

# **Green Building**

Understanding, Bidding and  
Building Green

# Green Building

## Understanding, Bidding and Building Green

By

Words & Images

for

Foundation of the Wall and Ceiling Industry

Buildings are the single largest contributor to global warming, accounting for almost half of total annual U.S. energy consumption and carbon dioxide emissions. — U.S. ENERGY INFORMATION ADMINISTRATION

“Roughly fifty percent of the homes that the U.S. will need by 2030 have not been built.”

—FRANCISCO BENAVIDES, SUSTAINABLE DEVELOPMENT MANAGER,  
KENNECOTT LAND, UTAH

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# Preface

## Foundation of the Wall and Ceiling Industry

In the late 1970s, there was a clear recognition among industry leaders for the need to unite and expand the educational and research activities available to contractors, manufacturers, distributors and the public, in general. At the time, there were many issues facing the industry—from a national energy crisis to injuries in the workplace, to unsafe buildings occupied by the public. In response to these issues, the Foundation of the Wall and Ceiling Industry was formed in 1977 with the following mission statement as an IRS designated non-profit 501(c)3 corporation to pursue educational and research activities benefiting the industry and the public at-large:

The Foundation's mission is to be an active, unbiased source of information and education to support the wall and ceiling industry.

To fulfill this mission, the Foundation owns and maintains the largest independent library serving the wall and ceiling industry, provides educational scholarships for those pursuing careers in engineering, construction and design, provides research support to industry inquiries and publishes research papers.

To obtain additional copies of this publication or to learn more about the Foundation of the Wall and Ceiling Industry, please contact

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# FORWARD

This publication is divided into two primary sections: Part 1—The Basics of LEED and Part 2—The Big Picture. A normal layout for a report might start with the big picture to set the stage and then dive into the details of the report. The stage referred to in this report addresses the need for the construction industry to improve its use of resources to lessen its impact on the production of carbon dioxide. If you are not already a believer in this need, this publication will not, by itself, convince you to change your position. It will tell you what the rest of the construction industry—owners, legislators, building officials, contractors and users are doing to make a difference.

Since the purpose of this report is not to change your mind about carbon footprints, The Big Picture section is part 2, and what you need to know as you operate in the construction industry is put in part 1. So part 1 explains how the Leadership in Energy and Environment Design (LEED) program relates to the wall and ceiling industry. Part 2 tells you why we need LEED.

# INTRODUCTION

This publication is divided into two primary sections: Part 1—The Basics of LEED and Part 2—The Big Picture. A normal layout for a report might start with the big picture to set the stage and then dive into the details of the report. The stage referred to in this report addresses the need for the construction industry to improve its use of resources to lessen its impact on the production of carbon dioxide. If you are not already a believer in this need, this publication will not, by itself, convince you to change your position. It will tell you what the rest of the construction industry—owners, legislators, building officials, contractors and users are doing to make a difference.

Since the purpose of this report is not to change your mind about carbon footprints, The Big Picture section is part 2, and what you need to know as you operate in the construction industry is put in part 1. So part 1 explains how the Leadership in Energy and Environment Design (LEED) program relates to the wall and ceiling industry. Part 2 tells you why we need LEED.

# PART I: THE BASICS

## Leadership in Energy and Environmental Design

As part of its Research Series, the Foundation of the Wall and Ceiling Industry has commissioned this report on green building in America, its current state and direction.

The current drivers of the movement: concerned citizen groups and organizations; state legislators; local, regional, national and international green building programs such as Leadership in Energy and Environmental Design (LEED) and Green Globes, primarily address architects and designers, as well as owners and general contractors, but seldom the subcontractor, who often sees little more of the picture than the narrow view provided by bid specs.

As a result, Association of the Wall and Ceiling Industry (AWCI) members, in the main, are still putting together those pieces of green building they come across on construction sites and at bidders' conferences, but they have so far not been introduced to the big picture, how it relates to the contractor specifically, and how he or she can be part of this process.

With the green building movement now catching hold, understanding the process and seeing the full picture has grown from being a convenience, and perhaps competitive edge, to a necessity.

The wall and ceiling industry is actually well suited to the green process, since recycled and recyclable alternatives are now available for most of our products; few of our products are volatile; and most are manufactured locally with small transport footprints.

Neither are these alternatives necessarily cost-prohibitive, especially as rising green demand is beginning to drive costs down, sometimes even below the current, non-green products they replace.

This paper examines the origin and growth of the green building movement, its effect on the AWCI contractor, and how he or she can best gain both the overall picture and the detailed information—such as provided by LEED accreditation—to profitably meet this rising green trend with skill and dexterity.

It is hard to pin down exactly when the Leadership in Energy and Environmental Design (LEED) was initially conceived, but its origins are with the U.S. Green Building Council (USGBC), which roots reach back to the mid-1980s, when a real estate developer named David Gottfried ran into an environmental lawyer named Michael Italiano. At the time they both worked on architect William McDonough's Environmental Defense Fund project in New York City, an early green building.

Over the next few years, through several informal meetings with a gathering of like-minded professionals, Gottfried and Italiano nursed and strengthened their plans for a national green alliance.

In 1993, this group—which now numbered a little over 20 and included prominent members like Robert Berkebile, chair of the AIA Committee on the Environment, William Browning and Amory Lovins of the Rocky Mountain Institute, Carl Costello of Greening America, as well as representatives from industry and federal agencies such as the U.S. Department of Energy—incorporated as the U.S. Green Building Council. Richard Fedrizzi, then of Carrier, now of Green-Think, was the founding chairman.

At its first conference, which attracted more than 600 participants, the USGBC set as its first goal the creation of a sustainability rating system in conjunction with the American Society of Testing and Materials (ASTM).

## **LEED History**

The next two years, however, proved frustrating for the USGBC members working on the ASTM subcommittee. Its consensus-based process moved far too slowly for their liking, and as a result, in 1995, the USGBC dropped the ASTM effort in favor of an independent USGBC rating system. Rob Watson, a senior scientist with the Natural Resources Defense Council, assumed the chair of the committee to formulate LEED—the *Leadership in Energy and Environmental Design* green-rating system.

Over the next three years, Watson's LEED committee considered—and rejected—a host of building sustainability ratings models, including the Green Builder program, a Canadian model (BEPAC), the Green Building Challenge, and the promising BREEAM system from the United Kingdom, but it, too, was rejected, first, according to Watson, because it relied on the development of an elaborate assessor infrastructure, essentially a national corps of code officials; and, second, because it was seen as focusing primarily on reducing carbon dioxide emissions, whereas the LEED committee wanted to address a much broader set of energy impacting factors.

After several starts and stops, in late 1998, the USGBC membership finally approved LEED Version 1.0, and within months, a pilot program was launched with support of the Federal Energy Management Program.

A reference guide was then drafted to steer participants through the LEED process, and within the year, buildings totaling more than a million square feet had registered for certification.

LEED had arrived.

This pilot program did, however, expose some shortcomings of LEED 1.0. According to Watson, several of the 40 credits that could be earned were either too strict or were already standard practice. They also found that energy-related credits were not sufficiently related to performance.

So they went back to the drawing board.

The result was LEED 2.0, which was approved by the USGBC membership in March 2000. This version of LEED expanded the credits from 40 to a maximum of 69. The range limits of the various categories—Bronze (now “Certified”), Silver, Gold and Platinum—were expanded. The resource guide was revised and upgraded.

A further refinement took place in early 2003 and gave us LEED 2.1, and subsequent revisions lead us to the current LEED 2.2.

The LEED rating system has now, in comparatively few years, begun to truly transform the \$315 billion U.S. design and construction industry.

The General Services Administration now requires all new GSA construction to seek LEED Silver status; Naval Facilities Engineering Command has incorporated LEED into instructions for new Navy buildings; other federal entities, such as the Army and the Air Force, are reworking LEED to meet their own specific requirements.

Major corporations—Ford, Sprint, Steelcase, PNC Financial Services, Toyota and others—have all embraced LEED and sustainable design. Foundations are coming aboard. Municipalities, counties and states are also either adopting LEED, or reworking it to meet local or regional needs.

Colleges and universities have made LEED a standard for new construction; and even some speculative real estate developers have accepted the LEED process, as with Four Times Square, in Manhattan, and EcoWorks at Southlake, outside Kansas City, Kan.

By the end of 2006, more than 650 projects have been LEED certified, an increase of 66 percent over 2005, and nearly 5,000 buildings had registered their intention to use the LEED rating system for new buildings, renovations, tenant remodeling and existing buildings, a 50 percent increase over 2005 year-end totals.

Although LEED is not without imperfections, its simple structure, based on a system of points to be achieved for various criteria met, has gained it a strong following, and it is now the most widely accepted program of its kind in the United States.

### **LEED Basics**

The stated goal of LEED is to transform the building industry by introducing rating systems that reflect scientific knowledge, leading-edge architectural and engineering design approaches, and best practices in construction and development.

LEED certification is divided into six different rating systems:

- LEED-NC for New Construction (and major renovations)
- LEED-CS for Core and Shell (office buildings and other speculative projects)
- LEED-CI for Commercial Interiors (remodels)
- LEED-EB for Existing Buildings (continuing building operation)
- LEED-ND for Neighborhood Development
- LEED-H for Homes

The dominant LEED system today is LEED-NC, LEED for New Construction, which comprises 77 percent of all certified projects, and 79 percent of all registrations (statement of intent to attain one of the six LEED certifications for the project registered).

### **LEED Points—How They Are Awarded**

The first four LEED rating systems above (NC, CS, CI and EB) are broken down into six categories of evaluation:

1. Sustainable Sites
2. Water Efficiency
3. Energy and Atmosphere
4. Materials and Resources
5. Indoor Environmental Quality
6. Innovation and Design

(LEED-ND and LEED-H have their own distinct areas). Below is a detailed discussion of the criteria in each of the six categories.

Each of these categories in turn are itemized as to specific targets of design and construction, which when achieved, and documented, are awarded points commensurate with the value of the item. The tables following the LEED rating systems below show how these points are valued and awarded.

### **LEED for New Construction (LEED-NC)**

This basic LEED rating system contains 32 types of credits of environmental design and energy concerns in the categories of site development, water efficiency, energy efficiency, material use/reuse and indoor environmental quality, with a total of 64 attainable point, and 5 possible innovation and design bonus points, for a total of 69.

To attain *certification* under the LEED-NC rating, a project must achieve a minimum of 26 points in the categories of site, water, energy, materials and indoor environment. To attain a *Silver* rating, it must reach 33 points; for *Gold*, the number is 39; and for *Platinum*, the bar is raised to 52.

To certify, each project requires fairly painstaking documentation that must be reviewed and evaluated by an independent auditor.

It is a testament to the workability of the process that projects that have been LEED-NC certified tend to be 30 percent or more energy efficient, tend to use 30 percent or less water, and tend to have healthier indoor air, with more daylighting and better outside views for their occupants than the building that merely measures up to current code.

The following table shows the areas of sustainability and the points awarded to each individual item in these areas as they are achieved and documented:

LEED-NC	Sustainable Sites	14 Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 2	Development Density & Community Connectivity	1
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation, Public Transportation Access	1
Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
Credit 4.3	Alternative Transportation, Low-Emitting & Fuel-Efficient Vehicles	1
Credit 4.4	Alternative Transportation, Parking Capacity	1
Credit 5.1	Site Development, Protect or Restore Habitat	1
Credit 5.2	Site Development, Maximize Open Space	1
Credit 6.1	Stormwater Design, Quantity Control	1
Credit 6.2	Stormwater Design, Quality Control	1
Credit 7.1	Heat Island Effect, Non-Roof	1
Credit 7.2	Heat Island Effect, Roof	1
Credit 8	Light Pollution Reduction	1
LEED-NC	Water Efficiency	5 Points
Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
Credit 2	Innovative Wastewater Technologies	1
Credit 3.1	Water Use Reduction, 20% Reduction	1
Credit 3.2	Water Use Reduction, 30% Reduction	1
LEED-NC	Energy & Atmosphere	17 Points
Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	Fundamental Refrigerant Management	Required

<b>Credit 1</b>	<b>Optimize Energy Performance</b>	<b>1 to 10</b>
	10.5% New Buildings or 3.5% Existing Building Renovations	1
	14% New Buildings or 7% Existing Building Renovations	2
	17.5% New Buildings or 10.5% Existing Building Renovations	3
	21% New Buildings or 14% Existing Building Renovations	4
	24.5% New Buildings or 17.5% Existing Building Renovations	5
	28% New Buildings or 21% Existing Building Renovations	6
	31.5% New Buildings or 24.5% Existing Building Renovations	7
	35% New Buildings or 28% Existing Building Renovations	8
	38.5% New Buildings or 31.5% Existing Building Renovations	9
	42% New Buildings or 35% Existing Building Renovations	10
<b>Credit 2</b>	<b>On-Site Renewable Energy</b>	<b>1 to 3</b>
	2.5% Renewable Energy	1
	7.5% Renewable Energy	2
	12.5% Renewable Energy	3
<b>Credit 3</b>	<b>Enhanced Commissioning</b>	<b>1</b>
<b>Credit 4</b>	<b>Enhanced Refrigerant Management</b>	<b>1</b>
<b>Credit 5</b>	<b>Measurement &amp; Verification</b>	<b>1</b>
<b>Credit 6</b>	<b>Green Power</b>	<b>1</b>
<b>LEED-NC</b>	<b>Materials &amp; Resources</b>	<b>13 Points</b>
<b>Prereq 1</b>	<b>Storage &amp; Collection of Recyclables</b>	<b>Required</b>
<b>Credit 1.1</b>	<b>Building Reuse, Maintain 75% of Existing Walls, Floors &amp; Roof</b>	<b>1</b>
<b>Credit 1.2</b>	<b>Building Reuse, Maintain 95% of Existing Walls, Floors &amp; Roof</b>	<b>1</b>
<b>Credit 1.3</b>	<b>Building Reuse, Maintain 50% of Interior Non-Structural Elements</b>	<b>1</b>
<b>Credit 2.1</b>	<b>Construction Waste Management, Divert 50% from Disposal</b>	<b>1</b>
<b>Credit 2.2</b>	<b>Construction Waste Management, Divert 75% from Disposal</b>	<b>1</b>
<b>Credit 3.1</b>	<b>Materials Reuse, 5%</b>	<b>1</b>
<b>Credit 3.2</b>	<b>Materials Reuse, 10%</b>	<b>1</b>
<b>Credit 4.1</b>	<b>Recycled Content, 10% (post-consumer + 1/2 pre-consumer)</b>	<b>1</b>
<b>Credit 4.2</b>	<b>Recycled Content, 20% (post-consumer + 1/2 pre-consumer)</b>	<b>1</b>
<b>Credit 5.1</b>	<b>Regional Materials, 10% Extracted, Processed &amp; Manufactured Regionally</b>	<b>1</b>
<b>Credit 5.2</b>	<b>Regional Materials, 20% Extracted, Processed &amp; Manufactured Regionally</b>	<b>1</b>
<b>Credit 6</b>	<b>Rapidly Renewable Materials</b>	<b>1</b>
<b>Credit 7</b>	<b>Certified Wood</b>	<b>1</b>
<b>LEED-NC</b>	<b>Indoor Environmental Quality</b>	<b>15 Points</b>
<b>Prereq 1</b>	<b>Minimum IAQ Performance</b>	<b>Required</b>
<b>Prereq 2</b>	<b>Environmental Tobacco Smoke (ETS) Control</b>	<b>Required</b>
<b>Credit 1</b>	<b>Outdoor Air Delivery Monitoring</b>	<b>1</b>
<b>Credit 2</b>	<b>Increased Ventilation</b>	<b>1</b>
<b>Credit 3.1</b>	<b>Construction IAQ Management Plan, During Construction</b>	<b>1</b>
<b>Credit 3.2</b>	<b>Construction IAQ Management Plan, Before Occupancy</b>	<b>1</b>

Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
Credit 4.2	Low-Emitting Materials, Paints & Coatings	1
Credit 4.3	Low-Emitting Materials, Carpet Systems	1
Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
Credit 5	Indoor Chemical & Pollutant Source Control	1
Credit 6.1	Controllability of Systems, Lighting	1
Credit 6.2	Controllability of Systems, Thermal Comfort	1
Credit 7.1	Thermal Comfort, Design	1
Credit 7.2	Thermal Comfort, Verification	1
Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
Credit 8.2	Daylight & Views, Views for 90% of Spaces	1
LEED-NC	Innovation & Design Process	5 Points
Credit 1.1	<b>Innovation in Design:</b> In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.	1
Credit 1.2	<b>Innovation in Design:</b> Same as Credit 1.1	1
Credit 1.3	<b>Innovation in Design:</b> Same as Credit 1.1	1
Credit 1.4	<b>Innovation in Design:</b> Same as Credit 1.1	1
Credit 2	LEED® Accredited Professional	1
LEED-NC	<b>Project Totals (pre-certification estimates)</b>	<b>69 Points</b>
	<b>Certified: 26-32 points, Silver: 33-38 points, Gold: 39-51 points, Platinum: 52-69 points</b>	

### LEED for Core and Shell (LEED-CS)

Whereas the LEED-NC standard evaluates a completed and fully furnished building, many speculative commercial projects are built as “core and shell” structures, which are not fully completed until an occupant/tenant has improved it by customizing that portion of the building they have leased for use.

A core-and-shell building normally has a lobby, elevators, finished internal and external structures, HVAC, plumbing and electrical systems and parking facilities, but little else.

The initial intent was to link the LEED-CS rating with a LEED for Commercial Interiors (LEED-CI) rating, in order to arrive at a complete certification for the fully improved building—in essence a LEED-NC certification. This, however, does not necessarily work out in practice, since even very green developers are loath (financially or otherwise) to impose green standards on tenant improvements.

The following table shows the areas of sustainability and the points awarded to each individual item in these areas as they are achieved and documented:

LEED-CS	Sustainable Sites	15 Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 2	Development Density & Community Connectivity	1
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation: Public Transportation Access	1

Credit 4.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
Credit 4.3	Alternative Transportation: Low-Emitting and Fuel-Efficient Vehicles	1
Credit 4.4	Alternative Transportation: Parking Capacity	1
Credit 5.1	Site Development: Protect or Restore Habitat	1
Credit 5.2	Site Development: Maximize Open Space	1
Credit 6.1	Stormwater Design: Quantity Control	1
Credit 6.2	Stormwater Design: Quality Control	1
Credit 7.1	Heat Island Effect, Non-Roof	1
Credit 7.2	Heat Island Effect, Roof	1
Credit 8	Light Pollution Reduction	1
Credit 9	Tenant Design & Construction Guidelines	1
<b>LEED-CS</b>	<b>Water Efficiency</b>	<b>5 Points</b>
Credit 1.1	Water Efficient Landscaping: Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping: No Potable Use or No Irrigation	1
Credit 2	Innovative Wastewater Technologies	1
Credit 3.1	Water Use Reduction: 20% Reduction	1
Credit 3.2	Water Use Reduction: 30% Reduction	1
<b>LEED-CS</b>	<b>Energy &amp; Atmosphere</b>	<b>14 Points</b>
Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	Fundamental Refrigerant Management	Required
Credit 1	Optimize Energy Performance (2 points mandatory for LEED for Core and Shell projects registered after June 26, 2007.)	1 to 8
	10.5% New Buildings or 3.5% Existing Building Renovations	1
	14% New Buildings or 7% Existing Building Renovations	2
	17.5% New Buildings or 10.5% Existing Building Renovations	3
	21% New Buildings or 14% Existing Building Renovations	4
	24.5% New Buildings or 17.5% Existing Building Renovations	5
	28% New Buildings or 21% Existing Building Renovations	6
	31.5% New Buildings or 24.5% Existing Building Renovations	7
	35% New Buildings or 28% Existing Building Renovations	8
Credit 2	On-Site Renewable Energy	1
Credit 3	Enhanced Commissioning	1
Credit 4	Enhanced Refrigerant Management	1
Credit 5.1	Measurement & Verification - Base Building	1
Credit 5.2	Measurement & Verification - Tenant Sub-metering	1
Credit 6	Green Power	1
<b>LEED-CS</b>	<b>Materials &amp; Resources</b>	<b>11 Points</b>
Prereq 1	Storage & Collection of Recyclables	Required
Credit 1.1	Building Reuse: Maintain 25% of Existing Walls, Floors & Roof	1
Credit 1.2	Building Reuse: Maintain 50% of Existing Walls, Floors & Roof	1
Credit 1.3	Building Reuse: Maintain 75% of Interior Non-Structural Elements	1
Credit 2.1	Construction Waste Management: Divert 50% from Disposal	1
Credit 2.2	Construction Waste Management: Divert 75% from Disposal	1
Credit 3	Materials Reuse: 1%	1
Credit 4.1	Recycled Content: 10% (post-consumer + 1/2 pre-consumer)	1

Credit 4.2	Recycled Content: 20% (post-consumer + 1/2 pre-consumer)	1
Credit 5.1	Regional Materials: 10% Extracted, Processed & Manufactured Regionally	1
Credit 5.2	Regional Materials: 20% Extracted, Processed & Manufactured Regionally	1
Credit 6	Certified Wood	1
<b>LEED-CS Indoor Environmental Quality</b>		<b>11 Points</b>
Prereq 1	Minimum IAQ Performance	Required
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3	Construction IAQ Management Plan: During Construction	1
Credit 4.1	Low-Emitting Materials: Adhesives & Sealants	1
Credit 4.2	Low-Emitting Materials: Paints & Coatings	1
Credit 4.3	Low-Emitting Materials: Carpet Systems	1
Credit 4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	1
Credit 5	Indoor Chemical & Pollutant Source Control	1
Credit 6	Controllability of Systems: Thermal Comfort	1
Credit 7	Thermal Comfort: Design	1
Credit 8.1	Daylight & Views: Daylight 75% of Spaces	1
Credit 8.2	Daylight & Views: Views for 90% of Spaces	1
<b>LEED-CS Innovation &amp; Design Process</b>		<b>5 Points</b>
Credit 1.1	Innovation in Design	1
Credit 1.2	Innovation in Design	1
Credit 1.3	Innovation in Design	1
Credit 1.4	Innovation in Design	1
Credit 2	LEED® Accredited Professional	1
<b>LEED-CS Totals (pre-certification estimates)</b>		<b>61</b>
Certified: 23 to 27 points, Silver: 28 to 33 points, Gold: 34 to 44 points, Platinum: 45 to 61 points		

### LEED for Commercial Interiors (LEED-CI)

This rating system covers the green design and energy issues of a tenant improvement project, including lighting energy use and quality, HVAC use and controls, access to public transport, material choices with regard to furniture and cabinetry and other issues pertaining to improving an existing, normally core-and-shell, building space.

The following table shows the areas of sustainability and the points awarded to each individual item in these areas as they are achieved and documented:

<b>LEED-CI</b>	<b>Sustainable Sites</b>	<b>7 Points</b>
Credit 1		<b>1 to 3</b>
	Select a LEED Certified Building	3
	OR Locate the tenant space in a building with following characteristics:	1 to 3
	Stormwater Management: Rate and Quantity	1/2

	Stormwater Management: Treatment	1/2
	Heat Island Reduction: Non-Roof	1/2 to 1
	Heat-Island Reduction: Roof	1/2
	Light Pollution Reduction	1/2
	Water Efficient Irrigation: Reduce by 50%	1/2
	Water Efficient Irrigation: No Potable Use or No Irrigation	1/2
	Innovative Wastewater Technologies	1/2
	Water Use Reduction: 20% Reduction	1/2
	Onsite Renewable Energy	1/2 to 1
	Other Quantifiable Environmental Performance	1/2 to 3
Credit 2	Development Density and Community Connectivity	1
Credit 3.1	Alternative Transportation: Public Transportation Access	1
Credit 3.2	Alternative Transportation: Bicycle Storage & Changing Rooms	1
Credit 3.3	Alternative Transportation: Parking Availability	1
<b>LEED-CI</b>	<b>Water Efficiency</b>	<b>2 Points</b>
Credit 1.1	Water Use Reduction - 20% Reduction	1
Credit 1.2	Water Use Reduction - 30% Reduction	1
<b>LEED-CI</b>	<b>Energy &amp; Atmosphere</b>	<b>12 Points</b>
Prereq 1	Fundamental Commissioning	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	CFC Reduction in HVAC&R Equipment	Required
Credit 1.1	Optimize Energy Performance - Lighting Power	1 to 3
	Option A: Reduce lighting power density to 15% below the standard	1
	Option B: Reduce lighting power density to 25% below the standard	2
	Option C: Reduce lighting power density to 35% below the standard	3
Credit 1.2	Optimize Energy Performance - Lighting Controls	1
Credit 1.3	Optimize Energy Performance - HVAC	1 to 2
	Option A: Equipment Efficiency and Zoning & Controls	1 to 2
	Option B: Reduce Design Energy Cost	1 to 2
Credit 1.4	Optimize Energy Performance - Equipment and Appliances	1 to 2
	70% of ENERGY STAR eligible equipment is ENERGY STAR rated	1
	90% of ENERGY STAR eligible equipment is ENERGY STAR rated	2
Credit 2	Enhanced Commissioning	1
Credit 3	Energy Use, Measurement & Payment Accountability	1 to 2
	Case A: Projects with area less than 75% of total building area	1 to 2
	Case B: Projects with area 75% or more of total building area	2
Credit 4	Green Power	1

LEED-CI	Materials & Resources	14 Points
Prereq 1	Storage and Collection of Recyclables	Required
Credit 1.1	Tenant Space, Long Term Commitment	1
Credit 1.2	Building Reuse, Maintain 40% of Interior Non-Structural Components	1
Credit 1.3	Building Reuse, Maintain 60% of Interior Non-Structural Components	1
Credit 2.1	Construction Waste Management, Divert 50% From Landfill	1
Credit 2.2	Construction Waste Management, Divert 75% From Landfill	1
Credit 3.1	Resource Reuse, 5%	1
Credit 3.2	Resource Reuse, 10%	1
Credit 3.3	Resource Reuse, 30% Furniture and Furnishings	1
Credit 4.1	Recycled Content, 10% (post-consumer + 1/2 pre-consumer)	1
Credit 4.2	Recycled Content, 20% (post-consumer + 1/2 pre-consumer)	1
Credit 5.1	Regional Materials, 20% Manufactured Regionally	1
Credit 5.2	Regional Materials, 10% Extracted and Manufactured Regionally	1
Credit 6	Rapidly Renewable Materials	1
Credit 7	Certified Wood	1
LEED-CI	Indoor Environmental Quality	17 Points
Prereq 1	Minimum IAQ Performance	Required
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
Credit 1	Outside Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3.1	Construction IAQ Management Plan, During Construction	1
Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
Credit 4.1	Low-Emitting Materials, Adhesives and Sealants	1
Credit 4.2	Low-Emitting Materials, Paints and Coatings	1
Credit 4.3	Low-Emitting Materials, Carpet Systems	1
Credit 4.4	Low-Emitting Materials, Composite Wood and Laminate Adhesives	1
Credit 4.5	Low-Emitting Materials, Systems Furniture and Seating	1
Credit 5	Indoor Chemical and Pollutant Source Control	1
Credit 6.1	Controllability of Systems, Lighting	1
Credit 6.2	Controllability of Systems, Temperature and Ventilation	1
Credit 7.1	Thermal Comfort - Compliance	1
Credit 7.2	Thermal Comfort - Monitoring	1
Credit 8.1	Daylight & Views - Daylight 75% of Spaces	1
Credit 8.2	Daylight & Views - Daylight 90% of Spaces	1
Credit 8.3	Daylight & Views - Views for 90% of Seated Spaces	1
LEED-CI	Innovation & Design Process	5 Points
Credit 1.1	Innovation in Design: Identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.	1
Credit 1.2	Innovation in Design: Same as Credit 1.1	1

Credit 1.3	Innovation in Design: Same as Credit 1.1	1
Credit 1.4	Innovation in Design: Same as Credit 1.1	1
Credit 2	LEED™ Accredited Professional	1
<b>LEED-CI</b>	<b>Project Totals (pre-certification estimates)</b>	<b>57 Points</b>
Certified: 21 to 26 points, Silver: 27 to 31 points, Gold: 32 to 41 points, Platinum: 42 to 57 points		

### LEED for Existing Buildings (LEED-EB)

This system aims at rating the continuing environmental footprint of an existing building. The long-term effect of a building on the environment results from a multitude of small choices that owners and operators make over the lifetime of a building. LEED-EB is the first system that aims to assess these choices and to suggest how to lessen their detrimental impact.

