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## Building the Green Way

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The dramatic, 647,000-square-foot PNC First-side Center in downtown Pittsburgh boasts a magnificent facade of curving glass, steel, and stone overlooking the Monongahela River. The winner of several design awards, the building rises from a large plaza graced with waterfalls and fountains. Its airy, light-filled interior has 11-foot ceilings, floor-to-ceiling windows, an atrium, an open floor plan, and all the latest building system technologies, including individual climate controls. What most observers don’t realize is that this is a “green,” or environmentally and economically sustainable, workplace—and that it costs 20% less per square foot to operate than its comparably sized “standard” sister building in Philadelphia.

Green buildings, as many know, have less negative impact on the environment than standard buildings. Their construction minimizes on-site grading, saves natural resources by using alternative building materials, and recycles construction waste rather than sending truck after truck to landfills. A majority of

a green building’s interior spaces have natural lighting and outdoor views, while highly efficient HVAC (heating, ventilating, and air-conditioning) systems and low-VOC (volatile organic compound) materials like paint, flooring, and furniture create a superior indoor air quality.

Just five or six years ago, the term “green building” evoked visions of tie-dyed, granola-munching denizens walking around barefoot on straw mats as wind chimes tinkled near open windows. Today, the term suggests lower overhead costs, greater employee productivity, less absenteeism, and stronger employee attraction and retention. Companies as diverse as Bank of America, Genzyme, IBM, and Toyota are constructing or have already moved into green buildings. Green is not simply getting more respect; it is rapidly becoming a necessity as corporations—as well as home builders, retailers, health care institutions, governments, and others—push green buildings fully into the mainstream over the next five to ten years.

In fact, the owners of standard buildings face massive obsolescence. They must act now to protect their investments. “Building owners are starting to do reviews of their portfolios to see how green their buildings are and what they need to do to meet growing market demand,” says Ché Wall, chair of the World Green Building Council. Citigroup, for example, has already begun looking at how its 100 largest buildings stack up against accepted green standards. Based on those findings, the company will then review its worldwide real estate portfolio and create a green road map to help improve the efficiency of its buildings. Soon, financial institutions and investors will use new valuation methodologies to quantify important green building factors like productivity and long-term life cycle costs when determining real estate values.

### The Shift to Green

Before 2000, companies generally regarded green buildings as interesting experiments but unfeasible projects in the real business world. Since then, several factors have caused a major shift in thinking.

First, the creation of reliable building-rating and performance measurement systems for new construction and renovations has helped change corporate perceptions about green. In 2000, for example, the U.S. Green Building Council (USGBC) in Washington, DC, launched its rigorous Leadership in Energy and Environmental Design (LEED) rating program. LEED evaluates buildings and awards points in six areas, such as innovation and design process. The program has Certified, Silver, Gold, and Platinum award levels. Other rating programs include the UK’s BREEAM (Building Research Establishment’s Environmental Assessment Method) and Australia’s Green Star. Certainly, companies can create green buildings without using these rating programs, and many that do follow program guidelines choose not to spend the time and money applying for certification. Nevertheless, certification assures prospective buyers and tenants that a building is truly sustainable. (For more on these rating programs, see the “Green Standards” sidebar.)

Second, hundreds of U.S. and international studies have proven the financial advantages of going green. Well-designed green buildings, for example, have lower utility costs. In its first

year of operation, Genzyme Center—Genzyme Corporation’s 12-story LEED-Platinum headquarters in Cambridge, Massachusetts—used 42% less energy and 34% less water than standard buildings of comparable size. Green buildings can also boost employee productivity by approximately 15%, in part because they use alternative building materials that don’t emit toxins, like formaldehyde, that are commonly found in standard building materials and workplaces. At Genzyme Center, 58% of the 920 employees report that they’re more productive there than they were in Genzyme’s former headquarters building. Employee sick time in the new headquarters is 5% lower than for all of Genzyme’s other Massachusetts facilities combined. Moreover, green design criteria—including abundant daylighting, individual climate controls, and outdoor views—raise morale and employee satisfaction, which also improves productivity.

