

Making the Case for Green Building

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Photo: Bronson Methodist Hospital

An abundance of daylight, plants, natural colors, textures, and artwork are intended to promote healing and comfort for patients and visitors at the Bronson Methodist Hospital in Kalamazoo, Michigan.

To those of us entrenched in the green building world the benefits seem obvious. Why would anyone choose to build in a way that isn't comfortable, healthy, and energy efficient? In the process of designing and building green, however, we keep running into others who are not yet as convinced. For those situations, it's useful to be able to spell out the benefits.

The building owner ultimately calls the shots, so getting that person or group on board early is essential. But not every owner will find the same arguments compelling: a hospital board may opt for green because certain green features promote healing, a commercial office property holding company may incorporate green features to speed the lease-out and thus lower carrying costs, a federal agency may desire green features to improve employee morale and increase job retention. Even within a single project, different team members often have different reasons for promoting a green agenda. The architect may promote environmental measures because she feels it's the right thing to do. The facilities manager who will take care of a building may recognize inherent durability and maintenance advantages. And the owner may look strictly at bottom-line financial benefits of green.

Note that while a green building might theoretically be able to achieve all of these benefits, most green buildings do not. For any specific project, it is important that any claims about the benefits are associated with green strategies that are actually being implemented—or at least considered—for that project. Further, there are green buildings in which benefits that are not achieved—such as durability—may render other benefits irrelevant. If poor moisture control results in premature building failure and the growth of mold, those problems could undo key benefits of the building, such as providing a healthy indoor environment. Green building is not only about adding together different green features—and green benefits—it is about how these systems fit together to create a building that works.

There are lots of reasons for building green, none necessarily better than others. This article examines the spectrum of reasons, providing short explanations for 46 benefits. Even if many of these items are already familiar, this list may provide some new insights and help you convince your next clients to pursue an even deeper shade of green.

Benefits of Building Green

FIRST-COST SAVINGS

Streamlined permitting and approvals

For some, but not all, green projects, regulatory delays and difficulties may be reduced as a result of green measures. A project that is designed to minimize loss of open space or that will result in less stormwater runoff, for example, can greatly reduce concerns by local citizen groups and planning commissions. (On the other hand, innovative development schemes may be unfamiliar to regulatory and citizen groups and result in additional review—but this outcome is less common.)

Reduced infrastructure costs

Substantial first-cost savings can often be achieved with green building through differences in how infrastructure is handled. For example, innovative stormwater infiltration systems can reduce or eliminate the need for storm sewers and stormwater detention ponds; narrower streets to slow traffic can reduce paved area; and clustering buildings on a site can reduce the amount of paved area and the length of sewers and utility lines. For some projects, the infrastructure savings are so significant that they can pay for other green features with higher construction costs.

Reduced material use

Designing smaller, more compact houses and other buildings can save a substantial amount of materials. Because construction waste volume is generally proportional to building size, smaller buildings also generate less construction waste—another savings (see next item). Keep in mind, though, that other strategies, such as daylighting, may conflict with the goal of keeping the building geometry simple.

Savings in construction waste disposal



Photo: Pizzagalli Construction

To make room for a Student Life complex at Champlain College in Burlington, Vermont, Pizzagalli Construction dismantled an old one-story cafeteria. Much of the equipment and the structure was salvaged or recycled, reducing landfill costs.

Disposal of construction waste was once an almost insignificant component of construction costs, but it has become significant in many regions. Reducing construction waste through optimizing building dimensions (designing on a two-foot module, for example) and separating and recycling waste can dramatically reduce these costs. Architect John Boecker, AIA, saw savings of \$20,000 and \$30,000 through these strategies on two recent projects: a \$2.5 million office building and a \$7.5 million school, respectively.

Savings from downsizing mechanical equipment

By improving the energy performance of a building envelope, it is often possible to downsize mechanical equipment as well as perimeter heating systems. With air-conditioning equipment, the cost is fairly proportional to the cooling capacity, so a reduction in cooling load translates into savings quite directly. (The correlation between heating capacity and cost is less direct.) Once loads have been reduced significantly, whole new approaches to heating and cooling sometimes become available—for example, using radiant systems rather than air distribution for heating and cooling, and separating ventilation air from comfort air. In some cases, by going even further with improved envelope energy performance, it's possible to totally eliminate heating or cooling equipment—and in the process pay for much or all of the envelope improvements.

