May 25, 2007

The Greenest Building Is…One That Is Already Built

By Carl Elefante, AIA, LEED AP

A page has turned. In decades hence, 2006 may well be regarded as the year when the national discussion about the future of our cities, perhaps our civilization, changed from a debate over *whether* human impacts on the environment are leading to potentially severe problems to one focused on *what we can do* to diminish and even reverse them. Halleluiah!

Evidence for this supposition is widespread. Certainly, Al Gore's Oscar-winning film, *An Inconvenient Truth,* has been singularly important in raising public awareness and defining environmental stewardship as a fundamental trait of American patriotism. Today, preventing climate change is the rallying call for millions, not just the environmental intelligentsia. There are hundreds of examples of how deeply our sense of national purpose has transformed. My profession accepted the Architecture 2030 Challenge[i] laid down by Ed Mazria at the 2006 AIA National Convention to cut in half fossil fuel consumption in architect-designed buildings by 2010, yes 2010, and create carbon-neutral buildings by 2030 (thus the name). Green building is *maturing*. *Green Buildings and the Bottom Line*, published by *Building Design + Construction* [ii] states the business case for green building, documenting increases in productivity, performance, and profitability and reductions in risk, insurance premiums, and financing costs. Green has found its way into the board room.

However, this growth process is far from complete. Largely, the green building movement remains blind to its most troubling truth: We cannot build our way to sustainability. Even if, with the wave of a green wand, every building constructed from this day hence has a vegetative roof, is powered only with renewable energy sources, and is built entirely of environmentally appropriate materials, sustainability would still be far from fully realized.

Seeking salvation through green building fails to account for the overwhelming vastness of the existing building stock. The accumulated building stock is the elephant in the room: Ignoring it, we risk being trampled by it. We cannot *build* our way to sustainability; we must *conserve* our way to it.

QUINN EVANS | ARCHITECTS
1214 Twenty-eighth Street, NW
Washington, DC 20007
v 202 298 6700
f 202 298 6666
www.quinnevans.com

Consider the numbers. The U.S. Department of Energy maintains a database of America's non-residential buildings, its *Commercial Building Energy Consumption Survey*.[iii] As of its latest update in 2003, there are some 65 *billion* square feet of non-residential buildings in the U.S. According to economic projections reported by *Architect* magazine in 2006,[iv] a prolonged building boom of historic proportions will produce an estimated 28 *billion* square feet of new construction by 2030, an increase of more than 40 percent. The report also notes (almost as an aside) that during the same period, more than 54 *billion* square feet of the existing non-residential building stock, about 84 percent of it, will undergo substantial modification.

Picture it this way: Four out of every five existing buildings will be renovated over the next generation while two new buildings are added. Can sustainability be achieved if our green vision extends only to new buildings, ignoring the enormous challenges of existing buildings and communities? After two decades working to promote green building within the architectural and environmental policy sectors, I believe that it is up to the preservation community to call attention to the elephant in the room.

Sustaining the Existing Building Stock

About 6 percent of the existing building stock was constructed before 1920. This small slice contains America's best-loved historic buildings, the "poster children" of historic preservation. From a green design viewpoint, this segment also includes those structures built *before* the introduction of climate-control and lighting systems powered with fossil fuels. There is a wealth of traditional, vernacular, and indigenous structures that deserve close study, by preservationists and green building professionals alike.

Another 11 percent of the non-residential building stock consists of mid-20th-century buildings constructed up to the close of World War II. Building technology began to change rapidly during this period, turning away from traditional construction materials and methods and dramatically increasing the complexity of mechanical and electrical systems.

The buildings that make up these two, older segments of the building stock garner by far the most attention from preservationists. Over the past four decades, tried-and-true conservation treatments have been developed that employ remarkably efficient methods to sustain these traditional structures. Preservationists are justified in heralding these achievements as sustainable in their own right. Indeed, we need to make a much more methodical effort to measure, document, and report the effectiveness of preservation as a green building strategy based on the work we have accomplished with these core elements of the historic building stock.

However, it must also be acknowledged that the buildings preservationists most frequently address represent a very small percentage of the entire stock. Preservation will become more relevant to sustainability by expanding the scope of the buildings we conserve. In my view, this expanded role should be paralleled by a shift in priorities among preservationists toward neighborhood revitalization models, where ordinary buildings are embraced for their contribution to a larger context. I see it as emphasizing more of our *Main Street* preservation culture.