Finally, green building materials, mechanical systems, and furnishings have become more widely available, and their prices have dropped considerably—in some cases below the cost of their standard counterparts. According to Turner Construction chairman Thomas C. Leppert, four industry studies of more than 150 sustainable buildings across the United States show that, on average, it costs only 0.8% more to achieve basic LEED certification than to construct a standard building. The PNC Firstside Center was already under construction as a standard building when the owner, PNC Financial Services Group, decided to go green instead. Even so, the project was completed two months early, came in \$4 million under the original (and only) construction budget, and earned LEED’s Silver rating. Now, PNC has constructed several of more than 200 planned green bank branches. The average construction time was 45 days faster than for PNC’s traditional branches, and the costs were the same or lower. In the northeastern United States, for example, PNC’s green branches each came in \$100,000 below the cost of a competitor’s new standard branches.

Building green is no longer a pricey experiment; just about any company can do it on a standard budget by implementing the following ten rules.

### Rule 1: Focus on the Big Picture

According to William Browning, a senior fel-

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low at the Rocky Mountain Institute in Colorado, integrating green principles into a building's planning and design process can generate 40% more savings and 40% better performance than simply adding green technologies to a traditionally planned and designed facility. Planning, designing, and constructing a green building isn't like installing new signage or adding a design feature at the last minute. If a company wants to stay within a standard budget and reap the full benefits of a sustainable building, all development decisions from the start must be guided by a green mind-set.

To launch a successful green planning and design process, it's important to hire the right project team members: architects, engineers, contractors, and consultants who are knowledgeable about the broad spectrum of green design tools and technologies and who have experience planning and constructing a variety of green facilities. Team members who are unfamiliar with green will often resist any de-

viation from standard design principles, building materials, and construction processes. They will make mistakes on everything from the amount of insulation needed to the selection of interior components like nontoxic flooring, therefore limiting the building's sustainability and having a negative impact on the budget.

A collaborative green project team begins by examining the building site, the exterior and interior plans, and the budget—managing up front each planning decision's effect on the overall project. A green planning and design process was essential to the success of the nine-story, \$112 million (in Australian currency) global headquarters for Lend Lease in Sydney, Australia. The company wanted the building to set a new benchmark for energy efficiency and indoor air quality to increase worker satisfaction and retention, but it insisted on a standard budget. Also, the city had imposed height and building density limits, so the building needed to have the greatest possible amount of usable space on each floor. One way the project team surmounted these challenges was by selecting a water-based, chilled beam air-conditioning system. Although it cost 30% more to install than a standard system, the water-cooled system was 30% more energy efficient and took up less room between ceilings and floors, leaving more usable space on each floor. The team reexamined all of the other planned elements as well. Replacing standard T-8 lamps, for example, with more energy efficient T-5 lamps (with smaller housing units) was another way to save space, which helped reduce materials and construction costs.

### **Rule 2: Choose a Sustainable Site**

If a building or a business campus is going to be truly green, it cannot be constructed on prime farmland, parkland, a historic or prehistoric site, or the habitat of an endangered species, nor can it be built within 100 feet of wetlands. Ideal locations for sustainable development include in-fill properties like parking lots and vacant lots, redevelopment sites like rail yards, and remediated brownfields. By choosing such locations, companies avoid contributing to sprawl and the degradation of environmentally significant sites, often while being near services they need.

Genzyme Center earned its LEED-Platinum rating in part because of its location. The build-

## Green Standards

A key catalyst for moving green buildings into the mainstream was the development of reliable standards and evaluation criteria around the world. In 1990, the UK government pioneered the green standards movement when, at the request of the British real estate industry, it launched BREEAM—the Building Research Establishment's Environmental Assessment Method. BREEAM evaluates the environmental performance of a broad spectrum of new and existing UK buildings.

In 2000, the U.S. Green Building Council—a coalition of more than 6,000 real estate professionals, government and other nonprofit organizations, and schools—started its Leadership in Energy and Environmental Design (LEED) rating program. The program awards points in the following categories: sustainable site (14 possible points), water efficiency (five possible points), energy and atmosphere (17 possible points), materials and resources (13 possible points), indoor environmental quality (15 possible

