the construction of the library portion of the building, the county was given an unlimited lease to their portion of the facility at no charge. The former site of the public library was returned to green space, essential to the community.

In 2007, planning teams were established for the project. The team included the following members as "regulars" who began meeting during the architectural design phase of the project and ultimately met weekly as the project was being built. The team included:

- Librarian and LEED AP as library project manager
- Architect and LEED AP as county project manager
- County project manager's supervisor
- Project manager for schools
- Project manager's supervisor from schools
- Interior designer from the county's Construction Department
- Architectural firm that won design bid issued by the schools

- Project manager from the construction management firm hired to manage the actual construction
- Construction manager from construction firm hired to construct the facility
- Foreman from the construction firm
- LEED documentation specialist
- School facility manager and program specialists
- Library manager.

Additional members were included at various times throughout the process as needed to address specific concerns or construction specialties. These included:

- County zoning staff
- County information technology staff
- School information technology staff
- Library information technology staff
- County telecommunications staff
- School telecommunications staff
- County maintenance managers
- School maintenance managers
- County inspection services staff
- County arborist
- Landscape architect
- Nursery contractor
- County landscape staff
- School landscape staff
- Locksmiths
- County emergency planning and response staff
- Library furniture vendors
- School furniture vendors
- Health inspectors for kitchens and school facilities
- Veterans' Affairs Department of Transportation staff
- County Public Art Department
- Interior signage consultants
- County public relations staff
- School public relations staff
- Library public relations staff.

As you can see from the long list, this project consumed a large amount of staff time. The inclusiveness of the team did have several important outcomes. A prime example is the building maintenance team. As they examined the initial blueprints for the new building, they asked several questions that resulted in significant design

changes. We have "translated" some of these changes from the original design and the user stories (in parentheses) that produced the changes:

- Solar panels on the roof required an OSHA-approved method for reaching the roof that was also safe from school children on the property. (Custodial staff cleans the solar panels).
- Two-story interior sections necessitated a lift to change light bulbs. (Custodial staff changes light bulbs as needed).
- The lift required a parking space inside the facility and an outlet to charge it (Custodial staff uses lift to change light bulbs.)
- The stacks were designed with integrated lighting. The wiring was included, but a way to turn integrated lights on and off was not. (Problem solved with eco-friendly timers on the electrical panel).
- Several filter locations for the HVAC systems were changed to provide better access for the maintenance crew. (Custodial staff changes HVAC filters in air handlers as needed). If the filters had not been easily accessible, the schedule to maintain them would have been altered and a resultant deterioration of the HVAC performance would have been the likely and costly outcome.

Similar stories were observed throughout the project. Had these individuals not been part of the team, the facility would have been very dysfunctional. County employees were not aware of some the legal requirements for some of the school programs to operate in the school portion of the facility. Since nursery daycare is provided in the facility for children of teachers in the district, those rooms required a ground-floor location by law. Access and egress from an interior courtyard in the school portion of the facility was also challenging. By having committed expertise available and at the table, these hurdles were more swiftly addressed and easily resolvable. The earlier in the process such changes are made, the less expensive it is to accommodate them.

Figure 7.3. (Photo courtesy of Agati Furniture.)

A LEED Design Process Outline

To further develop the planning concept so integral to the LEED process, we've included a timeline that will help libraries sequence the steps and professionals involved as the project planning begins and continues.

- Decision is made to explore the need for a new, expanded or renovated library facility with the approval of governing bodies. What commitment will be made to sustainability in the project? Is that one of the project goals, or perhaps, *the* project goal?
- Familiarize yourself with green building and its concepts. (Maybe here is where you plug in the background reading list.)
- Familiarize yourself with LEED as a standard.
- Familiarize yourself with the integrated approach to planning as required by a LEED project.
- Determine the LEED team players and who is responsible for which steps in the process. (In particular, know your role as an involved stakeholder and building owner.)
- Insure owner involvement throughout the process.
- Consider your space needs, both now and into the future, with emphasis on flexible space planning (especially considering that you should be building a hundred-year building). Do you want the next generation to praise your vision and foresight, or do you want them to curse you?
- Consider your (green) information technology strategic plan and current information technology needs.
- Library management reviews staff expertise and arranges to acquire additional professional services to complete the concept design analysis and service plan.
- Integrated Concept Design team that will analyze service and design needs is established. This team should include a LEED AP to review sustainable practices as part of the services designed. LEED documentation begins internally.
- Team connects with staff, current users, and potential users and funders to analyze current service design and delivery and to write user stories that form the basis of the space needs analysis.
- Team members visit other libraries to gather data, observe and review services, and get ideas.
- Professional architect and interior designer (or staff architects and designers, if they are available) works with team to establish space needs and proximities of one space to another.
- Decision is made to recommend moving forward or to rework existing services and spaces. Feedback is made to all participants as the process moves forward.
- "Go" or "no-go" decision to build or renovate library is made by management and governing bodies. The desired LEED designation is determined.
- Decision is made as to who will spearhead the Integrated Design team— client