The Modern-era Building Stock

By the sheer force of numbers, preservation will have to address a much larger building stock when modern-era buildings become more fully the *stuff* of preservation. The buildings of the 1950s, '60s, '70s, and '80s constitute more than half, about 55 percent, of the existing non-residential building stock in the United States, a whopping 36 *billion* square feet. In part, the postwar building boom was made possible by new design attitudes, ones that emphasized the new building forms and the application of new technology over traditional building types and craft.

Modern-era architecture is markedly different aesthetically from its traditional predecessors and generally performs very differently as well. Both preservation and green building advocates readily agree that modern-era buildings present greater challenges to both disciplines. Preservation professionals have begun to wrestle with the problems of modern-era structures, including their construction using materials and assemblies that often lack durability and their absolute reliance on equipment that consumes fossil fuels.

This large and problematic segment of the building stock is going to require new thinking about both preservation and green building. I see it as both a challenge and an opportunity. In practical terms, the quantity of the modern-era building stock dictates that we find ways to use these buildings far into the future. Their (lack of) quality requires that we find efficient yet effective ways to *transform* them, elevating their performance to sustainable levels.

The need to *transform* the modern-era building stock is an important point deserving more elaboration. Quite frequently, with the preservation of 18th-, 19th-, and early 20th-century buildings, we endeavor to retain or restore their original function as well as fabric. Repairing operable windows, shutters, and awnings on a Victorian house in a historic neighborhood overarched with 100-year-old trees is so obviously a *win-win* for both preservation and sustainability. The character of a historic resource is preserved and effective weather- and climate-responsive devices are returned to their intended function. But it is hard to discover such win-win scenarios with many, if not most, modern-era buildings. Far too frequently, the windows never operated and the mechanical system never performed efficiently. Something different, something new, something layered on to what already exists is needed.

By accepting the need to *transform* modern-era buildings, we may also need to accept that preservation will transform as well. In my view, preservationists have been somewhat too quick to embrace *historic exemptions*, most relevantly, from standards like the National Energy Code. As we face our responsibility to sustain the existing building stock, we should challenge ourselves to meet every high-performance benchmark possible. There are alternatives to historic exemptions. Achieving *reasonable accommodation* and proposing *alternative compliance methods* are two.

For both preservation and green building professionals, it is absolutely critical to study in detail and truly appreciate the characteristics that define the existing building stock. The preservation community needs to invest more resources into this endeavor. Even a brief overview makes it obvious that the scope of the challenge is monumental and that the issues we must tackle together are complex and varied. Although emerging green building principles and practices must be duly credited for identifying solutions to many of the unintended consequences of the industrial age, we cannot ignore the necessity to both preserve and transform the buildings and communities we already live in.

What Is Sustainable, Really?

If preservation is going to make a valuable contribution to sustaining our communities, it needs a deeper understanding of what constitutes sustainability. In today's "green marketplace," where green claims are made about virtually every product and service, clarification is required. What makes clarity most illusive is that our perspective on sustainability is evolving so rapidly.

Take recycling as an example. Most everyone recognizes that recycling is an effective and productive sustainable strategy, which it is. However when recycling is studied in more detail, it becomes apparent that things are not as simple as they seem. Much of what is called "recycling" is more accurately "down-cycling,"[v] where high-value materials are cycled down to low-value ones. While this approach may divert millions of tons of waste from landfills today, how many more cycles can these materials endure into the future? With the expenditure of energy, glass bottles can be recycled into glass bottles time and again;

however, plastic bottles are reduced to a pulp material that can only be formed into the most elementary objects. Can it be said that both examples of recycling are *sustainable*?

What is sustainable, really? There is no easy answer. Study the partnership between The Natural Step and Interface Carpets.[vi] For more than a decade, Interface has been leading a revolution in the building products industry. It has conducted perhaps the most complete analysis of its products and processes of any company in history. Yet Interface is still looking quite far into the future, 2020, to realize its mission of eliminating all negative impacts on the environment.

Both scientifically and culturally, we simply don't know everything we need to know to say with authority what comprises sustainability. Then how does the preservation community proceed toward sustainability? I believe there are three fundamentals which translate directly into new directions that will help bring preservation into partnership with green building.

As biological creatures we are, literally, one with the environment. To appreciate this best, study the work of Dr. David Suzuki,[vii] who documents in scientific terms our direct connection with nature's four elements: earth, air, water, and energy. What we do *in* the environment, we do *to* ourselves. To create sustainable communities, we must fully appreciate that they are seamlessly part of the natural world.