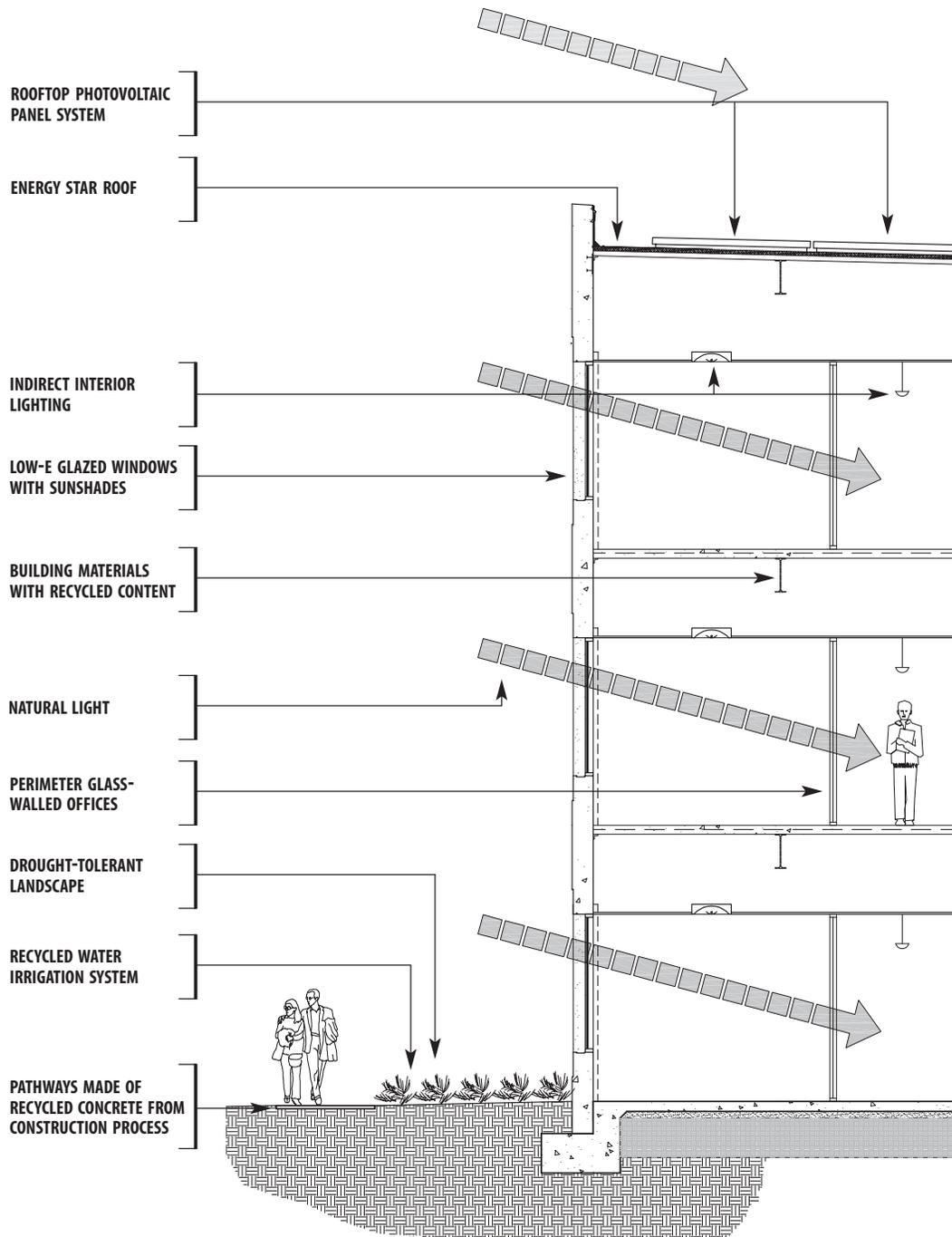
points), and innovation and design process (five possible points). Companies can earn points for everything from brownfield redevelopment to public transportation access. LEED has four award levels: Certified (26–32 points), Silver (33–38 points), Gold (39–51 points), and Platinum (52–69 points). A LEED-Gold building has 50% less negative impact on the environment than a standard building. A LEED-Platinum building has at least 70% less negative impact. Dozens of U.S. cities and several states now require that new and renovated public buildings satisfy LEED criteria.

More and more countries are creating their own green standards. The Green Building Council of Australia, founded in 2002, synthesized BREEAM, LEED, and other environmental criteria into the Green Star rating system, which is specific to the Australian environment, building practices, and real estate markets. India's Green Building Council is developing a rating system that it hopes to launch by the end of the year.

## Built to Save

Although they look like regular structures, green buildings are designed to have less negative impact on the environment, be healthier, boost the productivity of workers within,

and have lower overhead costs. They also yield a greater return on investment.



ing stands on a remediated brownfield site (where a coal gasification plant once stood). It is adjacent to a power plant—something that might typically be considered a challenge because it means unattractive views for workers and visitors. Genzyme, however, turned the plant's proximity into an opportunity by piping the plant's "waste" steam into the center's HVAC system to warm the building in the winter and cool it (with two steam absorption chillers) in the summer. Adopting this steam system reduced the building's electrical requirements and energy costs, and those savings are reimbursing the company for the system's higher up-front capital costs.