Tax credits and other incentives

A few states and municipalities offer tax credits and other financial incentives to developers of green buildings or buyers of green products, such as efficient clothes washers and water heaters, that might go into such buildings. New York, New Jersey, Maryland, and Oregon are among states that offer significant green building tax credits. Also, a growing number of local municipalities offer incentives for green building.

REDUCED OPERATING COSTS

Lower energy costs

Reduced energy use is often the single most obvious economic benefit of green buildings. Minimizing energy consumption is a priority in nearly all green buildings—from single-family houses to skyscrapers. Green buildings commonly use less than half as much energy as their conventional counterparts, and some green buildings consume less than a quarter as much energy. Much of this benefit often comes from an improved building envelope and more energy-efficient equipment, but, with residential projects, simply creating smaller houses can save tremendous amounts of energy—even without improving the envelope. In addition to reducing energy usage, many green design strategies lower peak energy demand, which has a huge impact on the energy costs of nonresidential buildings. If energy costs continue rising, as they have during 2004 and 2005, energy savings will become an even greater driver of green building.

Lower water costs

Many resource experts are more worried about freshwater supply than energy supply over the coming decades. Through a combination of indoor and outdoor water conservation strategies, many green buildings are using less than a quarter as much water as conventional buildings. In addition to conserving water, some green buildings collect water off their rooftops or separate graywater from the waste stream for use in landscape irrigation. A few green buildings, such as the Solaire high-rise apartment building in New York City and the Pennsylvania DEP office building in Norristown, Pennsylvania, include self-contained water collection and treatment systems to provide nonpotable water for toilet flushing and irrigation from wastewater. Very high water costs or high hook-up fees can be a motivation for strategies such as this.

Greater durability and fewer repairs

A very important, yet often overlooked, feature of green buildings is durability. Well-designed and properly built green buildings will not experience moisture problems because sound building-science principles were incorporated into the design and construction. Durable buildings cost less to operate because repairs and replacement of failed building components are less common. Although durable building materials and equipment may cost more up front, their life-cycle costs are often lower than conventional products because they last longer and require fewer repairs. Green (vegetated) roofs, for example, can significantly increase the durability of the roof membrane by protecting it from exposure to UV light and thermal shock.

Reduced cleaning and maintenance

Some green building strategies, materials, and products require less maintenance or reduce the need for cleaning. A rain-screen siding detail, for example, reduces the need for repainting wood siding. Track-off entryway grates and carpeting keep a building cleaner by capturing dirt before it enters the building—and thus reduce the costs of cleaning. A natural landscape created with native plants generally requires significantly less maintenance than conventional turf and shrubbery.

Reduced costs of churn

Reconfiguring office spaces and relocating office workers (churn) is a huge cost for many companies and agencies. The average churn rate in offices is about 25% per year, and some experience more than 100% churn per year. Certain green building strategies, principally raised access floors and modular wiring, can dramatically reduce this expense.

Lower insurance costs

While few insurance companies currently recognize the lower risks that green buildings carry, compared with conventional buildings, this benefit of green may soon be more widely recognized. Insurance companies are increasingly aware of the risks posed by mold in buildings, and green building design protocols that substantially reduce risk of moisture problems and mold could, in the future, result in lower insurance premiums.

Reduced waste generation within the building

Many green buildings are specifically designed to minimize waste generation. Many types of buildings can incorporate facilities for recycling waste. Hotels and motels can incorporate soap and shampoo dispensers to minimize throw-away soaps and shampoo bottles. Dining areas in

commercial buildings can be designed to rely on washable utensils and chinaware rather than throw-away products.