To paraphrase architect and industrial philosopher William McDonough: "Being less bad is not being good."[viii] Today, we are taking the first steps toward sustainability, reducing our "environmental footprint" by consuming less energy, releasing fewer harmful substances, and increasing the efficiency of technology. Such retooling is important; however, sustainability goals must reach beyond doing less harm. To be sustainable, human activities need to increase the vitality of the planet, not diminish it. Increasingly, green building professionals seek *regenerative* solutions that restore the natural environment. We need to break through to new plateaus. Why can't buildings produce safe, affordable, reliable, and renewable energy instead of consuming fossil fuels? Why can't buildings harvest rainfall and recharge aquifers with drinkable water instead of releasing "stormwater" and "wastewater"? (Listen to the language!)

Over the past decade I have coined a phrase: The greenest building is… one that is already built. Many who hear me say it assume that I am being metaphysical. I'm not. In the same way that the wisdom of indigenous cultures taught David Suzuki to see the links between humans and nature, preservation philosophy has sensitized me to see the value in the existing world, especially the *built* world. Taking into account the massive investment of materials and energy in existing buildings, it is both obvious and profound that extending the useful service life of the building stock is common sense, good business, and sound resource management. To fully capture the value of the existing building stock requires merging two disciplines: historic preservation and green building. It requires an understanding of how to respect and renew what is already here and a vision for where and how to transform the legacy of the past into the promise of tomorrow.

Practicing Green Preservation

The intersection between preservation and green building is becoming well traveled. Significant cross-pollination has occurred and the rate of collaboration is exploding. The *inherently green* aspects of historic and traditional buildings are being assessed and documented.[ix] *Greening* existing buildings, including important historic structures, is gaining recognition in green building circles.[x] This body of work contains many exciting projects involving traditional buildings that protect their material and cultural value while significantly improving their energy and environmental performance characteristics. Many well-publicized examples are worth "Googling."[xi] I leave it to you to explore.

Building Life-Cycles

As we conserve buildings, which treatments are undertaken is often determined by careful, even exhaustive, assessment of the conditions of each material and element. Buildings are complex assemblies. Conservators pick apart each assembly into its components and repair or replace what needs to be attended to. Following this process gives preservationists a very clear view of the life-cycles of buildings.

Life-cycle analysis (LCA) and life-cycle cost analysis (LCCA) are considered fundamental tools of green building. For construction materials and products, there are quite a number of well-developed LCA protocols for rating their cradle-to-grave performance and environmental impacts.[xii] However, there are considerable obstacles to applying LCA to entire building projects. The number of variables is simply overwhelming. Few tools have been developed that even attempt to encapsulate all the elements of a building project into a single impact assessment.[xiii] For those of us with an ingrained preservation outlook, more frequently than not, we find the use of LCA tools in green building practice to be short-sighted and shallow. Even the most rigorous LCA standards ignore any after-use impacts other than demolition and disposal. What about restoration and renewal? Where is the work of preservation that gives buildings new life?

In my architectural practice, I am working to codify building life-cycles by drawing from preservation. The overall outline is a simplification of one posed in Stewart Brand's thought-provoking book *How Buildings Learn*.[xiv] The process begins with sorting building elements into four categories: structure, building envelope, interior elements, and systems. I have found this to be a workable list that differentiates building components according to their life-cycle.

Preservation teaches firsthand the practical limits of durability. Structural elements can, and really should, be constructed to last for a very, very long time. By code and for life-safety reasons, structural elements must be constructed for *survivability*, that is, the ability to survive fires, earthquakes, and storms. (Oh, add to the list terrorist attacks!) In most cases, when survivability is achieved, almost unlimited durability is achieved at the same time. Doesn't life-cycle design suggest that there should be an intentional relationship between survivability and durability?

On the other hand, building envelope elements are exposed to weathering. Periodic renewal is an unavoidable reality, ranging from simple routine maintenance, like painting, to more substantial reconditioning and selective replacement. Preservationists familiar with the restoration of traditional wood windows know every trick to restore their operation and material integrity with the most minimal means possible: a segment of rotted wood replaced here, a patch of glazing compound there, replace a broken pane with salvaged glass that matches the characteristics of the original glass. Many of us have experience restoring 100-year-old windows through such straightforward means.

For preservationists, it is an absolute mystery why so many "high-performance" windows are designed without any consideration for their renewal. Such systems are sold as maintenance-free. In fact, they cannot be repaired.[xv] For example, today's glazing systems are complex, multi-component assemblies. While their thermal and solar heat-gain performance characteristics may be admirable, window assemblies made out of materials that last for hundreds of years (aluminum, glass) are doomed to early retirement due to "differential durability" problems, for example edge seals that fail in a couple of decades. A 20-year guarantee should not mean that a building element is guaranteed to need replacement in 20 years.

