Implementing Plan C – conservation, curtailment and cooperation

NewSolutions

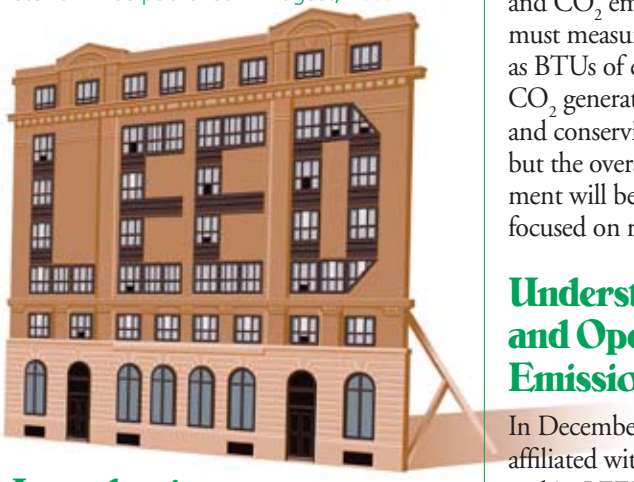
Community Solutions℠

July 2009 Number 19

Special Report: Part 2

LEEDing from Behind: The Rise and Fall of Green Building

Editor's Note: This is the second of three parts of our Special Report. Part 1 focused on the history of the dialogue about LEED energy performance. This issue discussess the additional building costs and related energy performance in LEED construction. It also analyzes U.S. Green Building Council (USGBC) marketing efforts around this topic. Part 3 will suggest options to the LEED rating system, and discuss water, embodied energy, location, etc. It will be published in August, 2009.



Introduction

The preceding *New Solutions* summarized people's concerns and the ongoing debate about the effectiveness of USGBC's LEED building rating system relative to reducing energy use and CO_2 emissions. A core consideration is whether to define green building as more about energy or more about those things that are less easily quantifiable such as toxicity, air quality, storm water, etc. A second question concerns the additional costs to build a so-called "green" building.

I conclude that green building as currently understood and marketed is relatively inexpensive but is also ineffective in reducing energy use and CO_2 emissions. To construct energy-saving buildings that meet the energy use standards of the 21st century will cost more than today's green buildings but will use much less operating energy.

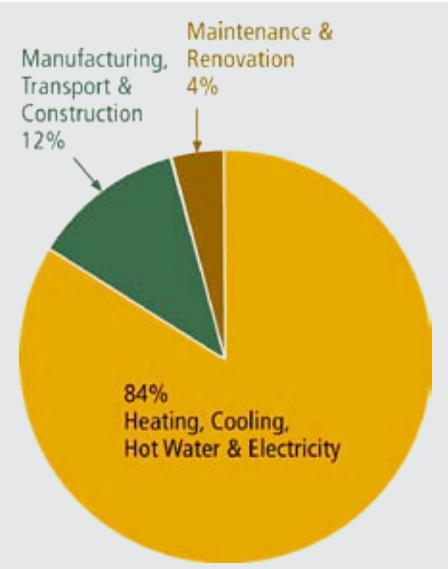
Due to global warming and fossil fuel depletion, it is vital to understand the energy performance of buildings and to separate this issue from other so-called "green" features such as less toxic materials in carpets and paints. "Green" is not readily definable and measurable. Building costs and the potential energy savings in energy and CO_2 emissions *are measurable* and we must measure them in standard units such as BTUs of energy consumed and tons of CO_2 generated. Using less toxic materials and conserving water are positive actions but the overall impact on the environment will be much greater if our efforts are focused on reducing energy consumption.

Understanding Embodied and Operating Energy (and Emissions)

In December 2005 Rob Watson, who is affiliated with the founding of USGBC and its LEED program, responded to Randy Udall's 2005 article "LEED is Broken – Let's Fix It"[1] with an article entitled "LEED Is Not Perfect, But It's Not Broken."[2] Watson says "On the subject of rigor, let's put to rest the canard that LEED buildings are not energy-efficient. They are. We need to abandon the 1980s view that operational energy is the only relevant parameter; it's about 60% of the equation. In terms of energy use involving buildings, their location matters (transportation energy), their water efficiency matters (energy to pump, purify and treat afterward), their landscaping matters (creation of heat islands), and the materials used to build them matter (embodied energy)."