The LEED rating program gives points to properties located within a quarter mile of bus lines and within half a mile of rail and

subway lines. Genzyme Center is a five-minute walk from a mass-transit station. Approximately 25% of the building's 920 employees leave their cars at home.

### Rule 3: Do the Math

To complete a successful green building on a standard budget, the project team must apply a cost/benefit analysis to each component before allocating funding. For instance, a green roof costs more than a standard roof to install, but it brings a larger return on investment because it lasts years longer and provides more benefits, particularly storm water management and lower energy costs. (See Rule 5 and Rule 8.)

When DPR Construction planned its green regional office in Sacramento, California, it used a proprietary software program called Ecologic3 to analyze the costs and benefits of each point in the LEED rating system for this building, as well as the costs to own and operate it. According to Ted van der Linden, DPR's director of sustainable construction, the company weighed each possible LEED credit against the overall \$6.2 million budget, projecting the costs and benefits of each credit, as well as a ten-year return on investment. DPR found that approximately \$85,000 of the \$6.2 million would be spent on additional green up-front costs, including architecture and engineering design fees. Over the first ten years, however, the 52,300-square-foot office building will more than make up that \$85,000 by generating \$400,000 in operations savings.

Cost/benefit analyses should also incorporate the financial assistance, tax breaks, and other incentives that more and more cities, states, and utility companies offer to organizations that construct green buildings. Chicago, for example, awards floor area ratio (FAR) density bonuses for downtown buildings that have green roofs. Since 2000, New York State's Green Building Tax Credit has given deductions against a company's or developer's state tax bill for projects that meet specific sustainable requirements, like the under-construction Bank of America Tower in Manhattan. California's Savings by Design program—sponsored by four of the state's largest utility companies—provides design assistance and subsidies for energy efficient nonresidential buildings.

## Toyota's Green Acres

The South Campus expansion of Toyota Motor Sales' headquarters in Torrance, California, "was a pivotal project for the green building movement, because it was such a myth buster," says S. Richard Fedrizzi, president and CEO of the U.S. Green Building Council. The largest facility in the United States to earn a LEED-Gold rating when it opened in 2003, the South Campus cost no more to build than a standard low-rise business campus in southern California.

Using a mainstream budget of \$90 per square foot, architects from LPA in Irvine, California, designed 624,000 square feet of space in two three-story office buildings. Each building has a long, narrow footprint and a north-south orientation to maximize interior daylighting. The perimeter of each floorplate is ringed with glass-enclosed private offices. Over 90% of the building's occupants enjoy natural light and outdoor views.

Since March 2003, when employees moved in, the South Campus has delivered substantial overhead savings. The buildings' rooftop photovoltaic panels, combined with highly efficient air-handling units and gas-powered chillers, help to make the South Campus

buildings 31% more energy efficient than the company's comparable Service Development Center building. In a region that imports most of its water, the South Campus consumes 60% less water on its 40-acre, drought-tolerant landscaped site than the typical turf-planted and sprinkler-watered business campus. Its use of recycled water for landscape irrigation, building cooling, and toilet flushing saves 20.7 million gallons of potable water a year.

The largest benefits have been reaped in internal operations. "Since moving onto the South Campus, we've had a very high retention rate, and we've seen increases in productivity and drops in employee absenteeism," says Sanford Smith, Toyota Motor Sales' corporate manager of real estate facilities. "Toyota Customer Services, for example, had a 14% decrease in absenteeism." The South Campus has become a "must stop" on the green building circuit. Officials from a hundred companies, organizations, and cities have toured the facility. Toyota has also shared its green workplace best planning practices with organizations such as Disney, the New York Times, and the U.S. Air Force.

#### **Rule 4: Make the Site Plan Work for You**

Site planning can minimize the amount of on-site infrastructure like roads and parking lots, reduce grading and other earthwork, limit erosion, maximize sediment control, and provide easy access to public transportation—all of which will earn LEED points, lower construction costs, and reduce the facility and infrastructure footprint. IBM Tivoli Systems, for example, has dedicated 70% (63 acres) of its 90-acre headquarters campus in Austin, Texas, to open space. The rest of the site has been designated for structures (up to eight office buildings and parking garages) and infrastructure.