OTHER ECONOMIC BENEFITS

Increased property value

With any income-generating (rental) property, reducing operating cost can boost the property value. This occurs because the lower operating costs increase the building's net operating income (NOI). According to the publication *Benefits Guide: A Design Professional's Guide to High Performance Building Benefits*, published by the New Buildings Institute, increasing the NOI of a building increases the building's appraised value by ten times the annual cost savings—a *capitalization rate* (cap rate) of 10%. For example, a 75,000 ft² (7,000 m²) office building that saves \$0.50/ft² (\$5/m²) per year in operating costs (\$37,500 per year), will see the value of the building increase by \$375,000. A higher building value (appraisal) can increase the loan amount available from lending institutions.

More rapid lease-out

Green buildings—whether office space or high-rise residential property—often lease out more quickly than conventional buildings, and often with higher rental prices! Reasons for this include media exposure about environmental and health features, marketing materials that tout the low operating costs or enhanced comfort, and word-of-mouth comments about the look and feel of such buildings. Developer Joe Van Belleghem of BuildGreen Developments, Inc., in Victoria, British Columbia, credits green features for the rapid lease-out of his Vancouver Island Technology Park during a period of downtime in the high-tech sector. Minimizing the number of months for which lease space remains unoccupied reduces carrying costs and increases profits.

More rapid sales of homes and condominiums

Green homes and condominiums often sell more quickly than their conventional counterparts. Developers Tom Hoyt of McStain Enterprises, Inc., of Boulder, Colorado, and Dennis Wilde of Gerding/Edlen Development Company of Portland, Oregon, report far more rapid sales of green buildings. Faster sales mean lower carrying costs and lower interest on swing loans, both of which increase bottom-line profits.

Easier employee recruiting

Recruiting quality employees can be a challenge for any employer, whether a private company, government agency, hospital, or school. The quality of the space in which prospective employees will be working, including such features as daylighting, views to the outdoors, and indoor air quality, can have a significant impact.

Reduced employee turnover

Green, healthy, comfortable buildings are more pleasant to work in, and employers with such buildings are likely to experience less employee turnover. With the high cost of employee recruiting

and training, this benefit can offer significant economic value. In Michigan, the firm Deloitte & Touche estimates the cost of recruiting and training employees to be \$12,000 for a nonprofessional worker and \$35,000 for a professional employee. The Families and Work Institute estimates that replacing a nonmanagerial worker costs about 75% of his or her annual salary, with the figure closer to 150% for a manager. At the PNC Firstside facility in downtown Pittsburgh, employee retention was a major factor in the requirement that at least 90% of employees have views to the outdoors. Retention of military personnel in the U.S. Navy has been a major impetus for greening Naval housing.

Reduced liability risk

Lawsuits over mold in buildings and sick-building syndrome are increasingly common. Green buildings that have been designed with state-of-the-art knowledge about building science and moisture control pose a much lower risk of lawsuits related to these problems. It will surprise many building owners to learn that problems related to mold are increasingly being *excluded* from insurance coverage, and it is certainly within the realm of possibility that mortgage holders and commercial real-estate lenders will begin requiring some sort of quality-control certification relating to mold and durability.

Staying ahead of regulations

Many of the most expensive lawsuits faced by companies today (for example, lawsuits over asbestos and PCBs) could have been avoided if companies had been more proactive in avoiding practices that might later be banned. The same goes for building owners. Planning now for future stormwater control regulations, or bans of HCFC refrigerants, certain flame retardants, or other potential health or environmental hazards could save significant costs down the road. According to the Rocky Mountain Institute book *Green Development*, “it is almost always more expensive to comply with regulations after the fact.”

Positive public image

The positive public image that can be realized through a commitment to healthy, environmentally responsible buildings can be tremendously beneficial. The development Dewees Island (see [EBN Vol. 6, No. 2](#)) garnered highly valuable press due to the project’s leading-edge environmental policies—so much so that building lots almost sold themselves, even as their costs increased. Stanley Selengut’s Maho Bay eco-resort in the U.S. Virgin Islands has realized millions of dollars’ worth of free publicity through articles in the popular press about the facility’s green features. Ford Motor Company’s revitalization of its Rouge Plant was covered in dozens of national magazines, including five pages in *Time* magazine, due to the green features; purchasing that coverage would have cost hundreds of thousands, if not millions, of dollars.

New business opportunities

Specializing in green development and in green building design and construction has proven to be lucrative for many of the pioneers. As word has spread about the success of these buildings, new opportunities have fallen into the laps of many green building experts. Though difficult to measure, these benefits can be substantial.