Watson's article brings up a key issue – the relationship of operational energy and embodied energy. An October 2008 report on high performance buildings entitled *Federal R&D Agenda for Net-Zero Energy, High-Performance Green Buildings* includes the following chart (Figure 1):[3]

Figure 1: Typical Building Energy Usage[3]



Ref: World Business Council for Sustainable Development 2007

Figure 1 shows that operating energy (including heating, cooling, hot water and electricity) consumes 84% of a building's lifetime energy use while maintenance and renovation consume 4% and manufacturing, transport and construction take 12%.

A 2008 book, *Energy for Sustainability, Technology, Planning and Policy*,[4] shows building operating energy at 41% of total U.S. energy consumed yearly and building embodied energy at 7% of all U.S. energy consumed annually. When converted to the same ratio as the high performance buildings represented by Figure 1, the percentage is 83% operating and 17% embodied.

These two examples show a much higher number for operating energy (84% and 83%) than the 60% quoted by Watson. The higher numbers for operating energy should not be surprising, but to many they will be. The distinction between embodied energy and operating energy is not commonly understood and

such life cycle analysis is not frequently used in buildings.

LEED's primary focus on materials, water, waste, location, etc., may have been appropriate at the time the USGBC was founded in the early 1990s but fossil fuel energy and CO_2 byproducts are now far more important. Critics of LEED have always been more concerned with energy (and the generation of greenhouse gases) and less concerned with toxicity and pollution from the materials that make up a building.

Watson's allocation of embodied and operating energy does not fit today's reality and may account for USGBC focusing on the materials that make up the building (iron, steel, concrete, aluminum, glass, wall board, etc.) rather than the materials that keep the building functioning (oil, natural gas, coal, uranium). Even the recently revised LEED 2009 rating system focuses on addressing secondary problems (being green) rather than on the primary problems that threaten the world today (energy consumption and CO_2 emissions).

LEED, Additional Construction Costs and Energy Saved

It is remarkable how little effort has been made to determine cost/energy benefit ratios for all aspects of LEED buildings. It took many years for the USGBC to make a first survey of LEED buildings and their estimated energy savings. This survey was partially funded by USGBC and performed in 2008 by New Buildings Institute (NBI). (See *New Solutions 18.*) The survey covered the period from 2000-2006. It was released eight years after the first LEED building was constructed in 2000.[5] A similar survey examining the costs and benefits to achieve the other "green" elements of LEED certification is needed. Energy and Atmosphere accounted for only 25% of the LEED points prior to 2009 and only 32% after 2009.

Greg Kats' Reports – 2003

Much of the limited reporting on performance and cost data for LEED buildings was done by Greg Kats of Good Energies. He authored one of the earliest studies on LEED and green building, published in October 2003, with the title *The Costs and Financial Benefits of Green Buildings, A Report to California's Sustainable Building Task Force.*[6] This report summarized data on 33 offices and schools. Table 1 shows the estimates of additional cost by certification level. The report also included energy savings by certification level, displayed in Table 2.

Another Kats report (also published in 2003) was titled *Green Building Costs and Financial Benefits.*[7] The numbers seem to be identical to those in his first report but include the number of buildings in each LEED category (see Table 3).

Greg Kats' 2003 Reports Update – 2008

What appears to be an update to the Kats data is referenced in a July 2008 report, *Energy Efficiency in Buildings: Business Realities and Opportunities, Facts and Trends Final Report,*[8] prepared by the World Business Council for Sustainable Development (WBCSD) (see Table 4). The referenced data for the information was another Kats report entitled *The Cost and Financial Aspects of Green Building* which I was unable to locate. This version of the Kats study appeared to contain a bit more data. Unfortunately it does not reflect the substantial increase in the number of LEED buildings in the five year period between 2003 and 2008 – the sample size has only increased from 33 buildings to 40 buildings, a relatively small change. *New Solutions #18* (part 1 of this report), "LEEDing from Behind: The Rise and Fall of Green Building"[9] contains four tables that analyze LEED growth. They show an increase from about 100 to about 1,000 certified new buildings in this same time period. To only evaluate seven additional buildings out of the thousand or so certified is to make a very small increase in the sample size.