One simple site-planning strategy that can reap significant benefits is building orientation. Consider interior lighting. Typically, it makes up 20% to 25% of an office building's direct energy use partly because heat generated by the lights leads to more air-conditioning. Building orientation, however, can create a daylit interior that needs much less artificial lighting, saving money both up front and over the long run. In locations commonly subject to winds, buildings can be oriented to capture the breezes through rooftop clerestories and other windows that provide cross-ventilation.

#### **Rule 5: Landscape for Savings**

Landscaping, particularly in suburban locations, is another cost-effective green tool. It is especially good at minimizing heat islands—the buildup of heat from sunlight pouring onto dark, nonreflective surfaces. West- and south-facing building walls, for example, often become heat islands. Covering them with green screens (metal lattices planted with vines or climbing flowers) will greatly reduce the heat island effect and minimize interior solar heat gain. Mature trees can shade building walls, roofs on low-rise buildings, roads, and parking areas.

A green roof landscaped with drought-tolerant grasses and plants also lessens the heat island effect. On a downtown building that is surrounded by many other buildings—each of which acts as a heat island—the impact can be dramatic. For example, studies show that Chicago City Hall's landscaped roof surface was, on average, 70 degrees cooler in the summer than the standard dark, heat-trapping roofs of nearby buildings, and the air temperature above the roof was 15 degrees cooler. A green

roof also helps clean the air, serves as a wildlife habitat, and absorbs and filters rain that would otherwise flood storm drains and streets.

#### **Rule 6: Design for Greater Green**

Companies can use a wide variety of techniques to cost-effectively design a green building. A long and narrow building shape, for example, maximizes natural lighting and ventilation for workers. Locating fixed elements like stairs, mechanical systems, and restrooms at the building's core creates a flexible and open perimeter, which also allows daylight to reach work areas. Operable windows and skylights enable natural ventilation in temperate weather. Windows with low-E (low-emission) glazing minimize interior solar heat gain and glare.

The LEED-Platinum CII-Sohrabji Godrej Green Business Centre in Hyderabad, India—the greenest building in the world when it was completed in 2003, according to the USGBC—was given a circular design that brings sunlight to every part of the 20,000-square-foot building. During the day, artificial lighting is not used in 90% of the Green Business Centre. Thanks to its green design and energy efficient technologies, it uses 55% less energy than a standard building of similar size.

#### **Rule 7: Take Advantage of Technology**

Green building technologies help conserve and even generate energy. Companies can, for example, install motion-sensitive lighting sensors and individual climate controls in offices and at workstations. They can also purchase highly efficient HVAC systems that do not use chlorofluorocarbon-, hydrochlorofluorocarbon-, or halon-based refrigerants, which deplete the ozone and require more energy than green refrigerants (ones that are chlorine free, for instance). Again, such technologies cost more up front than standard building systems, but companies and developers can stay on a mainstream budget by taking advantage of the growing number of incentives and funding opportunities offered to companies installing building systems that save energy over the long run.

Advanced energy-conserving systems and many other green features took up almost \$23 million (16%) of Genzyme Center's \$140 million budget. (LEED-Platinum buildings are more costly than other green buildings

because they are testing the new designs, technologies, and building materials that will become accepted components in the future.) Genzyme, however, expects the building's green components to generate a return on investment in ten years, in part through lower operating costs but primarily through increased productivity, longer employee retention, and less sick time.

Green facilities can also produce some of their own electricity with alternative technologies. The experimental green Wal-Mart Supercenter in Aurora, Colorado, has a 50-kilowatt wind turbine, natural gas microturbines, and photovoltaic systems attached to the rooftop clerestories.

### Rule 8: Save and Manage Water

As water becomes scarcer and more expensive in many parts of the world, firms need to focus on conservation. They can install water-conserving irrigation systems and plumbing, waterless urinals (which are more sanitary than standard ones), and native and drought-tolerant landscape plants, and they can use recycled (not potable) water for landscaping needs.

Many jurisdictions have storm water management regulations that property owners must satisfy to limit the risk of flooding in heavy rain and reduce pollutants, like motor

oil and fertilizer, that are swept into storm water. While an undeveloped site is able to absorb a significant amount of rainfall, impermeable surfaces like buildings and parking lots greatly increase the amount and speed of storm water flowing through and off the site, raising the risk of flooding. To address this problem, the Wal-Mart Supercenter in Aurora has two 400-foot-long tree-shaded bioswales (shallow canals lined with plants) in its parking lot that help slow and cleanse rainfall runoff from the parking lot and building roof and create an attractive pedestrian environment. Green roofs and man-made retention ponds and wetlands are other effective storm water management tools that can also beautify and add value to a property.