HEALTH AND PRODUCTIVITY BENEFITS

Improved health

By virtue of the materials used, moisture-control detailing, pollution- and contamination-rejection strategies, and ventilation strategies, green buildings are healthier buildings. Americans spend 85–95% of their time indoors, so the quality of the indoor environment is extremely important. Indeed, in many building sectors, ensuring healthy living and working spaces is likely to become the single most important driving force for a transition to green building.

Enhanced comfort



Source: BNIM Architects & Lake Flato Architects

The 200,000 ft² (18,000 m²) School of Nursing and Student Community Center at the University of Texas Health Science Center in Houston was completed in August 2004. Interior meeting rooms and workspaces open onto three atria that bring controlled, diffuse daylight deep into the building.

Measures that reduce drafts, minimize floor-to-ceiling temperature stratification, and control noise improve comfort in buildings. With houses in particular, a well-insulated, tight building envelope not only reduces energy consumption but also increases comfort—and the latter is just as important to many homeowners. In commercial and institutional buildings, the controllability of individual workspaces—a feature in many green buildings—addresses the fact that different people have different needs when it comes to temperature, ventilation, and light levels. Individuals often benefit psychologically just from knowing that they have this control over their workspace environment.

Reduced absenteeism

Keeping workers healthier—for example, through control of contaminants and displacement ventilation strategies (as achieved when raised access floors are used for conditioned air supply)—can significantly reduce work lost to illness. In the oft-cited Lockheed-Martin Building 157, absenteeism dropped 15% (see *EBN* [Vol. 14, No. 3](#)). William Fisk, P.E., head of the Indoor Environment Department at Lawrence Berkeley National Laboratory, has demonstrated that

improved ventilation systems would reduce respiratory illness by 9–20%, yielding a savings in the U.S. of \$6–\$14 billion per year (see *EBN* [Vol. 13, No. 10](#)).

Improved worker productivity

The economic benefits of boosting productivity are tremendous, with salaries and benefits costing on average \$318 per ft² per year in a U.S. office building—compared with \$50 for technology, \$16 for the mortgage or lease, \$2.35 for energy, and \$1 for churn (\$3,420, \$540, \$170, \$25 and \$11 per m², respectively). Just a 1% increase in productivity, for example, will more than offset the total energy costs in the average building. Studies by Carnegie Mellon University have shown productivity increases in green buildings ranging from 0.4% to 18%. As more companies come to appreciate the value of productivity improvements, this is likely to become an increasingly important driver of green building. For more on productivity benefits, see *EBN* [Vol. 13, No. 10](#).

Improved learning

In schools, such green features as daylighting, noise control, and views to the outdoors are being shown to increase rates of learning. A landmark 1999 study by the Heschong Mahone Group (HMG) found that daylighting in the Capistrano, California, school district increased the rate of learning by 20–26% (see *EBN* [Vol. 8, No. 9](#)). More recent studies by the same group in a different school system found a positive correlation between views to the outdoors and learning rates. Awareness of these benefits will influence school boards in their decision-making about school building design.

Faster recovery from illness

Views to the outdoors and connections to nature have been shown to promote more rapid healing in hospitals, while displacement ventilation can dramatically reduce the spread of illness through airborne viruses and bacteria—an increasing problem in many hospitals. Green building features such as these are increasingly being viewed as strategies for reducing healthcare costs. The nation's largest healthcare provider, Kaiser Permanente, which plans to build more than two dozen hospitals in the next decade, is committed to a comprehensive green building agenda.

Increased retail sales

A 1999 HMG study of 108 big-box stores in California found that daylighting increased sales by 40% (see *EBN* [Vol. 8, No. 9](#)). A more recent HMG study of another retailer's 74 stores in California found a 1–6% increase in sales that was correlated with daylighting. While less dramatic than the earlier study, the new study showed the increased sales benefit of the daylighting to be worth at least 19 times as much to the company as the energy savings provided by that daylighting. As this sort of information trickles down to the management of retail chains, daylighting and other green building strategies are likely to become the norm.