Apparently most of the 2008 data is from Kats' 2003 report. The reference in the WBCSD report is to "USGBC data-Capital E Analysis" and gives no detail as to where this analysis could be located. The distribution of the updated information is shown in Figure 2. The number of *certified* buildings is the same – eight. Three *silver* buildings were added to the original 18 for a total of 21. Three additional *gold* buildings were added bringing the total to six. And the *platinum* total is now two – only one was counted in the first data set. The weighted average we computed from these numbers is shown in Table 4.

Table 1: Level of Green Standard and Average Green Cost Premium[6]

Level	Additional Cost (%)
Level 1 Certified	0.66%
Level 2 Silver	2.11%
Level 3 Gold	1.82%
Level 4 Platinum	6.50%
Average of 33 buildings	**1.84%**

Source: USGBC, Capital E Analysis

Table 3: Average Green Cost Premium vs. Level of Green Certificationfor Offices and Schools[7]

Level	Additional Cost (%)
Certified (8 bldgs)	0.66%
Silver (18 bldgs)	2.11%
Gold (6 bldgs)	1.82%
Platinum (1 bldg)	6.50%
Weighted Average (33 bldgs)	**1.84%**

Source: USGBC, Capital E Analysis

Table 2: Reduced Energy Use in Green Buildings as Compared with Conventional Buildings[6]

	Certified	Silver	Gold	Average
Energy Efficiency (above standard code)	18%	30%	37%	28%
On-Site Renewable Energy	0%	0%	4%	2%
Green Power	10%	0%	7%	6%
Total	**28%**	**30%**	**48%**	**36%**

Source: USGBC, Capital E Analysis

Table 4: The Green Cost Premium

Level	Additional Cost (%)
Certified (8 bldgs)	.66%
Silver (21 bldgs)	1.91%
Gold (9 bldgs)	2.23%
Platinum (2 bldgs)	6.8%
Weighted average (40 bldgs)	**1.98%**

Table 5: Costs of Green Certification[8]

	Certified	Silver	Gold
Energy Efficiency	8%	30%	37%
On-Site Renewable Energy	0%	0%	4%
Green Power	10%	0%	7%
Total Efficiency Gains	**18%**	**30%**	**48%**
Related Cost Premium	**1%**	**2%**	**2%**

Source: USGBC, Capital E Analysis

Table 2 (which is the second figure from the first Kats report) was also replicated in the WBCSD report, but with some significant changes. This is shown in Table 5.

The differences between Table 2 and Table 5 include:

- The column labeled "Average" in Table 2 has been removed in Table 5.
- "Energy Efficiency (above standard code requirements)" in Table 2 has been changed simply to "Energy Efficiency" in Table 5.
- "Total" in Table 2 has been changed to "Total Efficiency Gains" in Table 5.
- A row "Related Cost Premium" has been added in Table 5, with no source given.
- The Energy Efficiency of *certified* has been changed from 18% in Table 2 to 8% in Table 5. This results in a change in the Total Efficiency Gains row.

The WBCSD report notes that the table "summarizes the relationship between LEED criteria and cost. It shows that the average cost to reach 18% improvement in energy efficiency, incorporating green power (photovoltaics or wind), is only 1%. Incorporating on-site renewable energy gains an efficiency of 48% at only a 2% premium." It is not clear where the 1% number comes from but the 2% number is close to the 1.84% and 1.98% of Tables 1 and 4. Why the *certified* energy efficiency changed from 18% to 8% is not clear. The charts that contain this data reference USGBC and Capital E. That the Kats study is still being quoted today, six years after publication, supports the view that cost information studies are few and far between.