### Rule 9: Use Alternative Materials

Green building materials create a healthier and safer workplace for employees. According to a 2002 study by the Indoor Environment Department at the Lawrence Berkeley National Laboratory in California, approximately 23% of U.S. office workers experience two or more sick building syndrome (SBS) symptoms—such as dizziness, nausea, and acute eye, nose, and throat irritation—in their workplaces annually. The same study found that the improved air quality generated by the use of green design, building materials, and technologies lowers SBS symptoms by 20% to 50%, while colds and influenza are reduced by 9% to 20% and allergies and asthma drop by 8% to 25%.

Many types of sustainable, nontoxic building materials are now readily available at reasonable prices. These include low- and zero-VOC paints, strawboard made from wheat (rather than formaldehyde-laced particle board), and linoleum flooring made from jute and linseed oil (rather than standard vinyl, which is packed with toxins). Materials like 100% recycled carpeting and heavy steel, acoustic ceiling tiles and furniture with significant recycled content, and soybean-based insulation often cost the same as or less than standard materials, and they have much less negative impact on the environment.

### Rule 10: Construct Green

How you build is just as important as where and what you build. Achieving a superior indoor air quality, for example, starts during the construction process. By coordinating wet and

## International Green

Green buildings are hardly a U.S. phenomenon. In fact, several European countries, particularly the United Kingdom and Germany, have been constructing cutting-edge sustainable buildings for two decades. India also has some of the world's most advanced green buildings, including the CII-Sohrabji Godrej Green Business Centre in Hyderabad. The facility combines traditional Indian building techniques with green innovations such as two wind towers that make air-conditioning virtually redundant.

In June 2005, mayors from 50 large cities around the world met at the United Nations World Environment Day conference in San Francisco and signed the Urban Environmental Accords,

which set out 21 sustainable-living actions for each city to complete by 2012. As part of the accords, the mayors pledged to mandate green rating standards for all new municipal buildings in their respective cities.

The World Green Building Council (WGBC), which was formed in 1999, is also spreading sustainability globally. It currently has nine members: green building councils representing Australia, Brazil, Canada, India, Japan, Mexico, Spain, Taiwan, and the United States. The WGBC is now working to help establish green building councils—a prerequisite for WGBC membership—in China, Germany, the United Arab Emirates, and the United Kingdom.

dry activities, construction crews can avoid contaminating dry materials with moisture and making them breeding grounds for mold or bacteria. Mechanical ductwork can be protected from project site pollutants if it's sealed in the factory before shipment and kept sealed until it's installed.

Recycling construction waste is part of the green process that brings several benefits. First, the waste is not dumped in a landfill. Second, recycling costs are often much lower than landfill fees. Finally, by crushing the concrete and asphalt from a demolished facility and using it as structural fill for a new building on that site, a company can save hundreds of thousands of dollars because it doesn't have to ship that waste off-site and buy gravel for structural fill. LEED gives points to every project that recycles at least 50% of its construction debris. Many companies do more. The Genzyme Center contractor, for example, recycled over 90% of the project's construction waste.

### Revamp and Refresh

As green goes mainstream, standard buildings will rapidly become obsolete and lose value. To avoid this problem, building owners should carry out green renovations. The LEED-CI program for commercial interiors offers guidelines to convert any standard workplace into a green building by generally following the same ten rules that apply to new construction, such as selecting alternative building materials. A green renovation can include everything from a new green roof to more efficient HVAC

and lighting systems, enlarged existing windows, and low-VOC paints and flooring. The LEED-CI renovation of the 110,000-square-foot Puget Sound Energy corporate headquarters in downtown Bellevue, Washington, included more natural lighting and outdoor views, low-VOC interior finishes, lighting controls and sensors, and other energy efficient technologies that have improved worker satisfaction and saved the company \$10,000 annually in energy costs. Citigroup is working with the USGBC to develop a streamlined process that will enable companies to earn LEED certification across entire real estate portfolios rather than applying for a LEED rating one building at a time.

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The green future is here. Like the dramatic, occasionally unsettling, and ultimately beneficial transformations wrought by the introduction of electric lights, telephones, elevators, and air-conditioning, green building principles are changing how we construct and use our workplaces. Armed with the ten rules discussed above, corporations no longer have an excuse for eschewing sustainability—they have tools that are proven to lower overhead costs, improve productivity, and strengthen the bottom line.

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