The following table shows the areas of sustainability and the points awarded to each individual item in these areas as they are achieved and documented:

LEED-EB	Sustainable Sites	14 Points
Prereq 1	Erosion & Sedimentation Control	Required
Prereq 2	Age of Building	Required
Credit 1.1	Plan for Green Site & Building Exterior Management - 4 specific actions	1
Credit 1.2	Plan for Green Site & Building Exterior Management - 8 specific actions	1
Credit 2	High Development Density Building & Area	1
Credit 3.1	Alternative Transportation - Public Transportation Access	1
Credit 3.2	Alternative Transportation - Bicycle Storage & Changing Rooms	1
Credit 3.3	Alternative Transportation - Alternative Fuel Vehicles	1
Credit 3.4	Alternative Transportation - Carpooling & Telecommuting	1
Credit 4.1	Reduced Site Disturbance - Protect or Restore Open Space (50% of site area)	1
Credit 4.2	Reduced Site Disturbance - Protect or Restore Open Space (75% of site area)	1
Credit 5.1	Stormwater Management - 25% Rate and Quantity Reduction	1
Credit 5.2	Stormwater Management - 50% Rate and Quantity Reduction	1
Credit 6.1	Heat Island Reduction - Non-Roof	1
Credit 6.2	Heat Island Reduction - Roof	1
Credit 7	Light Pollution Reduction	1
LEED-EB	Water Efficiency	5 Points
Prereq 1	Minimum Water Efficiency	Required
Prereq 2	Discharge Water Compliance	Required
Credit 1.1	Water Efficient Landscaping - Reduce Potable Water Use by 50%	1
Credit 1.2	Water Efficient Landscaping - Reduce Potable Water Use by 95%	1
Credit 2	Innovative Wastewater Technologies	1
Credit 3.1	Water Use Reduction - 10% Reduction	1
Credit 3.2	Water Use Reduction - 20% Reduction	1

LEED-EB	Energy & Atmosphere	23 Points
Prereq 1	Existing Building Commissioning	Required
Prereq 2	Minimum Energy Performance - Energy Star 60	Required
Prereq 3	Ozone Protection	Required
Credit 1	Optimize Energy Performance	1 to 10
	Energy Star Rating - 63	1
	Energy Star Rating - 67	2
	Energy Star Rating - 71	3
	Energy Star Rating - 75	4
	Energy Star Rating - 79	5
	Energy Star Rating - 83	6
	Energy Star Rating - 87	7
	Energy Star Rating - 91	8
	Energy Star Rating - 95	9
	Energy Star Rating - 99	10
Credit 2.1	Renewable Energy - On-site 3% / Off-site 15%	1
Credit 2.2	Renewable Energy - On-site 6% / Off-site 30%	1
Credit 2.3	Renewable Energy - On-site 9% / Off-site 45%	1
Credit 2.4	Renewable Energy - On-site 12% / Off-site 60%	1
Credit 3.1	Building Operation & Maintenance - Staff Education	1
Credit 3.2	Building Operation & Maintenance - Building Systems Maintenance	1
Credit 3.3	Building Operation & Maintenance - Building Systems Monitoring	1
Credit 4	Additional Ozone Protection	1
Credit 5.1	Performance Measurement - Enhanced Metering (4 specific actions)	1
Credit 5.2	Performance Measurement - Enhanced Metering (8 specific actions)	1
Credit 5.3	Performance Measurement - Enhanced Metering (12 specific actions)	1
Credit 5.4	Performance Measurement - Emission Reduction Reporting	1
Credit 6	Documenting Sustainable Building Cost Impacts	1
LEED-EB	Materials & Resources	16 Points
Prereq 1.1	Source Reduction & Waste Management - Waste Stream Audit	Required
Prereq 1.2	Source Reduction & Waste Management - Storage & Collection	Required
Prereq 2	Toxic Material Source Reduction - Reduced Mercury in Light Bulbs	Required
Credit 1.1	Construction, Demolition & Renovation Waste Management - Divert 50%	1
Credit 1.2	Construction, Demolition & Renovation Waste Management - Divert 75%	1
Credit 2.1	Optimize Use of Alternative Materials - 10% of Total Purchases	1
Credit 2.2	Optimize Use of Alternative Materials - 20% of Total Purchases	1
Credit 2.3	Optimize Use of Alternative Materials - 30% of Total Purchases	1
Credit 2.4	Optimize Use of Alternative Materials - 40% of Total Purchases	1
Credit 2.5	Optimize Use of Alternative Materials - 50% of Total Purchases	1
Credit 3.1	Optimize Use of IAQ Compliant Products - 45% of Annual Purchases	1
Credit 3.2	Optimize Use of IAQ Compliant Products - 90% of Annual Purchases	1

Credit 4.1	Sustainable Cleaning Products & Materials - 30% of Annual Purchases	1
Credit 4.2	Sustainable Cleaning Products & Materials - 60% of Annual Purchases	1
Credit 4.3	Sustainable Cleaning Products & Materials - 90% of Annual Purchases	1
Credit 5.1	Occupant Recycling - Recycle 30% of the Total Waste Stream	1
Credit 5.2	Occupant Recycling - Recycle 40% of the Total Waste Stream	1
Credit 5.3	Occupant Recycling - Recycle 50% of the Total Waste Stream	1
Credit 6	Additional Toxic Material Source Reduction - Reduced Mercury in Light Bulbs	1
<b>LEED-EB</b>	<b>Indoor Environmental Quality</b>	<b>22 Points</b>
Prereq 1	Outside Air Introduction & Exhaust Systems	Required
Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
Prereq 3	Asbestos Removal or Encapsulation	Required
Prereq 4	PCB Removal	Required
Credit 1	Outside Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3	Construction IAQ Management Plan	1
Credit 4.1	Documenting Productivity Impacts - Absenteeism & Healthcare Cost Impacts	1
Credit 4.2	Documenting Productivity Impacts - Other Productivity Impacts	1
Credit 5.1	Indoor Chemical & Pollutant Source Control - Reduce Particulates in Air System	1
Credit 5.2	Indoor Chemical & Pollutant Source Control - Isolation of High Volume Copy/Print/Fax Room	1
Credit 6.1	Controllability of Systems - Lighting	1
Credit 6.2	Controllability of Systems - Temperature & Ventilation	1
Credit 7.1	Thermal Comfort - Compliance	1
Credit 7.2	Thermal Comfort - Permanent Monitoring System	1
Credit 8.1	Daylight & Views - Daylight for 50% of Spaces	1
Credit 8.2	Daylight & Views - Daylight for 75% of Spaces	1
Credit 8.3	Daylight & Views - Views for 45% of Spaces	1
Credit 8.4	Daylight & Views - Views for 90% of Spaces	1
Credit 9	Contemporary IAQ Practice	1
Credit 10.1	Green Cleaning - Entryway Systems	1
Credit 10.2	Green Cleaning - Isolation of Janitorial Closets	1
Credit 10.3	Green Cleaning - Low Environmental Impact Cleaning Policy	1
Credit 10.4	Green Cleaning - Low Environmental Impact Pest Management Policy	1
Credit 10.5	Green Cleaning - Low Environmental Impact Pest Management Policy	1
Credit 10.6	Green Cleaning - Low Environmental Impact Cleaning Equipment Policy	1

LEED-EB	Innovation & Design Process	5 Points
Credit 1.1	Innovation in Upgrades, Operation & Maintenance: Specify the exemplary performance achieved (Option A). Alternatively, identify the intent of the proposed innovation credit, the additional environmental benefits delivered, the proposed requirements for compliance, the proposed performance metrics to demonstrate compliance and the approaches (strategies) that might be used to meet the requirements; meet the proposed requirements during the performance period (Option B).	1
Credit 1.2	Innovation in Operations: Same as Credit 1.1	1
Credit 1.3	Innovation in Operations: Same as Credit 1.1	1
Credit 1.4	Innovation in Operations: Same as Credit 1.1	1
Credit 2	LEED™ Accredited Professional	1
<b>LEED-EB</b>	<b>Project Totals (pre-certification estimates)</b>	<b>85 Points</b>
	Certified: 32-39 points, Silver: 40-7 points, Gold: 48-63 points, Platinum: 64-85	

### LEED for Neighborhood Development (LEED-ND)

This LEED version was announced in early 2007 as a beta rating system of up to 240 projects. It seeks to provide a national set of standards for the location of new neighborhoods, and to evaluate the combined effect of smart growth, new urbanism and green building.

The following table shows the areas of sustainability and the points awarded to each individual item in these areas as they are achieved and documented:

LEED-ND	Smart Location & Linkage	30 Points
Prereq 1	Smart Location	Required
Prereq 2	Proximity to Water and Wastewater Infrastructure	Required
Prereq 3	Imperiled Species and Ecological Communities	Required
Prereq 4	Wetland and Water Body Conservation	Required
Prereq 5	Farmland Conservation	Required
Prereq 6	Floodplain Avoidance	Required
Credit 1	Brownfield Redevelopment	2
Credit 2	High Priority Brownfields Redevelopment	1
Credit 3	Preferred Location	10
Credit 4	Reduced Automobile Dependence	8
Credit 5	Bicycle Network	1
Credit 6	Housing and Jobs Proximity	3
Credit 7	School Proximity	1
Credit 8	Steep Slope Protection	1
Credit 9	Site Design for Habitat or Wetlands Conservation	1
Credit 10	Restoration of Habitat or Wetlands	1
Credit 11	Conservation Management of Habitat or Wetlands	1

LEED-EB	Neighborhood Pattern & Design	39 Points
Prereq 1	Open Community	Required
Prereq 2	Compact Development	Required
Credit 1	Compact Development	7
Credit 2	Diversity of Uses	4
Credit 3	Diversity of Housing Types	3
Credit 4	Affordable Rental Housing	2
Credit 5	Affordable For-Sale Housing	2
Credit 6	Reduced Parking Footprint	2
Credit 7	Walkable Streets	8
Credit 8	Street Network	2
Credit 9	Transit Facilities	1
Credit 10	Transportation Demand Management	2
Credit 11	Access to Surrounding Vicinity	1
Credit 12	Access to Public Spaces	1
Credit 13	Access to Active Public Spaces	1
Credit 14	Universal Accessibility	1
Credit 15	Community Outreach and Involvement	1
Credit 16	Local Food Production	1
LEED-EB	Green Construction & Technology	31 Points
Prereq 1	Construction Activity Pollution Prevention	Required
Credit 1	LEED Certified Green Buildings	3
Credit 2	Energy Efficiency in Buildings	3
Credit 3	Reduced Water Use	3
Credit 4	Building Reuse and Adaptive Reuse	2
Credit 5	Reuse of Historic Buildings	1
Credit 6	Minimize Site Disturbance through Site Design	1
Credit 7	Minimize Site Disturbance during Construction	1
Credit 8	Contaminant Reduction in Brownfields Remediation	1
Credit 9	Stormwater Management	5
Credit 10	Heat Island Reduction	1
Credit 11	Solar Orientation	1
Credit 12	On-Site Energy Generation	1
Credit 13	On-Site Renewable Energy Sources	1
Credit 14	District Heating & Cooling	1
Credit 15	Infrastructure Energy Efficiency	1
Credit 16	Wastewater Management	1
Credit 17	Recycled Content for Infrastructure	1
Credit 18	Construction Waste Management	1
Credit 19	Comprehensive Waste Management	1
Credit 20	Light Pollution Reduction	1

LEED-EB	Innovation & Design Process	6 Points
Credit 1.1	Innovation and Exemplary Performance: In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach and strategies that might be used to meet the requirements.	1
Credit 1.2	Innovation and Exemplary Performance: Same as Credit 1.1	1
Credit 1.3	Innovation and Exemplary Performance: Same as Credit 1.1	1
Credit 1.4	Innovation and Exemplary Performance: Same as Credit 1.1	1
Credit 1.5	Innovation and Exemplary Performance: Same as Credit 1.1	1
Credit 2	LEED® Accredited Professional	1
LEED-EB	<b>Project Totals (pre-certification estimates)</b>	<b>106 Points</b>
	Certified: 40-49 points, Silver: 50-59 points, Gold: 60-79 points, Platinum: 80-106 points	

### LEED for Homes (LEED-H)

This is a two-year pilot nearing completion.

The categories include sustainable sites, water efficiency, energy efficiency, materials and resources, and indoor environmental quality (much the same as LEED-NC, but applied to the single family home), with two added categories pertinent to residential projects: location and linkages, and homeowner awareness and education about green buildings.

# Walls and Ceilings Industry Points

The LEED rating system applies to all aspects of building construction, and to all trades; points are often earned through the combined efforts of many diverse contractors.

The wall and ceiling industry does, however, have a large share in this effort, and an analysis of where and how, specifically, the wall and ceiling contractor contributes to LEED certification may be useful.

## Walls

The main areas where walls, both exterior and interior, can contribute to LEED points are as follows:

### Energy and Atmosphere

Optimized Energy Performance: Exterior walls utilizing either insulated concrete forms or exterior insulation and finish systems can, through the improved insulation, contribute as many as 10 points (if the energy performance is shown to improve 42 percent or better). This is a large block of points, constituting more than a third of the 26 minimum points needed for basic LEED-NC certification. Other products that can contribute to this include Celbar wall spray systems.

### Materials & Resources

Construction Waste Management: By redirecting recovered resources back to the manufacturing process, and redirecting reusable materials to the appropriate sites—such as properly sorting on-site waste into designated containers—the wall contractor can contribute 1 or 2 LEED points to the project.