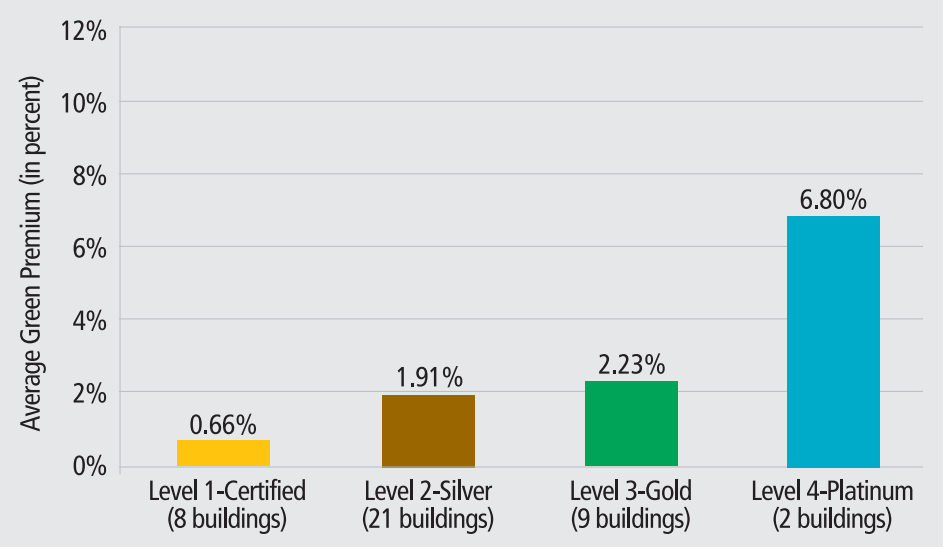
Kats Latest Studies

The results of a new study about green building entitled *Greening Buildings and Communities: Costs and Benefits* were announced in November 2008 but the report itself will not be available until sometime in 2009 – to be published as a book; thus report data was not available for analysis at the time of this writing. A presentation on the report is available on the Good Energies web site.[10] Kats is listed as the lead author and USGBC is a sponsor.

A press release is available on the Good Energies web site which provides performance data from the study.[11] It states that green buildings cost roughly 2% more to build than conventional non-green buildings and reduce energy use by an average of 33%. A footnote says the median increase in cost is 1.6% and the mean increase in costs is 2.5%. Possibly the "roughly 2%" comes from averaging these two numbers. (Much controversy was raised about the NBI report when mean values were compared to median values. It is important that any such results about LEED be provided in a consistent way and in a form accepted for scientific work.) The average cost of 2.5% in this latest report by Kats is slightly higher than his earlier estimates of 1.84% to 1.98%. The sample size has gone from 33 to 40 to 150. This is still a small sample considering the thousands of LEED-certified buildings. The report includes other green buildings that are not LEED-certified.

This newest report by Kats was discussed in a *New York Times* article in November of 2008 entitled "Debating the Green Building Premium."[12] Author Kate Galbraith notes that the report was funded by the USGBC and "other real-estate and architectural groups." Galbraith quotes Austin architect Peter Pfei as saying "My experience is that the features built into a home or building that are green-related (i.e., make it more durable, healthy, energy-efficient) can add as little as 1% to as much as 5%." Galbraith says that the study found the average energy savings to be 33% a year, which she noted was higher than some other recent studies.

Figure 2: The Green Cost Premium[8]



Source: Kats, Greg. CapitalE. The Costs and Financial Benefits of Green Buidlings.

It is important to remember that all LEED energy savings mentioned are projected and estimated since LEED does not require any measuring of energy use after construction. Nor does it require the testing of any other point-earning elements which are part of certification (such as the use of bike racks). Basically, the numbers and percentages are from computer models of the building's design. Once the design is modeled and submitted the buildings are certified – actual readings of energy bills after construction and comparing the numbers to computer models is not typically done. USGBC did contract with NBI to survey energy consumption of LEED-certified buildings for its 2008 report but actual measurements of use were not taken by NBI. Information provided was from building owners.