rep, architectural firm, facilities staff, LEED AP. Typically this would be someone found on the list of regular project participants as shown above.

- Architectural design professional staff is hired. Look for an architect who holds a LEED AP in the type of project you are doing. Also include the costs of presenting charrette sessions and model construction so that the plans can be reviewed by users and staff who do not understand blueprints or space diagrams.
- Interior design professional is hired. Often these professionals are part of the architectural firm, but it is preferable to have a professional assigned to your project, as it is for the interior designer to hold a LEED AP.
- Integrated Design Phase is carried out. Expect that the design staff will make proposals to the team during this process for their review. This step is normal and changes are to be expected.
- Architect and interior designer present proposals/plans. The team reviews all of the user stories to see how they are carried out in the proposed space. Satisfying these user stories is critical to the success of the design.
- Final plans are approved, and the project is bid. It is preferable to have separate bids for interior specialties such as furniture, shelving, floor coverings, and the like. Specialized bid documents allow the library more flexibility in the acquisition of these special elements. Often, this purchasing process can be part of a contract with a design firm.
- Construction professionals are hired or appointed, including LEED APs. LEED documentation and certification process begins its officially documented existence. Baseline measurements of existing systems are established.
- Construction team is assembled. Many of the design team members should be included to continue to trace and advocate for satisfaction of user stories throughout the process.
- Construction or renovation begins. Professional expertise is consulted throughout the process to ensure the sustainability of fixture and infrastructure choices. Again, your LEED AP can be invaluable in this process.
- Facility systems are commissioned as part of the building process prior to the end of construction. Commissioning includes testing of all systems to see if they operate as designed, and correcting any flaws in the performance results. Window seals, air flow, light levels, plumbing fixtures, and air quality are among many systems tested to see if they meet pre-determined performance targets. This often-ignored process is essential to the success of the finished space.
- Project is finished and move-in is completed. LEED documentation is completed and certification results made public.
- Design team remains in place to help establish workflows in the new space and to continue to write and test new user stories.

Assuring the Green Elements You Plan Become Reality

Figure 7.4. Westover Branch Library, Arlington, Virginia. (Photo Courtesy: Arlington Public Library.)

Make sure whatever you want, whether it is a green element or not, is written into the specification documents, not just drawn on the blueprints. The contractors are obligated to build your building to the specifications that are developed to bid the project. After the bid documents have been released, it takes a great deal of work (and lots of extra dollars) to make changes. Consult with a LEED AP with library experience or have a conversation with the director of another LEED-certified library to see if you have missed a step or if there are pitfalls to be avoided.

Notes

1. Sandra Nelson, *Strategic Planning for Results* (Chicago: American Library Association, 2008), xi.
2. Ibid.

Additional Resources

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Yudelson, Jerry. *Green Building Through Integrated Design.* New York: McGraw-Hill, 2008.

CHAPTER 8

Anticipation: LEED® v4

Everything old is new again...

If LEED® is anything, it is iterative. As the co-authors look ahead in an attempt to forecast the future the LEED standards, we do so with caution and a great degree of speculation because the changes described here might be changed again, and again, before the next versions of LEED are published.

At one point the authors decided to wait until LEED 2012 was published, keying this book to the newer version. They were prepared to wait until they would have actual examples of buildings that had applied the new and revised LEED credits. However, in June 2012 the USGBC decided to postpone LEED 2012, renaming it LEED v4. Because of the delay in publishing the next version of LEED, that horizon is now farther away, way in the distance. Presently publication of LEED v4 is scheduled for late 2013, but that's not certain either. By the time examples to illustrate the new or greatly revised credits in LEED v4 were available this book would not be published until sometime in 2015 and by that time perhaps a LEED v5 might be in the works. In other words, current and the anticipated versions of LEED will always be with us and they will exist simultaneously. So, the co-authors adopted the saying, "No time like the present." Instead, the co-authors have pledged to revise this work based on LEED v4 just as soon as possible following its implementation in the market.