Recycled Contents: By using 10 to 20 percent recycled products—such as concrete with high pot ash contents—the wall contractor can again contribute 1 or 2 LEED points to the project.

Regional Material: By obtaining regionally processed or manufactured material, the wall contractor can contribute 1 or 2 LEED points.

### Indoor Environmental Quality

Low-Emitting Materials: By using low-emitting adhesives and sealants, the wall contractor can contribute 1 or 2 LEED points to the project.

Thermal Comfort: Through the use of ICF or EIFS or other high-quality insulation material, the wall contractor can contribute 1 LEED point to the project.

## Ceilings

Interior finishes, such as ceilings, can help accrue points in both the *Materials & Resources* and *Indoor Environmental Quality* categories—LEED categories that have the greatest impact—as well as the *Energy and Atmosphere* category, and a special category known as *Innovation in Design*.

It is important to note, however, that ceilings alone cannot deliver LEED points, but they can contribute to earning credits in those categories.

### Energy and Atmosphere

Optimize Energy Performance: To aid in energy cost savings and reduced lighting power density, high light reflectance (LR) ceilings and systems provide the same level of luminance with fewer luminaires. This can help reduce energy costs by 20 percent in new or existing buildings used for offices where a high LR ceiling is installed along with a reduction in the number of fixtures and reduced wattage lamps. The number of LEED points awarded for such improvement is different for new and existing buildings.

## Materials & Resources

Construction Waste Management: By redirecting recovered resources back to the manufacturing process, and redirecting reusable materials to the appropriate sites—such as properly sorting on-site waste into designated containers, the ceiling contractor can contribute 1 or 2 LEED points to the project.

Recycled Contents: Acoustical ceilings normally contain high levels of recycled content in the form of either pre-consumer (post-industrial waste) or post-consumer product. The amount of recycled content varies by product, so check with the manufacturer for exact percentages and appropriate documentation. The ceiling contractor can contribute 1 or 2 LEED points to the project in this category.

Regional Materials: If the ceiling contractor uses a minimum of 20 percent of all construction and Division 12 materials (furniture) and products that are manufactured regionally (within a radius of 500 miles), he can contribute 1 or 2 points to the project.

## Indoor Environmental Quality

Daylight and Views: If the ceiling contractor achieves a minimum glazing factor of 2 percent in a minimum of 75 percent of all regularly occupied areas, or achieve at least 25 foot-candles, and provide daylight redirection and/or glare control devices to ensure daylight effectiveness, he can contribute 1 point to the project. High light reflectance (LR) ceilings can aid in extending daylighting into a space. A typical acoustical ceiling reflects just 75 percent of the light striking its surface, while a high LR ceiling is engineered to reflect up to 90 percent of the light striking its surface.

## Finishes

Finishes offer a great opportunity to make the project environmentally friendly, and so can earn LEED points. Low-VOC paints, natural plasters on walls, certified wood, recycled foam padding, all contribute.

Specifically, gypsum boards, acoustical ceilings, wall coverings, and painting and coating all contributed directly to the project's LEED points, primarily in the *Materials & Resources* and *Indoor Environmental Quality* categories:

## Materials & Resources

Construction Waste Management: As with the ceiling contractor, by redirecting recovered resources back to the manufacturing process, and redirecting reusable materials to the appropriate sites—such as properly sorting on-site waste into designated containers, the contractor working finishes can contribute 1 or 2 LEED points to the project.

Recycled Contents: Acoustical ceiling tiles and gypsum boards can contain high levels of recycled content. Although the amount of recycled content varies by product, the contractor can contribute 1 or 2 LEED points to the project in this category.

Regional Materials: If 20 percent or better of the material and products the contractor uses on the job are manufactured regionally (within a radius of 500 miles), he can contribute 1 or 2 points to the project.

## Indoor Environmental Quality

Low-Emitting Materials: By using low-emitting adhesives and sealants, or no adhesives or sealants at all (for example, by screw attaching all gypsum), the contractor can contribute 1 or 2 LEED points to the project.

## Framing

Steel is the world's—and North America's—most recycled material. As a consequence, the steel used in steel stud framing typically contains 6.1 percent *post-industrial* or *pre-consumer* (meaning the reintroduction of manufacturing scrap—such as trimmings, defective products, byproducts, etc.—back into the manufacturing process) and 22.3 percent *post-consumer* (meaning what the consumer discards after use, what we think of as garbage) recycled contents.

LEED calculates the percentage of recycled material as the full post-consumer recycled percentage plus half of the post-industrial recycled percentage.

Typically, then, for LEED purposes, steel stud framing contains 25.35 percent recycled material:  $22.3\% + 1/2 \times 6.1\% (3.05\%) = 23.35\%$ .

This percentage well exceeds both the 5 percent and 10 percent LEED goals, and so can contribute 2 LEED points to the project.

The basic category of point contribution for the (wood) framer is the use of wood products that have been certified by the Forest Stewardship Council, as reclaimed or as managed according to FSC's guidelines.

These guidelines evaluate forest management practices in three areas: sustainable harvest, ecosystem health and community benefits. Biologists, ecologists, silviculturists and foresters examine and measure the impact of forest practices on wildlife and their habitat, water quality, soil and plant conservation, natural forest sustainability and biodiversity, visual aesthetics and the total ecological integrity of the forest.

Through the use of certified wood, the framing contractor can contribute 1 LEED point to the project.

## **Insulation**

Insulation points are covered under Walls and Ceilings, above, and under EIFS, below.

## **EIFS**

EIFS can contribute to LEED points in the following categories:

### **Energy and Atmosphere**

**Optimize Energy Performance:** An airtight, well-insulated building enclosure has a significant effect on the energy consumption of a building. A 2005 National Institute of Standards and Technology study showed that use of a structural air barrier can reduce energy consumption of a building by up to 40 percent. In addition, the overall energy performance of a building and its interior environment can be greatly improved by placing the insulation on the outside of the building, thus minimizing thermal bridging across the structural elements of the wall construction.

EIF systems featuring waterproofing/air barrier assembly and a protective blanket of exterior insulation can provide energy savings and protection from moisture intrusion in a cost effective cladding, and can contribute up to 10 LEED points to the project.

### **Materials & Resources**

**Building Reuse:** Recoating an existing building or applying a new insulated wall cladding over the existing cladding are both strategies that can be used to repair, protect and provide an updated aesthetic design to the structure. In this category EIFS can contribute 1 or 2 points to the project.

**Construction Waste Management:** EIFS products are typically packaged in bags or pails that can be recycled through traditional waste management programs. EIFS can contribute 1 or 2 points in this category.

**Recycled Content:** Depending on the level of recycled material in the EIFS product, its use can contribute 1 or 2 points to the project.

### **Indoor Environmental Quality**

**Low-Emitting Materials:** Paints, coatings and primers with Volatile Organic Compound (VOC) content that is less than 50 g/L comply with this LEED requirement. Most EIFS products meet these criteria and so can contribute 1 LEED point to the project.

Thermal Comfort: Through the use of ICF or EIFS or other high-quality insulation material, the wall contractor can contribute 1 LEED point to the project.

### **A LEED Project from the Wall/Ceiling Perspective<sup>1</sup>**

A Hamilton, Ontario-based stucco contractor is part of the construction team striving to build the first mid-rise building in Canada to achieve a LEED Platinum certificate.

The nine-story, 208,000 square foot students residence, West Village Student Condominiums, at McMaster University in Hamilton, is celebrated for innovative technology and building methods that include a gray water cistern, solar panels, energy recovery ventilators in all 107 units and other green features.

While the contract is fairly conventional, it is a factor in the owner's objective to meet the lofty LEED Platinum status. The contract includes 12,000 square feet of EIFS—a system that scores high marks in energy efficiency.

The contract also calls for 60,000 square feet of stucco applied over top of the building's insulated concrete formwork, which makes up the first eight stories of the project.

EIFS will cover the steel framed ninth story and the terraces, and make up such trim work as soffits that consist of tubes of foam 10 by 10 inches by 8 feet long with wedge indentations for a rain drip system. For the EIFS wall, the contractor is applying a dual barrier moisture drainage system. It consists of a layer non-papered face gypsum sheathing applied to the steel frame. The sheathing is plastered with an air barrier and mesh inserted before the plaster dries hard at the joints.

The adhesive is vertically applied to the backside of the 2-inch (R-5.75) rigid foam insulation with a notched trowel to provide an air barrier. The idea is to not put a lot of pressure on the insulation when applying it so the grooves in the adhesive can act as a moisture drain. This air flow will prevent mold growth.

The exterior of the foam insulation is rasped before a base coat is applied. Fiberglass reinforced mesh is embedded in the coat. The acrylic finish coat is applied over top.

Another reason for selecting EIFS was that it blends well with the stucco finish on the ICF walls; it's hard to tell where the ICF stops and the EIFS starts.

EIFS has become a fairly standard finish these days, being well-suited to LEED buildings because of its high insulation value.

Another factor in the LEED Platinum target is the building's drywall. The drywall consists of 96 percent recycled content. That includes 4 percent post-consumer and 92 percent pre-consumer content. The fact that the drywall was made in Toronto adds a point toward the LEED Platinum goal.

The 208,000 square foot student residence is one of the largest, if not the largest, ICF high-rise in Canada. The standard construction method for the building was a structural steel skeleton with steel stud framing. While ICFs cost more, they incorporate a higher R-value and an air barrier.

To achieve a LEED Platinum is not easy for any developer. One of the key initiatives is the use of energy recovery ventilators in each suite. The ERVs run hot air from bathrooms and kitchens through a heat exchanger that preheats cool air coming into the building. The building also has a gray water cistern that collects water off the roof for toilet use. Solar panels are installed on the roof, but the developer was undecided at press time whether he would also install wind turbines for hydro-electric generation.

# LEED Criteria—Details

A green building, for the purposes of LEED, is defined by how well it meets the LEED criteria in its five main categories, with bonus points available in the sixth category, Innovation & Design Process.

- Site Selection
  
- Water Efficiency
  
- Energy Efficiency
  
- Material Reuse
  
- Indoor Environmental Quality

The following analysis of the rating system for New Construction (LEED-NC) provides a good overview of what, in the opinion of a majority of current architects and developers, constitutes a green building.

Note: For the complete *LEED for New Construction (LEED-NC) Rating System v2.2*, visit the USGBC site.<sup>2</sup>

## Site Selection

Select an appropriate site, and perform environmentally sustainable site development — *To reduce the environmental impact from the location of a building on a site.*

- Do not develop buildings, hardscape, roads or parking areas on portions of sites that meet any one of the following criteria:
  - Prime farmland.
  - Previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood.
  - Land that is specifically identified as habitat for any species on federal or state threatened or endangered lists.
  - Within 100 feet of any wetlands or within setback distances from wetlands prescribed in state or local regulations.
  - Previously undeveloped land that is within 50 feet of a water body, defined as seas, lakes, rivers, streams and tributaries that support or could support fish, recreation or industrial use.
  - Land that prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner.
- Channel development to urban areas with *existing* infrastructure (saving the cost and potential contamination of developing new infrastructure).
- Construct or renovate building on a previously developed site with pedestrian access between the building and as many as possible of the following services: bank, place of worship, convenience grocery, day care, cleaners, fire station, beauty, hardware, laundry, library, medical/dental, senior care facility, park, pharmacy, post office, restaurant, school, supermarket, theater, community center, fitness center and museum.
- Rehabilitate damaged sites (*Brownfield Sites*—where infrastructure is normally already in place) where development is complicated by environmental contamination, reducing pressure on undeveloped land.
- Locate the building near *Public Transportation* to reduce pollution and land development impacts from automobile use. Specifically:
  - Locate project within a half a mile of an existing, or planned and funded, commuter rail, light rail or subway station, or locate project within one-quarter mile of one or more stops for two or more public or campus bus lines usable by building occupants.
  - Provide for Alternative Transportation, including bicycle storage and changing rooms, in order to reduce pollution and land development impacts from automobile use. Specifically:

- Provide secure bicycle racks and/or storage (within 200 yards of a building entrance) for 5 percent of all building users (measured at peak periods) and provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5 percent of maximum full-time equivalent shift occupants.
- Provide for Alternative Transportation by making available for use by 3 percent of the maximum full time equivalent shift, low emitting and fuel efficient vehicles to reduce pollution and land development impacts from automobile use; or
- Provide preferred parking for low-emitting and fuel-efficient vehicles for 5 percent of the total vehicle parking capacity of the site; or
- Install alternative-fuel refueling stations for 3 percent of the total vehicle parking capacity of the site (liquid or gaseous fueling facilities must be separately ventilated or located outdoors).
  - For the purposes of this credit, low-emitting and fuel-efficient vehicles are defined as vehicles that are either classified as Zero Emission Vehicles (ZEV) by the California Air Resources Board or have achieved a minimum green score of 40 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide.
  - “Preferred parking” refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.
- Provide parking capacity for Alternative Transportation to reduce pollution and land development impacts from single occupancy vehicle use.
- Protect or restore habitat to conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.
- Maximize open space by providing a high ratio of open space to development footprint to promote biodiversity.
- Manage storm water to limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from storm water runoff, and eliminating contaminants.
- Manage storm water to limit disruption and pollution of natural water flows by managing storm water runoff.
- Manage non-roof Heat Island Effect to reduce thermal gradient differences between developed and undeveloped areas in order to minimize impact on microclimate and human and wildlife habitat, by providing any combination of the following strategies for 50 percent of the site hardscape (including roads, sidewalks, courtyards and parking lots):
  - Shade (within 5 years of occupancy);
  - Paving materials with a Solar Reflectance Index (SRI) of at least 29; and
  - Open grid pavement system; or
  - Place a minimum of 50 percent of parking spaces under cover (defined as under ground, under deck, under roof, or under a building). Any roof used to shade or cover parking must have an SRI of at least 29.
- Manage roof heat island effect to reduce thermal gradient differences between developed and undeveloped areas in order to minimize impact on microclimate and human and wildlife habitat by
  - using roofing materials having a Solar Reflectance Index (SRI) equal to or greater than the values in the table below for a minimum of 75 percent of the roof surface; or

Roof Type	Slope	SRI
Low-Sloped Roof	≤2:12	78
Steep-Sloped Roof	>2:12	29

- installing a vegetated roof for at least 50 percent of the roof area; or
- installing high albedo and vegetated roof surfaces.
- Reduce light pollution to minimize light trespass from the building and site:
  - Reduce sky-glow to increase night sky access;
  - Improve nighttime visibility through glare reduction; and
  - Reduce development impact on nocturnal environments.