Kats makes many references to energy savings percentages in his 2003 report:

- On page 19, he says "On average, green buildings use 30% less energy than conventional buildings." He further states that a detailed review of 60 LEED-rated buildings shows that, when compared to conventional buildings, they are "On average 25-30% more energy efficient compared with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1-1999 standard and, for California buildings, Title 24 baselines)."
- On page 20, he says "These California LEED-rated buildings on average demonstrate energy efficiency commensurate with the 25-30% national average reduction for green buildings."
- Then, on page 23, Kats says, "LEED places a high priority on building energy performance…. LEED-rated buildings, on average, use 30% less energy than those that meet the standard energy requirements of Title 24 (for California buildings) or ASHRAE 90.1 (in the rest of the country)… On a weighted average basis, green buildings are 28% more efficient than conventional buildings…"
- Other comments, on page 25, include "As indicated…average green building use of conventional energy (and the resulting associated emissions) is therefore on average about 36% lower than conventional buildings…" and "Evaluation of LEED certification documentation for over a dozen buildings, including four California buildings, indicates an approximate average reduction in energy use of 30%."
- On page 27, he notes "As discussed above, green buildings provide an average reduction in energy use, as compared with minimum energy code requirements."
- On page 30 Kats says "green building use of conventional energy (and the resulting associated emissions) is on average about 36% lower than conventional buildings."

Kats' 2003 report was written very early in the history of "green" building and LEED. The sample size was small. It discusses cost, energy, emissions and productivity and, even though outdated, may be a model for a wide spectrum of green capabilities. Possibly this is why it continues to be quoted in more recent reports. Unfortunately, the average numbers are typically reported as a range and, since the data sets are small, it is not clear why a range of energy savings is given rather than a single number.

In a 2007 article "Buildings That Breathe: Green Construction Is Coming of Age"[13] Kats is quoted as saying "Green construction often adds less than 1% to the cost of a conventional building, but the payoffs can include energy costs cut by one-third." This differs from his own report data that shows the increased cost at near 2%. Many LEED supporters seem to want to convince the public that the additional costs for green building are very low. This is unfortunate since the data Kats provides does not substantiate the statement and adds to the credibility issue of overly optimistic statements that surround LEED.

Kats and the USGBC

In the first 2003 report[14] Kats' background is given, including two statements concerning his relationship to the USGBC.

The opening page includes the following statements: "This report was developed for the Sustainable Building Task Force, a group of over 40 California state government agencies.... This collaborative effort was made possible *through the contributions of Capital E*, (all italics mine) Future Resources Associates, Task Force members, *and the United States Green Building Council*." The principal author, Greg Kats, is also the founding Principal in *Capital E*, "a national green technology deployment and strategy firm."

Kats' second 2003 referenced report entitled *Green Building Costs and Financial Benefits* includes the information that "Mr. Kats served from 1996 to 2001 as the Director of Financing for the $1.1 billion dollar Office of Energy Efficiency and Renewable Energy at the U.S. Department of Energy.... He is Chair of the Energy and Atmosphere Technical Advisory Group for LEED and serves on the LEED Steering Committee."

"This paper reviews a major recent report on the issue of green building costs benefits, "The Costs and Benefits of Green Buildings," Kats et al., October 2003. *Led by Capital E,* the Report was prepared *in partnership with the U.S. Green Building Council* and California's Sustainable Building Task Force for 40+ California state agencies."

These same credentials are reiterated on the Good Energies web site,[15] where it also states that Kats is "currently Director of Climate Change Policy and a senior leader in *Good Energies' Green Buildings and Energy Efficiency investment cluster*...".

Given his apparently extensive involvement with USGBC and its LEED program, one begins to wonder if Kats should be viewed as a consultant for USGBC and its business interests rather than as an independent researcher attempting to provide an impartial perspective on LEED energy savings and associated costs.

I suggest giving him the benefit of the doubt and waiting for the announced appearance later this year of *Greening Buildings and Communities: Costs and Benefits*, of which Kats is listed as the lead author, and to review that publication against the background of his earlier reports.