Currently, we are designing our first new-building project using an aluminum window wall system that allows the glazing stops to be removed, exposing the entire internal water management system. All gaskets and seals can be inspected, accessed, and repaired or replaced if needed. Even the frames' thermal break elements can be replaced.[xvi] You see, progress is possible.

Energy Performance

Preservationists must accept the need to improve the energy performance of the existing building stock. We simply cannot ignore the fact that the electrical power that runs our buildings contributes substantially to global warming and climate change. Seeking exemption from this requirement does nothing more than marginalize preservation. We must rise to the challenge. The carbon-neutral goals that have been adopted across a wide spectrum of the green building world are not beyond reach. However, let's be clear that meeting sustainable energy targets will require substantially improving building envelope performance, upgrading the effectiveness of all energy-consuming systems, and converting to renewable energy sources both on and off site.

Far too many preservationists bristle at the mention of using renewable energy at historic sites. Images of solar collectors that are promoted as looking absolutely just exactly like a slate roof immediately come to mind. (Believe me, I've heard it all.) But preservationists should understand more than most that good solutions come from well-integrated design. Our office has installed ground-coupled heating and cooling systems at two National Historic Sites where open land made the requisite well-fields practical.[xvii]

Over the past 20 years, green building practitioners have developed technologies that make changing the energy performance of existing structures achievable. Many preservationists are adopting them today. In my experience, energy modeling is the most powerful one. Energy modeling has become a routine step in our project development protocol. Energy models are simulation tools that predict the energy performance of a building using computers. The characteristics of the building are entered including climate data, building orientation and form, roofing, wall materials, and window sizes and types. The performance characteristics of all energy-consuming systems are input, including mechanical systems, lighting, and plug loads. Finally, operational and interior environmental settings are input. The program predicts energy use around the clock and year. Energy simulations can be calibrated to provide amazing accuracy. Many scenarios can be simulated so that trade-offs between building alterations and system design can be tested.

Over the past few months, our office has used energy modeling to help design two very different preservation projects that serve as revealing examples of its use. The first project is the restoration of Eastern Market in Washington, D.C.[xviii] The energy model showed that implementing a repair-in-kind approach to window restoration did *not* have an adverse impact on the energy performance of the building. Window "upgrade" scenarios were shown to reduce energy consumption by no more than 3 percent, nowhere near justifiable using an LCCA cost-benefit analysis. The second project is the stewardship and greening of the American Institute of Architects National Headquarters Building, also in Washington, D.C.[xix] Quite to the contrary of the Eastern Market example, energy modeling showed that achieving energy goals was, essentially, impossible without making significant upgrades to window performance. Nearly 60 percent of the annual heat loss and gain is directly attributable to the window system. However, this does not necessarily require window replacement. We studied alternatives for achieving the required performance upgrades both with and without window replacement. Energy modeling gives us choices.

A Final Thought

"The earth is not given to us by our parents, it is lent to us by our children."[xx]

My professional immersion in preservation has revealed to me something about our culture that I believe to be of the very greatest importance in the pursuit of sustainability. Our culture is *drunk* on the *new* and *now*. This intoxication clouds our judgment, causing us to profoundly undervalue the legacy of our forbearers. Clearly, preservation itself is a calculated reaction to our culture's insensitivity to the past and to the vandalism that it has perpetrated in the name of progress. I am certain that all preservationists recognize truth in this observation.

Beyond regretting these blows to history's legacy, my deepest concern is that our intoxication blurs our vision of the future. I worry that our culture equally under-appreciates the significance of our actions today on the future; not a distant future, but our children's. As preservation teaches us all to better value the past, it is my hope and prayer that it also helps us to fully awaken to our responsibilities to the future. In my eyes, this is the unbreakable bond between preservation and sustainability.

---

[i] For information about Architecture 2030 founded by Edward Mazria, AIA, go to www.architecure2030.org where his speech laying out the 2030 °Challenge can be downloaded.

[ii] "Green Buildings and the Bottom Line", A Supplement to *Building Design + Construction*, published by Reed Business Information, November 2006, Chapter 3. Financing Green Office Buildings, pages 10-17.

[iii] United States Department of Energy, Energy Information Administration, Commercial Building Energy Consumption Survey (CBECS), 2003 Detailed Tables, Table B1. Summary Table: Total and Means of

---

Floorspace, Number of Workers, and Hours of Operation for Non-Mall Buildings, 2003, can be found on the internet at www.eia.doe.gov

[iv] Arthur C. Nelson, "The Boom To Come, America Circa 2030", *Architect*, Volume 95, Number 11, Mid-October 2006, Hanley Wood Business Media, pages 93-97.