## Water Efficiency

Use water resources efficiently — *In order to curtail water consumption and to lessen sewage flows.*

- Reduce landscaping water use by 50 percent.
  - 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.
  - Reductions shall be attributed to any combination of the following items:
    - Plant species factor – xeriscaping.
    - Irrigation efficiency.
    - Use of captured rainwater.
    - Use of recycled wastewater.
    - Use of water treated and conveyed by a public agency specifically for non-potable uses.
    - Eliminate the use of potable water in landscaping.
  - Use only captured rainwater, recycled wastewater, recycled graywater or water treated and conveyed by a public agency specifically for non-potable uses for irrigation; or
  - Install landscaping (xeriscaping) that does not require a permanent irrigation system. (Temporary irrigation systems used for plant establishment are allowed only if removed within one year of installation.)
- Implement innovative wastewater technologies to reduce generation of wastewater and potable water demand, while increasing the local aquifer recharge; specifically:
  - Reduce potable water use for building sewage conveyance by 50 percent through the use of water-conserving fixtures (water closets, urinals) or non-potable water (captured rainwater, recycled graywater and on-site or municipally treated waste water); or
  - Treat 50 percent of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.
- Reduce overall water use by 20 to 30 percent.
  - Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

## Energy Efficiency

Conserve energy by using renewable energy and protect atmospheric resources — *In order to curtail energy consumption and reduce ozone-harming emissions.*

- Optimize energy performance in order to achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.
- Develop and use on-site renewable energy.
  - Encourage and recognize increasing levels of on-site renewable energy self-supply in order to reduce environmental and economic impacts associated with fossil fuel energy use.
- Enhanced building commissioning by beginning the commissioning process early during the design process and execute additional activities after systems performance verification is completed.
- Implement enhanced refrigerant management in order to reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.
  - Do not use refrigerants; or
  - Select refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming.
- Install energy use measurement and verification to provide for the ongoing accountability of building energy consumption over time.
- Implement and use green power to encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.
  - Provide at least 35 percent of the building's electricity from renewable sources by engaging in at least a two-year renewable energy contract. Renewable sources are as defined by the Center for Resource Solutions (CRS) Green-e products certification requirements.

## Material Reuse

Reduce construction waste, conserve building materials, and use natural resources sensibly — *In order to lessen the strain on landfills, facilitate the reuse of building materials, and lessen the environmental impact of the construction and operation of the building.*

- When the project involves the reuse of an existing building, maintain 50 to 95 percent of existing walls in order 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.
- Divert 50 to 75 percent of the construction waste from disposal:
  - Divert construction, demolition and land-clearing debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.
  - Recycle and/or salvage at least 50 percent of non-hazardous construction and demolition debris.
- Reuse 5 to 10 percent of existing materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.
- Use 10 to 20 percent recycled materials content to increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.
- Use 10 to 20 percent regional materials in order 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.
  - Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10 percent (based on cost) of the total materials value.
- Use rapidly renewable materials to reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.
  - Use rapidly renewable building materials and products (made from plants that are typically harvested within a 10-year cycle or shorter) for 2.5 percent of the total value of all building materials and products used in the project, based on cost.
- Use Certified Wood to encourage environmentally responsible forest management.
  - Use a minimum of 50 percent of wood-based materials and products, certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components including structural framing and general dimensional framing, flooring, subflooring, wood doors, furnishings, finishes and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

## Indoor Environmental Quality

Improve indoor environmental quality — *In order to enhance indoor air quality in buildings, thus contributing to the comfort and well being of the occupants.*

Note: Such a building must be non-smoking, or have separate ventilation systems provided where smoking is allowed.

- Provide outdoor air delivery monitoring in order to provide capacity for ventilation system monitoring to help sustain occupant comfort and well-being.
- Provide increased ventilation in order to provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.
- Manage indoor air quality during construction in order to reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.
- Provide a pre-occupancy IAQ management plan in order to reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

- Provide low-emitting adhesives and sealants in order 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.
- Provide low-emitting paints and coatings in order 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.
- Provide low-emitting carpet systems in order 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.
- Provide low-emitting composite wood and agrifiber products in order 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.
- Control indoor chemical and pollutant sources in order to minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.
- Provide controllable lighting systems in order to provide a high level of lighting system control for retail employees to promote the productivity, comfort and well-being of building occupants.
- Provide controllable thermal comfort systems in order to provide a high level of thermal comfort system control for retail employees to promote the productivity, comfort and well-being of building occupants.
- Design and provide thermal comfort in order to provide a comfortable thermal environment that supports the productivity and well-being of building occupants.
- Verify thermal comfort in order to provide for the assessment of building thermal comfort over time.
- Provide Daylight and views for 75 to 90 percent of spaces in order to provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

### **Innovation and Design Process**

To provide design teams and projects the opportunity to be awarded LEED-NC points for exceptional performance above the requirements set by the LEED-NC Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED-NC Green Building Rating System, up to 5 additional points can be awarded for the following:

- Exceptional design performed by a LEED Accredited Professional in order to support and encourage the design integration required by a LEED-NC green building project and to streamline the application and certification process.

## PART II: THE BIG PICTURE

### Why Build Green?

The green building movement is more than an industry whim or fad; it is a movement that originated in, and grew from, a genuine necessity to avert a potential long-term disaster, while also—as luck and nature would have it—providing several important benefits, both human and economical.

The green building movement has four interested parties: the environment, the owner, the user and the contractor.

#### The Environment – Our Planet

When it comes to the man-made threat to the environment, it's mostly about carbon dioxide.

The amount of carbon dioxide in the atmosphere affects our planet's temperature. With current carbon dioxide concentrations of 383 parts per million (ppm), our planet is now roughly 0.8 degrees Celsius warmer than it was prior to the 1750 dawn of the fossil fuel era, an increase influenced in part by carbon dioxide levels.

Since then, enough coal, oil and natural gas have been burned to increase carbon dioxide concentrations in the atmosphere from 260 ppm to 383 ppm.

Environmental scientists are now warning that at approximately 450 ppm carbon dioxide in the atmosphere (resulting in a 2°C global warming above pre-industrial levels<sup>3</sup>) we will probably trigger a potentially irreversible glacial melt, and consequent sea level rise, both out of humanity's control.

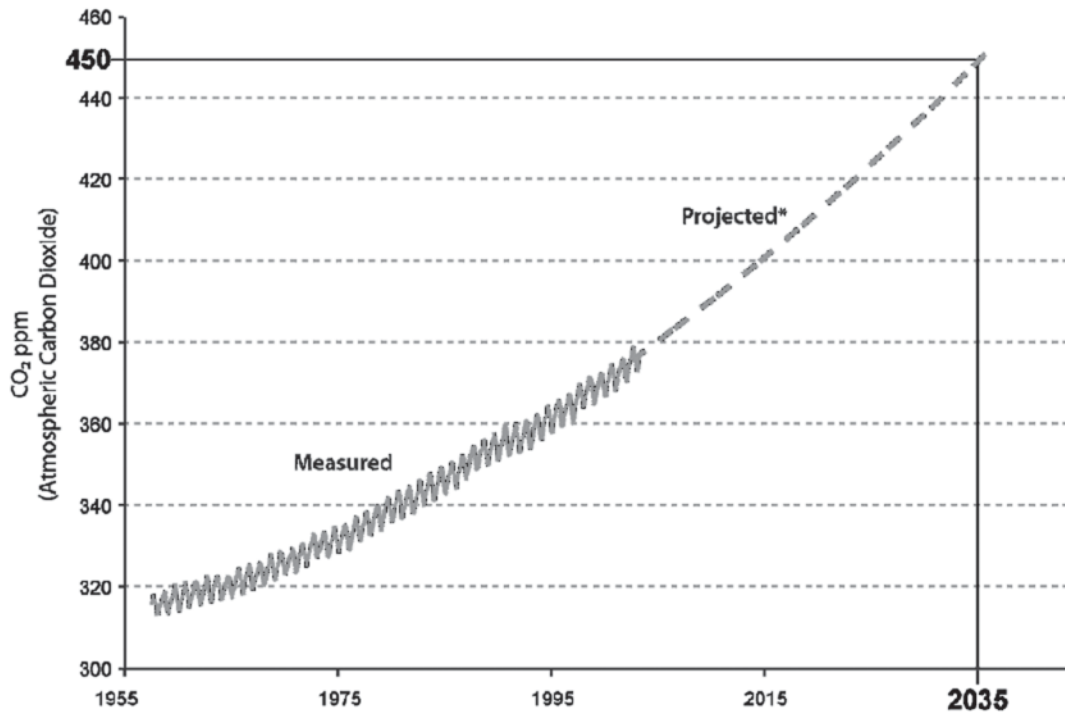
Currently, atmospheric concentrations of carbon dioxide are increasing at 2 ppm each year.<sup>4</sup> At this rate, we will reach 450 ppm in 2035 (*see Atmospheric CO<sub>2</sub> Trend chart on the next page*).

Another 10 years of unchecked growth of carbon dioxide-producing infrastructure and emissions will make it impractical, and most likely impossible, to avert this threshold.<sup>5</sup>

It has further been demonstrated that buildings are the single largest contributor to man-made global warming, and, as stated earlier, now account for approximately 48 percent of total annual U.S. energy consumption, and 43 percent of total annual U.S. greenhouse gas emissions.<sup>6</sup>

Bottom line: If we do not design and build greener buildings, we *will* hit the 450 part per million carbon dioxide concentration.

The graph below illustrates the current trend, and where it will hit 450 ppm, were we to continue “business as usual.”



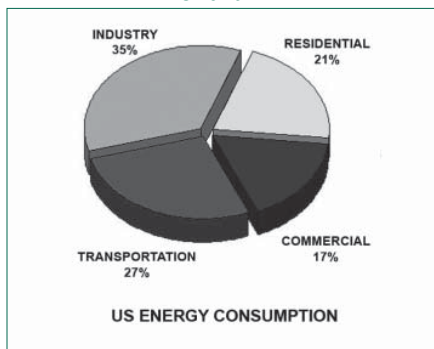
Source: Adapted from Scripps Institution of Oceanography and National Oceanic and Atmospheric Administration  
 1958-1974 Scripps Institution of Oceanography  
 1974-2006 National Oceanic and Atmospheric Administration  
 \*2006-2035 2030, Inc.: Projected trend based on Atmospheric CO<sub>2</sub> as measured at Mauna Loa Observatory

With the current public focus on transportation emissions (autos, truck, jets, etc.—see Chart A, below) many may be surprised to learn that buildings are in fact the single largest contributor to global warming. In order to clarify this misconception, Architecture 2030<sup>7</sup> has retabulated the existing energy consumption statistics to clearly show the building sector on its own.

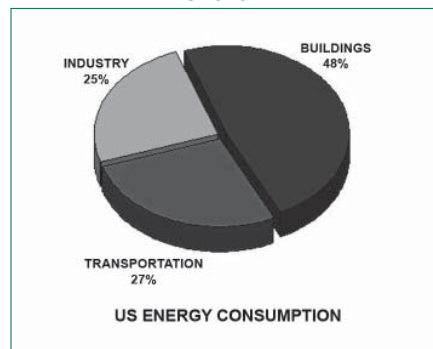
Previous energy consumption charts distributed the various elements of the building sector as being an integral part of other sectors, such as industry, commercial, residential and transportation. To determine the real energy impact of buildings, Architecture 2030 combined the building portions of these various elements into a single sector called “Buildings.”

Here, as shown in Chart B, data from the U.S. Energy Information Administration show that buildings are responsible for almost half (48 percent) of all energy consumption and GHG (Greenhouse Gas) emissions annually; globally, the percentage is even greater. Also, 76 percent of all power plant-generated electricity is used just to operate buildings (Chart C).

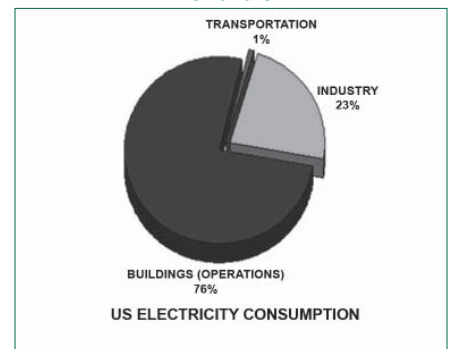
**Chart A**



**Chart B**



**Chart C**



Clearly, the building sector needs to take *immediate* action if we are to avoid contributing to a potentially hazardous climate change.

That is why we *will* build more and more green, and why the movement is indeed here to stay, ready or not.

And that is why, according to USGBC President Rick Fedrizzi, “12 federal agencies, 25 states, and more than a hundred municipalities, have adopted LEED as the benchmark for their own building portfolio.”

He goes on to underline the point: “Forty of the largest organizations in America are integrating LEED into all new and existing buildings in their portfolios, and are doing this in a cost efficient way, without sacrificing the integrity and the technical rigor of LEED.”

And more to the point when it comes to the contractor and the need for green training, Fedrizzi sums it up, “Forty-three thousand building professionals are now LEED accredited, with 50 more taking the exam every day.”

## Benefits

The environment (our planet) is not the only interested party to benefit from green building. It is a testament to the synergistic dynamics of building green that owners (economical), users (health and productivity), and, yes, contractors (opportunity), also stand to benefit greatly from the green movement.