COMMUNITY BENEFITS

Reduced demand on municipal services

Many green buildings have lower water demands and produce less wastewater than conventional buildings, thus reducing demand on municipal services. In areas where droughts are frequent or where municipal water utilities are already pushed to capacity, this benefit of green building can be significant. With Oakes Hall at the Vermont Law School (see [EBN Vol. 9, No. 5](#)), a moratorium on new hook-ups to the town's wastewater treatment plant drove a very aggressive water conservation agenda, which included composting toilets in the building. Even when capacity is not a problem, the use of energy and chemicals in sewage treatment plants is proportional to treatment volume, so reducing sewage volumes is environmentally attractive.

Reduced erosion and stormwater runoff



Photo: Pat Sudmeier

For this Carbondale, Colorado, residence designed by Graybeal Architects, site-excavated rock and native vegetation were used to create drainage swales, reducing the cost of stormwater management while preserving wildlife habitat.

Some of the most localized environmental impacts of buildings are the erosion that occurs during construction and the increase in stormwater runoff that results from added impervious surface. Site management, landscaping, and other features of green building can dramatically reduce both of these problems. By incorporating green roofs (see [EBN Vol. 10, No. 11](#)), rooftop rainwater harvesting systems (see [EBN Vol. 6, No. 5](#)), porous pavement (see [EBN Vol. 13, No. 9](#)), and other practices to provide for on-site stormwater infiltration (see [EBN Vol. 3, No. 5](#)), the environmental impacts of stormwater runoff can be significantly reduced.

Reduced automobile use, traffic congestion, and sprawl

Green building should look beyond the individual building to how well that building is integrated into the community and the regional highway infrastructure; a high priority should be to lessen dependence on automobiles. Clustering buildings, mixing residential and commercial uses, linking buildings by pathways, building near light-rail and bus routes, and providing facilities and

incentives to encourage commuting by means other than private automobiles can all help to reduce automobile use and traffic congestion. Reduced traffic congestion in an area improves the quality of life, boosts productivity (because people spend less time in traffic), and reduces air pollution. Such changes can also keep people healthier by enabling them to get more exercise (see *EBN* [Vol. 13, No. 2](#)).

Creating “community”

Development patterns that have been common during the last half of the 20th century have contributed to a loss of community in many areas. Green development, when implemented on a community scale, can help to reverse these trends and return to people-focused neighborhoods in which residents interact with their neighbors. Safety increases with more “eyes on the streets,” and dependence on automobiles decreases. These ideas are among the key principles of New Urbanism or neo-traditional development—design and planning ideas advanced by the Congress for the New Urbanism. While not all New Urbanist development is as green as it could be, green building and new Urbanism should go hand-in-hand.

Support of local agriculture

A key feature of green development is the preservation of open space—both for ecosystem benefits (see below) and to protect farmland. Some of the most exciting green developments that have been created over the past few decades, such as Village Homes in Davis, California, Prairie Crossings north of Chicago, and numerous cohousing projects, incorporate sustainable agriculture as a key component of the development. Often, houses are located on steeper topography so that the flatter land best suited for agriculture can remain in productive use.

ENVIRONMENTAL BENEFITS

Reduced global warming impacts

To the extent that green buildings use less energy and generate less carbon dioxide through their operation, require less transportation energy for their occupants, or avoid release of other greenhouse gases (such as HCFC and HFC refrigerants and foam insulation blowing agents), they contribute less to global warming, which is clearly one of the greatest environmental threats we face today. It is important to recognize that climate change impacts are global in nature—what we do in one part of the U.S. affects the world’s climate, and, conversely, anything we do to reduce greenhouse gas emissions results in global benefits.

Minimized ozone depletion

Green buildings minimize the use (and release) of ozone-depleting substances. This involves replacing CFC-based chillers, specifying non-HCFC mechanical equipment, and avoiding foam insulation produced with HCFC blowing agents. Note that with refrigerants, there is often a trade-off to be considered between ozone-depletion and global-warming potential. With renovation of existing buildings, measures can be taken to capture and destroy ozone-depleting refrigerants and blowing agents.