Other Studies

In 2003, Northbridge Environmental Management Consultants (NEMC) prepared an analysis of LEED costs, both soft and hard, for the American Chemistry Council.[16] Soft costs are those

activities associated with LEED that are not construction costs and include the additional design efforts by architects and design engineers, organizing the project, documenting compliance with the various criteria selected, energy modeling for the project, and LEED application fees. Hard costs are the actual construction costs.

The report noted that an appropriate range for the additional costs of "greening" a construction project (e.g. LEED certification) is 3-8% higher construction costs plus 1.5-3.1% increased soft costs, giving a range of 4.5-11.1% for increases in hard and soft costs combined. These numbers are much higher than Kats' numbers.

In 2004, Steven Winter Associates developed a LEED Cost Study for the U.S. General Services Administration (GSA) to estimate the costs of developing "green" (LEED-certified) federal facilities.[17] The report included a review of both the hard (construction) costs and soft (design, modeling, etc.) costs implications of achieving *certified, silver*, and *gold* LEED ratings for two GSA building types, using two established design standards as a point of comparison.

The soft costs are defined in that report as those activities associated with LEED that fall outside the range of construction costs and are similar to the five criteria in the NEMC analysis. The two building types studied were a new 262,000 square foot mid-rise federal courthouse and a mid-rise 306,600 square foot federal office building modernization.[18] Table 6 summarizes the results for the construction costs only. Soft costs are not included. There are low cost and high cost columns to provide a range for each certification level.

In July 2004 a report *Costing Green: A Comprehensive Cost Database and Budget Methodology*[19] compared LEED proposed buildings to existing buildings. An update to this report was provided in July 2007 in a report entitled *Cost of Green Revisited.*[20] Both reports implied that there was no additional cost for green building. The evaluation methodology was unclear and it appears the comparison was between actual buildings and proposed LEED projects, which were labeled "LEED seeking." It is also unclear if the cost data was for actual buildings or for estimates of costs before LEED certification was granted. Both of these papers were prepared by the Davis Langdon construction consulting company. One of the key authors for the David Langdon reports was Lisa Matthiessen, who was recently selected to be Vice Chair of the US Green Building Council's LEED Market Sector Committee. [21]

In 2008, an important performance contribution was added by GSA in a report called *Assessing Green Building Performance*[22] which showed 26% less energy use (65 kBtu/sf/yr vs. 88 kBtu/sf/yr) and 33% fewer CO_2 emissions (19lbs/sf/yr vs. 29lbs/sf/yr). It is noteworthy that GSA showed the data in terms of Btus and pounds of CO_2 per square foot. This is superior to using green points or Olympic medal labels. (Adding a consideration of location, such as heating degree days, would also be useful.)

In late 2008, Rob Watson (quoted at the beginning of this *New Solutions*) took a strong stand on LEED performance. Watson has enormous credibility with LEED, being touted in the press as the "Founding Father of LEED." He was national Steering Committee Chairman for LEED between 1994 and 2005. His *Green Building Impact Report 2008*[23] concludes that LEED buildings consume 25% less energy than comparable commercial buildings. He refers to the NBI report, saying that "the NBI report has been criticized on various grounds, some of which, in our opinion, are valid and others less so." Possibly this is an indirect acknowledgement that Henry Gifford's work has value. (See *New Solutions 18* for details on Gifford.)[24]

Current Payback Studies for Green Buildings

The energy savings debate took a new turn in February 2009 with the publication of a *New York Times* article "Can Green Buildings Pass Payback Tests?."[25] The topic was payback time rather than energy savings. In the article, Saqib Rahim describes a study called *Achieving 30% and 50% over ASHRAE 90.1-2004 in a Low-Rise Office Building*[26] done by ConSol, a building consultant firm. It was prepared for NAIOP, the Commercial Real Estate Development Association, which is a leading organization for developers, owners and related professionals in office, industrial and mixed-use real estate.