### Owners: Economical

The owner’s economical benefits include the following:

- Potential Higher Occupancy Rates
  - With cleaner indoor air, and lighter working conditions, tenants are more likely to lease space in a green building.
- Higher Future Capital Value
  - As the green building movement spreads and becomes the norm, any high performance building constructed now will retain or increase its value.
- Reduced Risk of Obsolescence
  - Per the point above, if constructed as a high performance building today, it will still be of “current” design tomorrow, when sustainability becomes the norm.
- Less Need for Refurbishment in the Future
  - By designing the building for sustainability today, the need to refurbish the building in the future grows less or non-existent.
- Ability to Command Higher Lease Rates
  - By providing healthier working conditions, which in turn have shown to enhance employee productivity, a green building will be more attractive to tenants, and by the laws of supply and demand, such a building will command higher lease rates.
- Higher Demand from Institutional Investors
  - Lower operating costs, and the factors listed above, make a high-performance building a desirable target for institutional investors.
- Lower Operating Costs
  - By the nature of its design, the green building will require less energy (electricity, natural gas, etc.) and other utilities, such as water and sewage, storm drains, etc., to operate. The energy-saving features will, in the medium- to long-term, pay for themselves, after which all such savings drive directly to the bottom line as economic gain.
- Mandatory for Government Tenants
  - As discussed earlier in this paper, green building is already becoming the government norm. If a developer hopes to lease all or portions of the building to a government agency, chances are good (and increasing daily) that the building must be green.
- Lower Tenant Turnover

- Healthy employees are productive employees, leading in turn to happy employers (tenants), who plan to stay put.

### **Users: Health and Productivity**

- People in the United States spend about 90 percent of their time indoors.
- EPA studies indicate indoor levels of pollutants may be two to five times higher—and occasionally more than 100 times higher—than outdoor levels.
- An investigation of 20 studies with 30,000 subjects found significant associations between low ventilation levels and higher carbon dioxide concentrations—a common symptom in facilities with sick building syndrome.<sup>8</sup>

Human comfort and productivity go hand in hand. If you're too cold or too hot, some of the mental energy that should go to productive work goes to figuring out how to stay cool or warm.

When we talk of comfort, we talk about air temperature and velocity, radiant surface temperature and relative humidity. Or, as LEED defines comfort, “a thermally comfortable environment that supports the productivity and well-being of building occupants.”<sup>9</sup>

The LEED rating system takes into account that human comfort directly affects productivity and health in buildings, and therefore rewards buildings that maintain established comfort standards throughout the year.

Buildings with operable windows, for example, provide user control, which heightens perceived comfort. And, of course, the slowly moving air, let in through these windows, fresh from outdoors, will heighten the actual degree of comfort.

Eight different case studies have shown that natural ventilation and mixed-mode systems can pay for themselves in less than one year due to energy and productivity benefits.<sup>10</sup>

Natural light (daylighting) is another important aspect to user health and productivity: It has been shown that without adequate daylighting, people will not perform well and will not be healthy. This means that no building should be designed wider than 66 feet, side to side, or about 33 feet to a window from any workstations, which, is often a standard requirement in Europe, where people's health, as a rule, is placed before economic efficiency.

The benefits from daylighting are immediately apparent: People see better and feel better in natural light.

According to a report from Carnegie Mellon University analyzing daylighting research, “Eleven case studies have shown that innovative daylighting systems can pay for themselves in less than one year due to energy and productivity benefits.”<sup>11</sup>

The same study suggests, “The United States needs to meet European and Scandinavian standards that ensure that every worker is within 7 meters of a window wall, for views, light and air.”<sup>12</sup>

Improved health also leads to fewer sick days, which again leads to improved productivity. There are dozens of studies that link higher productivity to the number of the building's green features.

A key figure here is that 1 percent gain in worker productivity will offset the entire annual energy bill. Further, daylighting, views of the outdoors and healthy indoor air will likely lead to a productivity gain of 3 percent to 5 percent or more.

### **Contractors: Opportunity**

The contractor who recognizes the green movement as anything but a fad, and informs himself or herself

about the ins and outs of green design, or—better yet—who studies the subject and attains LEED accreditation, will soon find a new market where his or her skills and know-how will be in great demand.

### **Greenwash – A Case for Training**

One reliable indicator that the green movement is here to stay, and that industry is taking it seriously, is that companies that only a few years ago touted the effortless disposability of their products have now begun beating the recycling drum, and now tout how green these very same, now suddenly recyclable, products are.

And this “creative” advertising stands to reason: As awareness of global warming and other planetary ills filters down to the man in the street, *green* becomes more than a concept for change, it becomes a marketing opportunity; for given an economical choice, many consumers would now rather buy green.

The term “greenwash” (coined by combining the words “green” and “whitewash”) came into use around 1990, most notably as the title of an article in the 1991 March/April issue of **Mother Jones** magazine. It is used to refer to those practices where significantly more money or time is spent advertising being green (that is, operating with consideration for the environment), than is spent on environmentally sound practices.

Greenwashing is often accomplished by changing the name or label of a product—to give the feeling of nature, by, for example, putting an image of a forest on a bottle of harmful chemicals.

Environmentalists often use “greenwashing” to describe the actions of energy companies, which are traditionally the largest polluters.

A commonly cited example of greenwashing is the George W. Bush *Clear Skies Initiative*, which environmentalists have argued actually weakens air pollution laws.

### **The Six Sins of Greenwashing**

In December 2007, environmental marketing company TerraChoice gained national press coverage for releasing a study called “The Six Sins of Greenwashing,” which found that 99 percent of 1,018 common consumer products randomly surveyed for the study were guilty of greenwashing. According to the study, the six sins of greenwashing are these:<sup>15</sup>

- *Sin of No Proof*: Shampoos claiming to be “certified organic,” but with no verifiable certification. Four hundred fifty-four products and 26 percent of environmental claims committed this sin.
- *Sin of Vagueness*: Products claiming to be 100 percent natural when many naturally occurring substances are hazardous, like arsenic and formaldehyde. Seen in 196 products or 11 percent of environmental claims.
- *Sin of Irrelevance*: Products claiming to be CFC-free, even though CFCs were banned 20 years ago. This sin was seen in 78 products and 4 percent of environmental claims.
- *Sin of Fibbing*: Products falsely claiming to be certified by an internationally recognized environmental standard like EcoLogo, Energy Star or Green Seal. Found in 10 products or less than 1 percent of environmental claims.
- *Sin of Lesser of Two Evils*: Organic cigarettes or “environmentally friendly” pesticides. This occurred in 17 products or 1 percent of environmental claims.

The caution, of course, is that just because a manufacturer *says* their product is green, does not mean it *is* green.

And the best defense against questionable marketing practices, and false claims, is, of course, to learn, and *know*, what is green and what is not.

## Current State of Green Building Industry

### Shift in Building Codes

David Eisenberg, a national expert on green building aspects, and whose involvement with building codes and building codes officials over the past several years is his way to affect change, offers this view on building codes: “Building codes are based on a societal decision that it is important to protect the health and safety of people from the built environment. If, inadvertently, the codes are actually jeopardizing the health and safety of everyone on the planet by ignoring their impacts on resources and the environment, resulting in the destruction of the ecosystems that sustain us, we are obligated to re-invent the codes with that larger perspective.”<sup>14</sup>

At this writing, the change of building codes in a green direction is a sometimes slow affair. Green builders often have to file code appeals to modify or gain exemption from current, green-restrictive codes, until such time as the new building, now proven safe for the occupants and the environment alike, by its very success may affect a change in the code.

On the other hand, some municipalities are moving faster than others, as witnessed by a recent press release announcing that the city of Greensburg, Kan., is to become the first city in the United States to commit to LEED Platinum Green Building Certification.

Greensburg, devastated by a massive tornado on May 4, 2007, has focused its recovery on rebuilding as a model green community. On Dec. 17, 2007, the City Council adopted a resolution that all city buildings greater than 4,000 square feet will be certified LEED Platinum and required to reduce energy use by 42 percent over current building code requirements.

Following the council’s historic vote, City Administrator Steve Hewitt said, “I am very excited about being the first city in the United States to adopt this system for a town. I am ecstatic about this commitment, and what it is telling the world about our town’s character and where we are headed.”

As an indication of what is to come, local, state and national organizations and agencies were all instrumental in promoting green building best practices for Greensburg and in helping the community plan for future generations.

The green rebuilding effort has support from Kansas Governor Kathleen Sebelius and the U.S. Department of Agriculture. The U.S. Department of Energy’s National Renewable Energy Laboratory and its subcontractors are providing technical assistance on all aspects of energy use and building design in Greensburg.

Whereas existing municipal building codes may be notoriously slow in rolling over to give up the ghost, the above is a clear indication that that process may be speeding up—a lot, and sooner rather than later.

### Government Incentives/Legislation

While green building government incentives and legislation are moving targets right now, there is no doubt that governments—federal, state and local—are embracing green building both as a means of reducing cost and to achieve sustainability. Although some incentives, such as the Energy Policy Act signed into law by President Bush on Aug. 8, 2005, have now in large part expired, others are still in place, and more are added to the books with increasing frequency.

These examples illustrate the U.S. government’s current view:

- On June 19, 2006, the Department of Agriculture issued an agency-wide building policy that requires new or major renovation construction of covered facilities to achieve LEED Silver certification.<sup>15</sup>
- On Nov. 13, 2006, the Smithsonian Institution issued “Smithsonian Directive 422” in response to Executive Order 13123: Greening the Government through Efficient Energy Management. The directive articulates the Smithsonian’s goal to design, build and maintain facilities that are eligible for, and that obtain, LEED

certification. Initially, the Smithsonian requires all new buildings and renovation work to aim for a minimum of LEED certification. In addition, the Smithsonian will integrate the LEED checklist and guidelines into the planning, engineering, design, construction, deconstruction and maintenance of Smithsonian facilities.<sup>16</sup>

- The General Services Administration requires that all building projects meet the LEED Certified level, with a target of LEED Silver. To support this policy, the GSA signed a Memorandum of Understanding with the Department of the Interior and USGBC supporting the use of LEED on all new partnered (GSA-DOI) projects. The GSA strongly encourages projects to apply for certification. The department has 24 projects registered, including federal courthouses, laboratories, border stations and office buildings. *The GSA is the nation's largest landlord, managing space in more than 8,000 owned and leased buildings for more than one million federal employees. The GSA was the USGBC's first federal member and supported the development of LEED for Commercial Interiors.*<sup>17</sup>
- New construction and major renovations of NASA facilities projects planned for FY 2006 and beyond are required to meet LEED Silver certification, and to strive for LEED Gold. FY 2004 and FY 2005 projects will strive to meet LEED Silver certification. All other building projects will strive to follow the LEED rating system as much as possible. The LEED goal for NASA facilities projects will be reviewed, renewed or changed every three years.<sup>18</sup>
- California Governor Schwarzenegger signed Executive Order #S-20-04 on Dec. 14, 2004, requiring the design, construction and operation of all new and renovated state-owned facilities to be LEED Silver. The state is pursuing LEED for New Construction for its projects at the Silver certification level, and LEED for Existing Buildings certification for existing facilities.<sup>19</sup>
- On Aug. 28, 2007, the Dormitory Authority, New York State's building and construction agency, announced its commitment to register all new construction and major renovations projects with USGBC beginning in 2008, striving for LEED Silver.<sup>20</sup>
- Arkansas Governor Mike Huckabee signed Act 1770 in July 2005 encouraging all state agencies to use green design strategies, including LEED. The bill also creates a "Legislative Task Force on Sustainable Building Design & Practices," which is to meet and continue to review, discuss and advise on issues related to sustainable building design.<sup>21</sup>
- On Feb. 11, 2005, Arizona Governor Janet Napolitano signed Executive Order #2005-05 requiring all state funded buildings to achieve LEED Silver certification. The Executive Order also requires newly constructed state-funded buildings to incorporate renewable energy. *This makes the state the first governmental entity in Arizona to adopt a mandatory green building standard.*<sup>22</sup>
- On April 16, 2007, Colorado Governor Bill Ritter signed Senate Bill 51 into law requiring any new or renovated building whose total project cost includes 25 percent or more in state funds to be designed and built to a high performance green building standard. The new law requires the state architect to select an independent third-party certification program, such as LEED. The project must achieve the highest level performance certification possible, which is determined by calculating whether the increased initial costs can be recouped from decreased operational costs within 15 years.<sup>23</sup>
- On July 15, 2005, Colorado Governor Owens signed Executive Order #D005 05 adopting LEED for Existing Buildings and incorporating LEED for New Construction practices for all state buildings. The order also creates a Colorado Greening Government Coordinating Council to develop and implement conservation policies.<sup>24</sup>
- On April 18, 2007, Massachusetts Governor Deval Patrick signed Executive Order 484, "Leading by Example – Clean Energy and Efficient Buildings." The order instructed all agencies involved in the construction and major renovation projects of more than 20,000 square feet to meet LEED certification as well as energy performance 20 percent better than the Massachusetts Energy Code, independent third-party commissioning and outdoor water reduction requirements.<sup>25</sup>
- On June 5, 2006, the Baltimore County Council passed bill # 85-06 that gives a county property tax credit to any commercial building that achieves LEED-NC Silver certification. The duration of the tax credit is for 10 consecutive years.
- On Sept. 4, 2007, the Costa Mesa City Council approved a resolution that established a green building incentive program for private development, effective Sept. 5, 2007, through June 30, 2008. The program encourages green building practices through various incentives, including priority permitting and fee waivers for all green installations, and fee reductions to cover the cost of LEED certification.

These and other federal, state and local incentive programs and legislation clearly illustrate where the U.S. government stands when it comes to green building.