[v] William McDonough and Michael Braungart, *Cradle To Cradle*, 2002, North Point Press, page 4.

[vi] For information about the sustainability program adopted by Interface Carpets, go to www.interfaceinc.com/goals/sustainability

[vii] David Suzuki is a prolific writer and lecturer. The David Suzuki Foundation website is a good source of information about his activities promoting the science of sustainability, at www.davidsuzuki.org

[viii] William McDonough and Michael Braungart, *Cradle To Cradle*, 2002, North Point Press, Chapter 2, Why Being "Less Bad" Is No Good, pages 45-67.

[ix] For a good sampling of recent green preservation articles, see the APT Bulletin Special Issue on Sustainability and Preservation, Volume 36, Number 4, 2005, Mount Ida Press.

[x] Two widely recognized sources for green building case studies are the American Institute of Architects Committee on the Environment Top 10 Green Buildings (www.aiatopten.org) and the United States Green Building Council Leadership in Energy and Environmental Design Green Building Rating System Project List (www.usgbc.org). Both green building lists include quite a few existing building projects including historically designated ones that demonstrate the best practices in green preservation. However, I cannot help but note that neither list specifically acknowledges building re-use and historic projects in their database.

[xi] Google these four projects which present an informative spectrum of green preservation: Draper Hall at Berea College by Sim Van Der Ryn, Jean Vollum Natural Capital Center (Ecotrust headquarters) in Portland Oregon by Green Building Services, California College of Arts and Crafts (former Greyhound Bus Maintenance Facility) in San Francisco by Leddy Maytum Stacy, and Chicago Center for Green Technology by Farr Associates.

[xii] Life Cycle Assessment (LCA) tools are largely targeted at products and, more specifically, the impacts associated with their manufacture and use. The U.S. Environmental Protection Agency (EPA) and National Institute of Standards and Technology (NIST) have developed the Building for Environmental and Economic Sustainability (BEES) software tools for rating environmental performance, in essence the "official" U.S. government LCA tool.

[xiii] In my experience, the most comprehensive LCA system to address entire building projects is the Environmental Impact Estimator (EIE) program developed by The Athena Institute, a Canadian non-profit organization. Athena has applied EIE to two existing building renovation projects, testing contrasting approaches to assessing the value of re-using buildings: "benchmarking" and "avoided impact". It should be noted that even the EIE does not capture the life-cycle implications of *future* building renewal regimens.

[xiv] Stewart Brand, *How Buildings Learn*, 1994, Penguin Books, Chapter 2, Shearing Layers, pages 12-23.

[xv] I have shamelessly borrowed this point from Michael Jackson, FAIA, with the Illinois Historic Preservation Agency.

[xvi] Headquartered in Germany with U.S. manufacturing and distribution, Schuco International KG produces an aluminum window wall, curtain wall, and skylight system that can be taken apart down to the structural frame and fully reconditioned by inserting new gaskets and other weatherizing inserts. Go to www.schuco-usa.com for more information.

[xvii] QUINN EVANS | ARCHITECTS has installed ground-coupled heating and cooling systems at the Monroe School in Topeka Kansas, the Brown vs. Board of Education National Historic Site, and the Ulysses S. Grant National Historic Site in St. Louis Missouri. Ground source systems provide heating and cooling by passing water through a series of wells extending into the earth which maintains a constant temperature year-round only a few feet below its surface. Electricity, generated using fossil fuels or nuclear power throughout most of the U.S., is used only to power pumps and fans. A far greater power need for chillers and boilers is eliminated.

[xviii] QUINN EVANS | ARCHITECTS has prepared recommendations for the rehabilitation of Easter Market in Washington DC, Washington's only remaining 19th-century market building and one of six remaining buildings designed by Adolph Cluss. The energy model showed that adding insulation to the roof is the only envelope improvement that would have measurable results.

[xix] QUINN EVANS | ARCHITECTS has prepared recommendations for the *greening* of the American Institute of Architects Headquarters building designed by The Architects Collaborative (TAC), founded by Walter Gropius. Quite to the contrary of the traditional architecture of Eastern Market, the continuous ribbon windows at AIA make window upgrades a matter of the greatest necessity.

[xx] Soka Gakkai International, *War and Peace, From a Century of War To a Century of Hope*, UN Department of Disarmament Affairs, attributed as a "Kenyon Proverb".