NAIOP provides industry networking and education, and advocates for effective legislation on behalf of its members. The report stated that 30% and 50% improvements in energy efficiency over code were not financially feasible for most new, Class A office construction. It said that developers striving for the 30% target would not recoup the cost of their initial energy efficiency investments within a 10-year period. Energy modeling was used to obtain these numbers.

In a March 2009 blog article entitled "Green Building Industry Apoplectic Over NAIOP Commercial Energy Efficiency Study,"[27] author Stephen Del Percio discusses some of the responses to the report. He quotes Ed Mazria as saying it was "meant to confuse the public and stall meaningful legislation, insuring that America remains dependent on foreign oil, natural gas and dirty conventional coal," and cites Lloyd Alter of Treehugger saying the report is "one of the dumbest studies that has crossed our screen in a while."

Del Percio notes that the NAIOP study concluded that the best possible scenario for energy efficiency improvements to a hypothetical 4-story, 95,000-square-foot office building is 23% over the ASHRAE 90. He says that the NAIOP study

Table 6: LEED Construction Cost Impacts[18]

	Certified 1a	Certified 2a	Silver 3a	Silver 4a	Gold 5a	Gold 6a
	Low Cost	High Cost	Low Cost	High Cost	Low Cost	High Cost
New Courthouse	-.4%	1.0%	-.03%	4.4%	1.4%	8.1%
Office Modernize	1.4%	2.1%	3.1%	4.2%	8.2%	7.8%

* Construction cost estimates reflect a reference date of October 2003 (GSA FY04) and a reference location of Washington, DC.

evaluated a handful of energy efficiency measures as implemented across the same building type in three different U.S. climate zones in order to determine the feasibility of 30-50% reduction targets over the ASHRAE 90.1 standard.

He further notes that the energy model used in connection with the study considered enhanced wall and roof insulations, varying levels of exterior glazing, efficient windows, reduced air infiltration, reduced lighting power densities, efficient HVAC equipment, and photovoltaic electricity energy generation. Payback periods for the same building in Chicago, Baltimore and Newport Beach were respectively 8.8 years, 11 years and 12.2 years. NAIOP president Thomas J. Bisacquino is quoted as saying that "with the results of achieving higher efficiency targets differing so greatly across climate zones, the study reveals that a 'one-size-fits-all' approach to mandatory energy reductions does not work in legislation or other mandates. It is important that policymakers and others realize the economic consequences that imposing mandated targets will have on the development industry."

Del Percio reports that ConSol used the Department of Energy's EnergyPlus Version 2.2 simulation tool in order to derive its results and thus the study was based on a projection and not actual data. He notes that studies done by some of the organizations that decried the NAIOP study have also been heavily criticized, and referenced the 2008 NBI report which claimed that LEED buildings performed 25% better than comparable conventional buildings with respect to energy efficiency. He also points out that the USGBC issued a statement in response to the NAIOP report saying LEED-certified buildings are "proof-positive that you can achieve 30% and greater energy efficiency using integrated design with little or no additional first costs."

Del Percio says that the NAIOP study may be particularly useful to policymakers who are considering mandating the 30-50% improvements in efficiency that the study was specifically contemplating. He goes on to say that if those improvements are not possible, or are more difficult than many believe, design professionals, contractors, and consultants may be exposing themselves to significant liability without sufficiently protective language in their construction agreements. Del Percio concludes that until we get studies that are grounded in actual performance-related data, it is dangerous to advocate for policies that are based on energy models.

In a March 13, 2009 response to Del Percio's paper, Ujjval Vyas also criticizes the way many of the studies have been undertaken. He says that a good study should have robust and relevant data sets and a coherently structured methodological approach, both of which must be transparent. He notes that the studies by Greg Kats so often cited clearly lack these basic elements, making them difficult to understand or evaluate. Vyas also says that the 2008 NBI study put out under the auspices of the USGBC suffers from fatal methodological flaws.