And to underscore the U.S. government's commitment to green building, President Bush, on Dec. 18, 2007, signed into law the Energy Independence and Security Act of 2007, which, among other things, establishes the Office of High-Performance Green Buildings in the U.S. General Services Administration. This office will promote green building technology implementation in federal buildings.<sup>26</sup>

Lastly, here are some additional examples of state and local green buildings and renewable energy incentives<sup>27</sup>:

Type of Incentive	State/City
Grants and loans for renewable energy system	Alabama, Connecticut, New York, Massachusetts, Ohio and Minnesota
Sales tax relief for solar units	Arizona, Florida, Ohio, Idaho, Iowa and Maryland
Priority processing of building permits	Los Angeles and Chicago
Income tax credit for green buildings	New York and Oregon
Income tax credit for solar energy systems	Arizona, New York, Utah, New Mexico and Oregon
Density bonuses for LEED projects	Seattle and Arlington, VA
Utility subsidies for photovoltaic systems	California, Florida, Hawaii, Texas and Arizona

### Green Growth

According to real estate and architectural experts, current growth in the green building market is not a short-lived trend, but the start of a permanent shift in how the world uses energy and natural resources within the spaces we live and work.<sup>28</sup>

The annual market for green building in products and services is \$7 billion, representing 37 percent growth over the prior year (based on 2004 figures).<sup>29</sup>

By the end of 2006, LEED-NC had captured between 4 and 5 percent of the total new building market, with nearly 4,000 registered projects representing more than 477 million square feet of new and renovated space.

At the beginning of 2007, more than 100 new projects were registered for LEED-NC certification each month.

### Schools

According to USGBC, the number of U.S. schools built or designed under strict environmental guidelines has increased in the past seven years.

In 2007, 60 schools nationwide have obtained LEED certification, and more than 360 others are applying for certification. In 2000, only four were in the pipeline.<sup>30</sup>

### Developers and Investors

According to a CSRwire report of June 18, 2007, the real estate industry is quietly transforming by embracing sustainable business practices and green technologies.

In an analysis of the industry, *Progressive Investor* reports that 41 percent of the 300 U.S. real estate investment trusts are now actively pursuing energy efficiency and green building upgrades, and another 27 percent plan to do so.

*Progressive Investor* identified the following drivers for the trend: Developers and building owners are feeling the crunch of high energy and water costs, which, according to the Building Owners and Managers Associa-

tion, constitute 28 percent of operating costs for downtown office properties, and 30.4 percent for suburban properties. They see the quick payback and cost savings energy efficiency and other green building upgrades offer.

*Building green no longer costs more.* Turner Construction's 2005 Green Building Market Barometer shows it costs a mere 0.8 percent more for basic LEED certification, easily recouped through lower operating costs.

*Increasingly, clients and tenants show a preference for green buildings, which have been proven to increase productivity, retain employees and lower absenteeism.* The combination of reduced operating costs and more satisfied occupants translates into 3.5 percent higher occupancy rates, 3 percent higher rents and a 7.5 percent increase in building value, says the McGraw-Hill **2006 SmartMarket Report**.

Corporations with sustainable business policies are building highly visible green headquarters including Bank of America, Toyota, Goldman Sachs, Hearst, IBM, JPMorgan Chase and Herman Miller. The Freedom Tower, which replaces the World Trade Center in New York City, will be LEED-certified.

Green building is increasingly being mandated. Nine states and more than 40 municipalities have passed legislation mandating LEED-certified buildings.

Real estate firms see the writing on the wall and are nervous about holding a portfolio of obsolete, inefficient buildings.

"The benefits will make green ubiquitous over the next two years," says George Caraghiaur, vice president for energy services at Simon Property Group (NYSE: SPG), owner of 300 shopping malls. "We're happy to have caught this trend at the beginning."

Six percent of commercial developments are LEED-certified, projected to jump to 10 percent of the market by 2010. Buildings produce 21 percent of the world's carbon dioxide emissions (38 percent in the United States), more than transportation or manufacturing. About 15 million new buildings will be added by 2015. Commercial buildings, the largest polluter, are expected to grow emissions 1.8 percent a year through 2030.

A recent United Nations study concluded that green buildings can do more to fight global warming than all curbs on greenhouse gases agreed under the Kyoto Protocol, while saving billions of dollars.

Progressive firms are increasingly focused on urban infill buildings rather than suburban greenfields and are incorporating advanced energy efficiency measures, as well as recycled building materials, gray water systems, rainwater capture and green roofs, the report says.<sup>31</sup>

### **Opportunities**

As Rick Fedrizzi, the president of the U.S. Green Building Council, put it: "Green collar jobs are the kinds of jobs that can bring prosperity to American communities that today are languishing because of flat wages and economic stagnation. Think about disadvantaged youth, or returning servicemen and women, those whose outsourced manufacturing jobs left them economically stranded. With more than 100 million individuals employed in the building and construction industry today, just think about what we could accomplish if we all embraced that vision. Let's also not forget that green affordable housing must be a part of this equation."<sup>32</sup>

# APPENDIX A

## The Acronyms, The Terms, The Concepts

When new subjects or technical areas develop, they soon gather to them a host of terms, concepts and acronyms to communicate the various aspects of the subject. Green building is no exception and it is necessary to know these terms in order to think with the subject.

Here are the major ones:

**Biodiversity** Biodiversity, or *Biological Diversity*, is the sum total of all the different species of animals, plants, fungi and microbial organisms living on Earth today, and the variety of habitats in which they live.

Some scientists estimate that upward of 10 million—and some even suggest more than 100 million—different species inhabit the Earth, each adapted to its unique niche in the environment.

Biodiversity is often used as a measure of the health of biological systems.

**Brownfield** Urban areas of former (and now abandoned) manufacturing or warehousing sites with varying degrees of existing contamination, from none to severe. They typically have valuable infrastructure—such as roads, water supply, sewage and storage drains—in place, which will cut down considerably on development costs.

The restoration of brownfields is a major target of green building.

**Building Envelope** The building envelope is what separates the interior and exterior environments of a building and includes the foundation, roof, walls, doors and windows. The dimensions, performance and compatibility of materials, fabrication process and details, their connections and interactions, are the main factors that determine the effectiveness and durability of the building enclosure system. Building Envelope design includes four major performance objectives:

- Structural integrity
- Moisture control
- Temperature control
- Control of air pressure boundaries

**Carbon Dioxide** A (greenhouse) gas naturally produced by animals during respiration. It is also generated as a byproduct of the combustion of fossil fuels or vegetable matter.

Carbon dioxide is called a greenhouse gas because it traps solar heat within the atmosphere. Having the effect of a greenhouse's glass roof, this carbon dioxide prevents solar heat from radiating back out into space. The trapped atmosphere is then absorbed by the earth's surface, slowly contributing to the planetary cycles majorly responsible for the raising of water, land and vegetation temperatures.

The reduction of carbon dioxide emission is one of the major goals of green building.

**Carbon Footprint** A general measure of the impact of human activities on the environment in terms of greenhouse gases produced, usually measured in units of carbon dioxide.

**Carbon Neutral** A statement that at the end of the day you (or your organization) has removed as much carbon dioxide from the atmosphere as you have emitted into it, normally by sponsoring the planting of trees, which will consume carbon dioxide and emit oxygen in its place.

**Certification** A process that provides an acknowledged third-party verification of achievement in the green arena. In our industry it has almost become equivalent with LEED certification, meaning the project is verified as having attained a certain qualifying amount of LEED points.

**Certified Wood** Wood products certified by a trustworthy third party (such as the Forest Stewardship Council—FSC) as being made from sustainable harvested lumber.

LEED-certified projects require 50 percent use of certified wood products for all permanent wood-based material, such as flooring, dimensional lumber, roof decks and paneling.

**Charrette** The term “charrette” evolved from a pre-1900 exercise at the Ecole des Beaux Arts in France, where architectural students were given a design problem to solve within an allotted time. When that time was up, the students would rush their drawings from the studio to the école in a cart called a charrette. Students often jumped in the cart to finish drawings on the way. The term evolved to refer to the intense design exercise itself.

Today, the charrette refers to a creative process akin to visual brainstorming used by design professionals to develop solutions to a design problem within a limited time frame.

**Comfort = Productivity** Healthy and comfortable occupants (employees) are more productive than unhealthy, uncomfortable ones. This is a major selling point when it comes to convincing the corporate bottom-liner that indoor air quality, temperature, available daylight, outside view and other aspects of green design will amply pay for itself in the short to medium term by productivity gains alone.

**Cool Roofs** The annual U.S. air conditioning bill runs roughly \$40 billion—more than 15 percent of all energy consumed annually. Dark or black roofs will drive the cooling bill up dramatically, whereas an energy-efficient roofing system, also called cool roofs, can reduce the summer roof temperature by as much as 100 degrees Fahrenheit, and so greatly reduce the building’s air conditioning needs.

LEED awards one credit point for a roof that covers at least 75 percent of the surface with efficiently reflective material (having a Solar Reflectance Index rating of at least 78 for a low-sloped roof and 29 for a steep-sloped roof).

**Daylighting** Simply stated, this means making daylight available to the occupants of a building. Many studies have concluded that employees without adequate natural daylighting do not perform as well, and are not as healthy, as those who do.

The design implication of this is a plan where no employee is farther than 33 feet from a window, making a daylight green building no wider than 66 feet. This is a standard requirement in many countries in Europe, where, as a rule, the health of people is rated higher than economic efficiency.

**Ecological Footprint** The ecological footprint question wonders: How many planet Earths would it take to sustain current human activity, assuming today’s levels of consumption, pollution and resource depletion? The answer, in 2003, was that if every man, woman and child were to maintain their existing level of consumption, pollution and resource depletion, we would need 1.25 Earths, right now.

More to the point, however: Were we to assume instead that every man, woman and child on our planet were to consume as much as we do here in the United States (in other words, had our *ecological footprint*) the much darker answer varies from a low (and most likely conservative) five Earths to the more probable 11 Earths.

We have only one.

**FSC** Forest Stewardship Council. The most active group to certify that lumber has been harvested in a sustainable manner.

**Global Warming** The current warming of the planet influenced in part by human activity.

**Greenhouse Effect** A warming of the Earth caused in part by the capacity of certain gases in the atmosphere—such as carbon dioxide—to trap heat emitted from Earth’s surface, so creating an insulating blanket. Without this insulation the Earth would be too cold for most living things to survive.

It has been posited recently that human activities may be influencing the normal process of warming and cooling that create the warm periods and ice ages in Earth’s existence (as a result of its position in relation to the sun and its activities), with potentially dangerous consequences (global warming), by trapping too much heat.

**Green Power** Earth provides three types of natural resources:

- *Perpetual*, those that are “virtually inexhaustible on a human scale,”<sup>33</sup> and include wind, solar and tidal.
- *Renewable*, those that can be replenished in a relatively short time, such as trees, and
- *Non-Renewable*, those that require millions or billions of years to replenish, such as oil and coal (although U.S. companies are now perfecting techniques for rapidly making oil out of algae—one of the sources of oil).

Green power normally falls within the *perpetual* category, and includes wind and solar power.

**Greenwash** A word coined from “green” and “whitewash,” and that describes the act of misleading consumers regarding the environmental practices of a company, or the environmental benefits of a product or service.

**Hardscape** Open areas, such as plazas and walkways, serving a landscaping function but normally consisting of paved surfaces.

**High-Performance Building** A term roughly equivalent to green building or sustainable building, but that flips the coin to stress the increase of the positive rather than the decrease of the negative. A high-performance building is rated and promoted in terms of energy efficiency, water conservation efficiency, indoor air quality, availability of natural light and recycling. This term and concept is often an easier sell to the corporate world than “green,” which still smacks a little of tree-hugging.

**LCA** Life Cycle Assessment. This holistic evaluation of an activity or a product takes into account such environmental factors as water pollution, air pollution, global warming, environmental degradation, ozone depletion, habitat destruction and human health.

The LCA of a product would involve the detailed measurement and assessment of its *ecological footprint* all the way from planning and design, through acquisition of raw materials needed for manufacture, transportation of raw materials, manufacture, waste products during manufacture, distribution, packing material, emissions during use, to recycling or reuse at end of the product’s useful life. This would add up to the ecological life cycle impact of the product, which is its *actual* cost to the planet.

**LEED: Leadership in Energy and Environmental Design** The U.S. Green Building Council’s now widely accepted yardstick of what constitutes a green, or high-performance, building.

**Light Pollution** Excessive evening and night light generated by a brightly lit neighborhood.

**Locally Sourced** As a rule, an item is considered locally sourced if it is obtained from a source within 500 miles of the building site.

**Mixed-Mode Systems** Mixed-mode refers to combining natural ventilation with air conditioning in the same building (for example, operable windows in an air-conditioned office space). Mixed-mode strategies have the potential to offer “the best of all worlds” by using natural ventilation to provide occupant control, high ventilation rates and reduced HVAC energy, while using air-conditioning to maintain comfort when necessary during temperature extremes.

**Passive Solar Design** The term refers to buildings designed to incorporate sunlight and natural ventilation into a building in order to eliminate the need for mechanical systems, and includes buildings with a long east-west axis to optimize utilization of sunlight.

**Permeable Pavement** Parking lot pavement material that allows water to filter through and into the ground rather than running off into storm drains to pollute lakes and rivers with runoff oil and grease.

**Photovoltaics** Designating electrical systems that convert direct sunlight into electricity. Solar cells are often made from semiconductor-grade silicon and are normally 5 to 12 percent efficient in converting sunlight energy to electricity.

Recently, some firms have announced significant improvements in this sunlight-to-electricity conversion ratio and claim to have reached a 20 to 22 percent efficiency.

**Rapidly Renewable Material** These are materials that can be planted, grown and harvested in less than 10 years. Examples include bamboo and cork.

**SFI** Sustainable Forestry Initiative

**SRI** Solar Reflectance Index. A composite index used by the U.S. Green Building Council to estimate how hot a surface will become when exposed to full sun. The temperature of a surface depends on the surface's reflectance and emission, as well as solar radiation. The SRI is used to determine the effect of this reflectance and emission on the surface temperature, and varies from 100 for a standard white surface to zero for a standard black surface.

**Sustainable Design** "A design philosophy that seeks to maximize the quality of the built environment, while minimizing or eliminating negative impact to the natural environment."<sup>34</sup> This definition complements the often quoted statement made by Gro Harlem Brundtland at the 1987 World Commission on the Environment and Development, that sustainable development aims to "meet the needs of the present without compromising the ability of future generations to meet their own needs."