While LEED v4 only exists as a draft version for now, there have already been five comment periods. It is important to look at how v4 will change. These changes reveal the possible direction that the USGBC is moving and the plans they have for the LEED rating systems.

The USGBC has always acknowledged that LEED buildings have room for improvement. While they may perform better than conventional buildings, the current LEED rating systems that are used to certify buildings (at all levels of certification) still have at least some negative environmental impact(s). **The USGBC's goal is to continue refining the rating systems until LEED certification reflects a neutral or positive environmental impact.** The process will be gradual, first with Platinum rated buildings, and then proceed through the other rating levels, until even Certified projects (the lowest level of certification) are providing a neutral impact on the environment.

The LEED v4 Edition Focus

The hallmark of LEED and its ability to affect market transformation is its continuous improvement cycle. Such a cycle enables the rating systems to increase in scope and stringency as market readiness increases and new technologies become widely available. LEED v4 will build on LEED 2009 in a thoughtful way. It optimizes the foundations in LEED 2009, and will continue to improve its clarity, usability and functionality. With LEED 2009, the primary changes were foundational changes, such as rating system content alignment, credit point value allocation, the development of LEED Online v3, and changes to the professional credentials and certification process. These foundational changes continue to be refined in the context of LEED 2009, but will not be fundamentally changed again with LEED v4.

In LEED v4, USGBC will focus on increasing the technical rigor of the rating systems, expanding the market sectors able to use LEED, and striving for simplicity in terms of usability. Some of the new market sectors will include EBOM (Existing Buildings: Operations and Maintenance) for Schools, Retail, Data Centers, Hospitality, and Warehouses.

At the point this chapter was written, the LEED v4 draft has 49 credits and 15 prerequisites (six more prerequisites than LEED 2009). The credits are organized into 10 categories, compared to seven under LEED 2009. Additions include an Integrative Process category; a Location and Transportation category; and a Performance category that covers commissioning, measurement, and reporting and a completely revamped Materials and Resources section. The update also addresses homes and LEED for Neighborhood Development, as well as all of the commercial rating systems. Of course, all this may change before the final LEED v4 is approved and published.

The certification thresholds currently proposed will remain the same as in the LEED 2009 version (Certified, 40-49; Silver, 50-59; Gold, 60-79; Platinum, 80+). Achievement of these certification thresholds depends on the weighting, or point allocation, process. For LEED v4, the USGBC has developed a number of impact categories more closely aligned to its mission, which will inform point allocation across the rating system. LEED is anticipated to maintain the 100-point system, and a minimum of one point per credit.

The proposed draft moves closer to the USGBC's goal of developing a performance-based rating system instead of prescriptive requirements. While a performance-based system and requirements will obviously require more evaluation, calculation and documentation by the project team, it also allows more opportunities for alternatives to compliance.

The draft of the rating system proposes that the principal LEED AP must have relevant specialty accreditation and that a minimum of two other team members must have at least Green Associate credentials. Specialty accreditation for a LEED AP signifies an advanced depth of knowledge in green building practices and reflects an ability to specialize in a particular LEED Rating System (LEED for Existing Buildings, Operations and Maintenance; LEED for Homes; LEED for New Construction; LEED for Commercial Interiors; or LEED for Neighborhood Development). The legacy LEED AP credential will no longer be recognized.

Besides the usual public comment processes and public comment pages the USGBC has also invited feedback from projects testing pilot credits. It has also incorporated input from other sources such as a moderated forum dedicated to discussing the evolution of LEED and from various webinars. The USGBC has over 150 project teams engaged in the Pilot Credit Library, many of them trying credits that are proposed for the update to LEED. The USGBC plans to use this feedback the same way as it does public comment feedback—to improve and evolve credit requirements and submittals.