Reduced resource extraction impacts

When we use materials to construct an office building or house, the impacts of that material use are not limited to our building location. The aluminum may have come from bauxite ore mined in what had been tropical rainforests in Brazil, the steel likely came in part from iron ore mined in Minnesota, the mahogany used in our decks or hardwood doors might have come from clearcut land in Indonesia, and the chrome finish on our bathroom vanities most likely came from high-impact mining in Zimbabwe. These impacts are all embodied in the materials we use. With green building, there is often an effort to consider those impacts—through a process called life-cycle assessment (LCA). Specifying green building materials can help to minimize these impacts of resource extraction.

Reduced toxic emissions

The manufacture of certain building materials, including some types of plastic, results in the emission of toxic air pollutants. The same materials (and others) may also emit toxins at the end of their lives, when they are landfilled or incinerated. There is growing concern about additives such as phthalate plasticizers and brominated flame retardants that are added to some plastics. A commitment to green building materials is a commitment to considering these LCA issues. Natural building materials often pose the lowest environmental risks.

Reduced energy and other impacts of transporting materials

The greater the distance building materials and products need to be shipped (and the distance raw materials have to be shipped in the manufacturing of these finished goods), the greater the energy use and environmental impacts. With green building, there is often an effort to select more local materials—indeed, the LEED® Rating System provides up to two points for use of local materials, and many projects have received innovation credits for significantly exceeding those thresholds.

Reduced contributions to local and regional air pollution

Burning fossil fuels to operate buildings and to transport people to and from those buildings causes local and regional air pollution—so any measures that reduce this energy use will help control air pollution. Some building materials also contribute to air pollution (smog) through the release of volatile organic compounds (VOCs). With green building, and the selection of green building materials, the air pollution sources should be minimized.

Reduced local and regional water pollution

Buildings contribute to water pollution in a number of ways: stormwater runoff that carries contaminants into nearby surface waters, effluent from manufacturing plants that produce the products used in constructing a building, and the wastewater generated by a building that either introduces residual pollutants into surface water after treatment or more directly contributes pollutants to the groundwater with onsite wastewater treatment. With green building, efforts are made to minimize these impacts and select products that carry minimal “upstream” or “downstream” water-pollution impacts.

Reduced urban heat islands

Reflective roofs and green roofs do not contribute significantly to the *urban heat-island effect*, which causes urban areas with many dark surfaces to be up to 15° F (8° C) warmer than

surrounding, undeveloped countryside. Higher air temperatures result in more smog and higher cooling costs.

Protection of biodiversity

Some environmentalists argue that the greatest damage we are currently doing to the environment—“the folly that our descendants are least likely to forgive us,” in the words of Harvard biologist E.O. Wilson—is the catastrophic loss of biodiversity we are causing globally. Green developments can help to protect biodiversity. They can do this locally by protecting open space, restoring ecologically damaged sites, and creating wildlife habitat—even on top of buildings in cities. They can do this more broadly through the specification of products and materials that do not damage ecosystems elsewhere.

Increased environmental awareness

Green buildings can be learning laboratories for all who use them. Interpretive signs about the benefits of low-water-use faucets in commercial restrooms, about how to sort recyclables in a building, about xeriscaping practices to conserve water outdoors, and about the use of energy-saving lighting controls educate those using the building, which in turn should further the penetration of green building practices throughout our building stock. Even in homes there are opportunities to increase awareness about the environment—children growing up with green features will consider that the norm. Green buildings that offer a direct connection with the natural environment may also nurture a more wholesome relationship with that environment among populations that are increasingly isolated from it.

SOCIAL BENEFITS

Support of sustainable economies

A green agenda can extend beyond the built environment into the economy at large. Locally based manufacture of building materials and local agriculture are opportunities that green building helps foster. Putting money into local companies that weatherize homes or install solar equipment can keep money within the community instead of sending it out of the community (and much of it out of the country) in purchasing fossil fuels.

Support of companies with socially responsible policies

While green building products have been identified to date based largely on their environmental characteristics (recycled content, low VOC emissions, and so forth), a next step might be broadening selection criteria to consider such issues as a company’s internal environmental policies, labor practices, and other measures that are typically addressed under the banner of “corporate social responsibility.”

– Alex Wilson