**TOD (Transit Oriented Development)** This is a commercial or residential development that is located and designed to maximize access to public transportation in order to encourage transit ridership, and so cut down on automobile usage and pollution.

**USGBC** United States Green Building Council

**Urban Heat-Island Effect** The thermal phenomenon of cities being noticeably hotter, typically 5 degrees to 7 degrees, than their surrounding countryside.

**VOC** Volatile Organic Compounds. Carbon-based chemicals that emit vapors at normal room temperatures. Products that emit VOCs include paint, lacquers, adhesives and sealants.

**Xeriscaping** "Xeri-" comes from Greek meaning "dry," while "scaping" is from "landscaping." The term has come to mean "to landscape in such a way that no additional water is needed to irrigate the result." The xeriscaping approach is to use only regionally appropriate plants, which—already being adapted to the local climate cycles—have no additional water needs.

# APPENDIX B

## Resources

### LEED Courses<sup>35</sup>

Possibly the best, and certainly most acknowledged, green training today—and the best way to ascertain whether a product is green or not—is the training courses (both online and live) made available by the USGBC.

Whether you are new to green building, working on a registered project, becoming a LEED Accredited Professional, or seeking industry-specific information on green building, chances are the USGBC offers a relevant course.

### Workshops & Online Courses

USGBC provides workshops and online courses to help increase knowledge, expand practice, and maximize success in the green building industry.

#### *Private LEED Workshops*

Employers can host in-house LEED workshops for employees. Private workshops are an exclusive benefit of USGBC membership and are available for groups of 20 or more. Choose from several full- or half-day sessions.

Contact USGBC for more information or to schedule a workshop.

#### *Course Descriptions*

##### ■ LEED Technical Reviews

LEED Technical Reviews go beyond the basics, walking you through the LEED Rating Systems with examples, case studies and exercises on how to apply the rating systems.

##### ■ 100 Level: Awareness

100-level courses are designed for individuals who have limited or no prior knowledge of green building principles.

##### ■ 200 Level: Understanding

200-level courses are designed for individuals familiar with the LEED Rating System and green building principles.

##### ■ 300 Level: Application & Implementation

300-level courses are designed for individuals who are implementing and applying the LEED Rating System.

### LEED Accreditation<sup>36</sup>

What is LEED Professional Accreditation?

LEED Professional Accreditation distinguishes building professionals with the knowledge and skills to successfully steward the LEED certification process. LEED Accredited Professionals (LEED APs) have demonstrated a thorough understanding of green building practices and principles and the LEED Rating System. More than 43,000 people have become LEED APs since USGBC launched the Professional Accreditation program in 2001.

The LEED AP credential represents the individual's knowledge of the LEED Rating System and its application in practice. LEED APs facilitate the integrated design process and streamline LEED certification.

#### *Benefits for LEED APs*

■ Valuable and marketable credential for employers, prospective employers or clients.

■ Listing on USGBC Web site directory of LEED APs.

■ LEED AP certificate Recognition for involvement in LEED projects.

### *Benefits for Employers*

- Eligibility for projects on which owners are mandating the participation of a LEED AP.
- Strengthened qualifications when responding to RFPs requiring LEED APs.
- Encourages employees to continue increasing their knowledge and understanding of green building and LEED.

### *Benefits for the Building Industry*

Encourages and promotes a higher understanding of LEED and supports USGBC's mission of transforming the built environment.

### *Candidate Handbook*

In addition to the information about exam preparation and scheduling provided on its site, the USGBC offers a handbook with important information about registration, scheduling, exam preparation, test-taking tips, test-day procedures and more.<sup>37</sup>

We believe that it would serve AWCI members well to take advantage of USGBC courses and eventually, and sooner rather than later, become an LEED Accredited Professionals.

### **Green Building Material Resources**

#### *American Recycling Market—Annual*

Directory/Reference Manual

Recycling Data Management Corporation (RDMC)

P.O. Box 577

Ogdensburg, NY 13669

(800) 267-0707

[www.recyclingdata.com](http://www.recyclingdata.com)

The directory contains more than 1,000 pages with more than 20,000 cross-referenced companies and agencies that deal in recycled materials.

#### *Austin Energy Green Building Program*

City of Austin

P.O. Box 1088

Austin, TX 78767

(512) 974-2000

[www.ci.austin.tx.us/greenbuilder](http://www.ci.austin.tx.us/greenbuilder)

The Web site includes a Sustainable Building Sourcebook that explains how and why building green makes sense.

#### *Bay Area Build It Green*

Alameda County Waste Management

Authority and Recycling Board (ACWMA)

777 Davis Street, Ste 100

San Leandro, CA 94577

(510) 614-1699

[www.stopwaste.org](http://www.stopwaste.org)

This site provides a searchable database of green products, local suppliers and service providers; also a green building resource guide.

#### *Buy Recycled Business Alliance*

National Recycling Coalition, Inc.

1325 G Street NW, Ste 1025

Washington, DC 20005

(202) 347-0450

[www.nrc-recycle.org](http://www.nrc-recycle.org)

This is a non-profit organization aiming to improve recycling, source reduction, composting and reuse.

#### *Buyer's Guide to Recycled Product*

METRO

600 NE Grand Avenue

Portland, OR 97232

(503) 797-1700

[www.metro-region.org](http://www.metro-region.org)

This Web site offers a searchable database of recycled-content building materials:

#### *Construction Waste Management Database*

Whole Building Design Guide

National Institute of Building Sciences (NIBS)

1090 Vermont Avenue NW, Ste 700

Washington, DC 20005

(202) 289-7800

[www.wbdg.org/ccbref/cwm.php](http://www.wbdg.org/ccbref/cwm.php)

A database of companies that haul, collect and process recyclable debris from construction sites.

#### *ECO Design Company*

1330 Rufina Circle

Santa Fe, NM 87507

(800) 621-2591

Manufacturer, distributor and catalog retailer of Bio-shield paints and finishes

*Energy Efficient Building Products*

Shelter Supply, Inc.  
151 East Cliff Road, Ste 30  
Burnsville, MN 55337  
(877) 207-7043

[www.sheltersupply.com](http://www.sheltersupply.com)

This site provides a list of products and technologies for energy-efficient, healthy home construction.

*Environment Building Products Guide*

SustainableABC.com  
P.O. Box 30085  
Santa Barbara, CA 93130  
(805) 898-0079

[www.sustainableabc.com](http://www.sustainableabc.com)

This site lists green and healthy building materials, including suppliers of such materials.

*Environmentally Preferable  
Purchase Database*

U.S. Environmental Protection Agency  
1200 Pennsylvania Avenue NW  
Mail Code 7409-M  
Washington, DC 20460

<http://yosemite1.epa.gov/eppstand2.nsf>

This is a searchable database that includes environmental information about more than 600 products and services.

*Forest Certification Resource Center*

Metafore  
The Jean Vollum Natural Capital Center  
721 NW Ninth Avenue, Ste 300  
Portland, OR 97209  
(503) 224-2205

[www.metafore.org](http://www.metafore.org)

This site lists search tools for certified forest products, certified businesses and approved certifiers.

*Green Book Product and Resource Guide*

Environmental Design and Construction  
2401 W. Big Beaver Road, Ste 700  
Troy, MI 48084  
(248) 244-1280

[www.edcmag.com/files/html/edc\\_buyers\\_guide](http://www.edcmag.com/files/html/edc_buyers_guide)

This is a searchable database of products and resources listed by company name, city, state or product category.

*Green Building Materials Fact Sheets*

Environmental Works  
Community Design Center  
402 Fifteenth Ave E  
Seattle, WA 98112

(206) 329-8300

[www.eworks.org](http://www.eworks.org)

These fact sheets describe environmentally friendly materials containing recycled content and that are produced in a non-polluting manner.

*Green Building Materials Resource Guide*

City of San Francisco  
Environment Department  
11 Grove Street  
San Francisco, CA 94102  
(415) 355-3700

[www.sfenvironment.org](http://www.sfenvironment.org)

This site lists green materials and services available in the Bay Area. It also offers fact sheets on various building materials.

*Green Building Materials Resource List*

Contra Costa County Green Building Program  
651 Pine Street, 4th Floor—North Wing  
Martinez, CA 94553  
(925) 335-1290

[www.ccrecycle.org/greenbuilding](http://www.ccrecycle.org/greenbuilding)

A site listing green products available from local suppliers.

*Green Building Resource Guide (1997)*

John Hermannsson, AIA, Architect  
The Architectural Machine  
P.O. Box 3808  
Redwood City, CA 94064

[www.greenguide.com](http://www.greenguide.com)

This is a database listing over 600 green building materials from the viewpoint of usefulness to the builder.

*Green Clips*

Sustainable Design Resources  
3168 Washington Street, Ste 6  
San Francisco, CA 94115  
(415) 928-7941

[www.greenclips.com](http://www.greenclips.com)

This is a biweekly electronic summary of sustainable building news, and related government and business issues.

*GreenSpec Product Directory*

Building Green, Inc.  
122 Bridge Street, Ste 30  
Brattleboro, VT 05301  
(802) 257-7300  
www.buildinggreen.com

This site lists more than 1,800 environmentally preferable building products with descriptions, manufacturer information, and links to additional resources.

*Guide to Resource-Efficient Building Elements (GREBE)*

Center for Resourceful Building Technology  
127 North Higgins, Ste 201  
Missoula, MT 59802  
www.crbt.org

This is a directory of green building products, listing products and manufacturers in a searchable database.

*Habitat for Humanity International*

Construction and Environmental  
Resources Department  
121 Habitat Street  
Americus, GA 31709  
(229) 924-6935  
www.habitat.org/env

This Web site provides both information and training on a variety of building methods and materials.

*Materials Database*

Green Resource Center  
Center Street  
Berkeley, CA 93939  
(510) 614-1699  
www.greenresourcecenter.org

This searchable database lists green products, as well as their local suppliers.

*Minnesota Building Materials Database*

Center for Sustainable Building Research  
College of Architecture and Landscape Architecture  
University of Minnesota  
1425 University Avenue SE  
Minneapolis, MN 55455  
(612) 624-7327  
www.buildingmaterials.umn.edu

This is a searchable database of green materials, products, systems, and services for commercial and residential construction in Minnesota.

*Minnesota Recycled Products Guide*

Recycling Association of Minnesota  
P.O. Box 14497  
St. Paul, MN 55114  
(615) 641-4560  
www.recycleminnesota.org

This site lists recycled-content products made by Minnesota companies. It also includes buy-recycled tips and other resources.

*Minnesota Recycled Products Directory*

Minnesota Office of Environmental Assistance  
520 Lafayette Road N, Floor 2  
St. Paul, MN 55155  
(800) 657-3843

www.moea.state.mn.us/rpdir/index.cfm  
This is another searchable database of recycled-content products made by Minnesota company.

*Oikos Green Building Source*

Iris Communications, Inc.  
P.O. Box 6498  
Bend, OR 97708  
(800) 346-0104  
www.oikos.com; www.irisinc.com

These Web sites list green products organized according to CSI 1995 MasterFormat.

*Real Goods Catalog*

Renewable Energy Catalog  
Real Goods  
360 Interlocken Boulevard, Ste 300  
Broomfield, CO 80021  
(800) 994-4243  
www.realgoods.com

This site lists energy-efficient technologies and products for the home, power generation and more.

*RecyclingMarkets.net*

Recycling Data Management Corporation (RDMC)  
P.O. Box 577  
Ogdensburg, NY 13669  
(800) 267-0707  
www.recyclingmarkets.net

This online database lists more than 5,000 certified listings of manufacturers and distributors of recycled products.

*Sustainable Design Resource Guide*

American Institute of Architects, Denver Chapter  
www.aiacolorado.org/SDRG  
A green products and materials list, arranged according to the CSI 1995 Master Format.

*The Environmentally Preferable  
Purchasing Guide*

Solid Waste Management Coordinating Board (SWMCB)  
www.swmcb.org/EPPG  
This site lists environmentally preferable products in  
over 30 product areas.

*The Metro Detroit Green Building  
Resource Directory*

WARM Training Center  
4835 Michigan Avenue  
Detroit, MI 48210  
(313) 894-1030  
www.warmtraining.org  
This is a searchable database listing green building  
materials available in the Detroit area.

*WoodWise Consumer Guide*

Green Page Online  
Co-op America  
1612 K Street NW, Ste 600  
Washington, DC 20006  
(800) 584-7336  
www.woodwise.org ; www.greenpages.org  
These sites contain forest-saving ideas, tools, referrals  
and a resource directory of forest-friendly wood and  
paper products.

**Online Information Resources**

*USGBC Resources*

Research and Publications: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=77>

This URL contains research and publications about green building, LEED, and more.

Green Building Links: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=76>

This URL contains links to Internet resource sites collected by USGBC staff and members to facilitate green  
building research. Although formidable, this list is not exhaustive and will remain a work in progress.

*Greenbuilder Resources*

<http://directory.greenbuilder.com> — Green Building Professionals Directory

<http://www.greenbuilder.com/sourcebook> — Sustainable Building Sourcebook

<http://www.greenbuilder.com/calendar> — Sustainable Building Calendar

<http://www.greenbuilder.com/conference> — Green Building Conferences

<http://www.greenbuilder.com/general/discussion.html> — Discussion Forums

<http://www.nrg-builder.com/greenbld.htm> — Green Building: A Primer for Consumers, Builders and Realtors

<http://www.greenbuilder.com/general/greendbs.html> — Green Building Materials Databases

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- <sup>10</sup> [http://aia.org/SiteObjects/files/BIDS\\_color.pdf](http://aia.org/SiteObjects/files/BIDS_color.pdf)
- <sup>11</sup> Ibid.
- <sup>12</sup> Ibid.
- <sup>13</sup> *Terrachoice.com* — [http://www.terrachoice.com/files/6\\_sins.pdf](http://www.terrachoice.com/files/6_sins.pdf)
- <sup>14</sup> <http://networkearth.org/naturalbuilding/codes.html>
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- <sup>27</sup> Directory of State Incentives for Renewable Energy
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