The proposed categories for LEED v4 are as follows:

INTEGRATIVE PROCESS (IP)
One of the new credit categories, now slated to be the first in the rating system is "Integrative Process". The IP category is intended to develop an early understanding of the relationships between technical systems, natural systems and occupants within a building project, its site, its context, and its intended use. All key project team members should be engaged for the purpose of making environmentally sound and cost-effective integrated decisions throughout the design and construction process. Starting with an "Integrated Design" credit is meant to encourage the integration of the project team. As one of the basic tenets of sustainable design, this credit is well suited to be placed first in the rating system.

The other credit in this category is the traditional IDc2 "LEED Accredited Professional" credit, which has caused detailed discussion. The current language for compliance with this credit requires a LEED AP with specialty applicable to the rating system (e.g., LEED-NC projects require a LEED AP BD+C). This has obviously raised questions by Legacy LEED APs who could no longer work on project teams if the project team intends to apply for this credit. What's even more interesting is that this credit no longer can be earned with only one project team member being a LEED AP; it now requires two additional individuals representing primary disciplines to be LEED AP (with any specialty) or Green Associates. Once again, Legacy LEED APs cannot contribute to any of the three required accredited team members.

LOCATION AND TRANSPORTATION (LT)

The second credit category is also new, with its title borrowed from the LEED-ND rating system. Most of the credits will be nothing new even though many of them have new names. The credits for "Site Selection", "Development Density and Community Access" as well as the four Alternative Transportation credits (SSc4.x credits) are now renamed and included in this category focusing on site selection and transportation management. What will be new is that there is now a prerequisite for "Bicycle Storage" and a new credit, also borrowed from LEED-ND called "Walkable Streets."

SUSTAINABLE SITES (SS)

There are no new credits in this category that will focus exclusively on providing a sustainable site. The biggest changes in this section are that the two Stormwater Management credits (SSc6.1 Stormwater Management, Quantity and SSc6.2 Stormwater Management, Quality) are now combined into a single "Rainwater Management" credit, while both Heat-Island Effect credits will be combined into a new "Heat Island Reduction" credit.

There is also a new option that awards additional credit for projects involving brownfields or zones designated by federal agencies for redevelopment.

WATER EFFICIENCY (WE)

The Water Efficiency category has a number of significant changes, including two new prerequisites for "Landscape Water Use Reduction" and "Appliance and Process Water Use Reduction" which LEED now deals with. There are also three credits for additional water use reduction associated with the prerequisites, the existing and renamed credit for "Sustainable Wastewater Management" and another new credit called "Cooling Tower Makeup Water". The prerequisites and credits in this category are relatively unchanged, but as a whole now provide a comprehensive approach to reducing the overall water consumption of LEED projects.

ENERGY AND ATMOSPHERE (EA)

While the number of credits in the Energy and Atmosphere category has been reduced, it will now be focused on the level of energy efficiency exhibited by the project at certification. Those credits which deal with measurement, verification and performance have been moved to the new and aptly named "Performance" category. One new credit in this category is "Demand Response", a credit designed to provide for electrical load demand shifting and reduce the overall demand on electrical power production and distribution systems.

MATERIALS AND RESOURCES (MR)

LEED v4 will introduce a more sophisticated approach to many of the materials credits, replacing simple proxies for environmental benefit, such as recycled content and rapidly renewable materials, with requirements that call for life-cycle assessment, disclosure of ingredients, and avoidance of problem chemicals. Although the credit titles in this category are relatively unchanged, the requirements for the credits have evolved and, in some cases, dramatically changed. This category, as proposed, is a lightning rod for commentary even though this category carries relatively few points (about 10% of the total in most Building Design & Construction rating systems). This is because the category has the most direct impact on major building material markets with their associated economic and ecological impacts.

To date the USGBC has stuck with its strong commitment to the Forest Stewardship Council (FSC) as the minimum standard for wood product certification. It has, however, backed off at this point from a credit that included PVC—the plastic most widely used in buildings—among the substances to be avoided. That's a function of a decision to reference the European REACH list for that credit. PVC remains among the substances that would have to be disclosed, based on the lists in Clean Production Action's Green Screen Benchmark.

LEED v4 introduces a more sophisticated approach to many of the materials credits, replacing simple proxies for environmental benefit, such as recycled content and rapidly renewable materials, with requirements that call for life-cycle assessment, disclosure of ingredients, and avoidance of problem chemicals.

There are now prerequisites for "Minimum Recycled Content" and "Construction and Demolition Waste Management Planning", which provide a minimum level of compliance for these frequently earned credits. The requirements for each one of these credits are now more detailed and relate better to real world practice. For example, the renamed "Bio-based Materials" credit now includes materials identified by the USDA BioPreferred program.

Under the materials and resources category, a new prerequisite would require projects to develop and implement a construction waste management plan. A new Whole Building Reuse credit would be given to projects that maintain at least 75% of the total building and reuse a historic building in a historically appropriate way or that reuse a blighted or abandoned building. Another new prerequisite requires metering of all water conveyed to the project. All meters and submitters must also be able to report data remotely.

INDOOR ENVIRONMENTAL QUALITY (EQ)

Similar to the Sustainable Sites category, there are no major changes to this category. EQc3.1 "Construction IAQ Management Plan, During Construction" is now a prerequisite and there is a new "Acoustic Performance" credit borrowed from LEED for Schools. The biggest change is the various Low-Emitting Materials credits are combined into one credit, "Low-Emitting Interiors" and now covers other systems such as ceilings and insulation. The traditional SCAQMD standards for sealants and paints remain unchanged, but all products in this category must now also comply with additional standards from the California Department of Public Health.

PERFORMANCE (PF)

Another change proposed for LEED v4 is to introduce a new credit category covering the on-going performance and measurement of building energy and water use. This new category adds prerequisites for building level energy and water usage, while also being the location of the relocated Commissioning prerequisite and credit. It's also where existing credits such as the renamed "Reconcile Projected and Actual Energy Performance" and "Occupant Experience Survey" are relocated. Two additional new credits require sub-metering of energy and water usage.

Another major change is a new performance credit category in which a newly constructed building can gain credit by installing an advanced energy-metering system and committing to share energy usage data with the USGBC for at least five years from the date of occupancy. These data would be reported anonymously through LEED's Building Performance Partnership (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2201). The Optimize Energy Performance credit would require project teams to use energy modeling to influence design rather than just using these models to confirm compliance. Teams would have to establish an energy performance target no later than the schematic design phase.

Performance standards in LEED v4 are expected to add value to a building's LEED certification status via post-certification reporting and new recertification requirements. This is especially important as green codes begin to raise the floor on the status quo and current LEED requirements become the norm. LEED v4 is shifting to a performance-based structure that supports recertification and raises the bar to maintain LEED as a leadership tool.

INNOVATION

Because the "LEED Accredited Professional" credit has been relocated, this category now deals exclusively with Exemplary Performance (still with a maximum limit of three credits allowed) and Innovation credits.

REGIONAL PRIORITY
Regional priority credits once again make an appearance as "bonus" credits for achieving credits deemed of significant environmental/sustainable importance to a specific geographic region.

Summary

Basically the proposed language for LEED v4 is the next evolution of the rating system. Until it is published, nothing is "set in stone." All of the credit language and requirements can still change. You can keep current with LEED v4 developments by referring to the USGBC website: LEED v4: The next version of LEED.

Questions

1. Can your project wait?

2. Is your funding secure?

3. What are the advantages to using 2009 as it is outlined?

4. Would the enhanced LEED v4 standards add value to the building's LEED certification status via post-certification reporting?

5. Would any new recertification requirements be something you need or want?

Conclusion

Our aim in writing this publication has been a simple one: to demystify the process of achieving a sustainable library facility, regardless of the type of library, the scope or type of project or the experience of the library staff.

We realize through a great deal of professional involvement in library building projects (as well as other building projects), that the language and process of building design professionals often present a challenge to our library colleagues. Similarly, our library jargon coupled with our understanding of library processes and services often presents challenges to the building and design professional.

Our aim has been to bridge this gap in a very mindful way and to focus specifically on a higher quality built environment that fulfills and surpasses our facility needs. We believe that the LEED process, as well as the planning scenarios we have outlined here, provides the basis for this outcome.

This is our hope for each of you who use the information we have provided here—that you will feel confident enough to advocate for your needs in any design and building process. Further, we hope that you understand now that there are well-documented, strategic and not overly costly ways to provide a superior librarybuilding that exceeds the needs of your customers and enhances your library as a place to work for you and your staff. Finally, we wish each of you a minimal ecological footprint on our planet, even as your professional footprint is celebrated. Tread lightly on our planet and be rewarded with an abundance of resources to continue our work in our communities wherever they might be.