It is not clear how financial payback should be factored into an analysis of energy performance. Much of the payback for green buildings comes from operating energy savings. Possibly the less than robust view of payback time has something to do with building owners' actual experience of the dollar savings from LEED certification, which may conflict with the optimistic numbers supplied by USGBC and its supporters. Payback is also a cultural question. People do not compute paybacks on cars, kitchen remodels or TVs. However, the term often seems to show up in ways that discourage energy-efficient building projects, which is rarely the case with other consumer expenditures.

LEED versus Energy Star Buildings

A further study published in March 2009 provided some disconcerting conclusions. This was reported by Stephen Del Percio in a paper on his web site entitled "RICS Study: No Premium for LEED-Certified Commercial Office Buildings,"[28] Del Percio notes the purpose of the study was to determine whether investors are currently willing to pay a premium for green

"until we get studies that are grounded in actual performance-related data, it is dangerous to advocate for policies that are based on energy models."

(Energy Star and LEED-certified) commercial office buildings.

The study's authors identified 1,360 buildings – 286 LEED-certified, 1,045 Energy Star-certified, and 29 certified under both systems – and obtained complete building characteristics and monthly rents from CoStar, a commercial real estate information company, for 649 of them. Conventional buildings equivalent to those in the study were obtained from nearby office buildings in the CoStar database.

Del Percio quotes from the study concerning LEED and Energy Star buildings, "the type of label matters. We find consistent and statistically significant effects in the marketplace for the Energy Star-labeled buildings. We find no significant market effects associated with the LEED label. Energy Star concentrates on energy use, while the LEED label is much broader in scope. Our results suggest that *tenants and investors are willing to pay more for an energy-efficient building, but not for a building advertised as 'sustainable' in a broader sense*" (italics mine).

Del Percio also notes that the results suggest that the LEED rating has no statistically significant effect upon commercial rents, but the Energy Star rating is associated with higher rents (which would tend to make Energy Star features a prudent investment for developers).

This may not be unique. In another March 2009 article entitled "Investigators: Green school claims oversold"[29] by Susannah Frame, Tacoma Washington's Gray Middle School was evaluated relative to

its energy performance. Gray was one of about 35 schools built in the state using new guidelines for high performance green buildings. A video about the 35 school buildings prepared by the Washington state Department of Ecology and the Office of the Superintendent of Public Instruction says it's a "fact" that green buildings are "a wise business choice for cost conscious schools. Relatively small increases in design and construction costs, usually less than 2%, ultimately bring 10-to-15% reductions in long-term operating costs."

The article points out that in some large districts in the state it was reported such buildings had cost between 3% and 7% more, rather than 2%. Frame reported that in the state video a Spokane School District official says Lincoln Heights Elementary School would save about $40,000 a year in utility operating costs. She states that the actual numbers were closer to $15,000 a year.

LEED – The "Low or No" Cost Approach

Jerry Yudelson is a strong LEED supporter and runs a green consulting business that trains LEED professionals.[30] He was one of the earliest LEED trainers in the country, having trained more than 3,500 people in the LEED system since 2001. He wrote *European Green Building Technologies: A Report on Research Conducted for the Mechanical Contractors Education and Research Foundation*[31] in which he notes, "Continued challenges with the availability of fossil fuels and the impact of global warming are pushing building owners and developers toward projects that have a much higher level of energy efficiency. The challenge is that this efficiency needs to be provided, while at the same time supporting the overall building project goals including architectural, operational and occupant comfort. The result is the need for a "high performance" building where the building systems are pushed to deliver more, *without necessarily costing more*"[32] (my italics).

This statement bears reflection. Why doesn't a high performance building – one that is more efficient and so less costly to operate – support a higher cost? Ordinary people know that better insulation and better windows and a more efficient furnace will provide better energy performance and will expect a higher original purchase price. Should commercial buildings be any different? Or does Yudelson have some other reasoning in mind?

In the 2008 WBCSD report previously referenced, *Energy Efficiency and Buildings: Business Realities and Opportunities, Facts and Trends, Full Report,*[33] chapter four is devoted to the topic, "Barriers revealed by Perception Research." The summary for this chapter says, "Some building professionals are willing and ready to lead green building progress but many are skeptical, uninformed or unenthusiastic. They tend to underestimate the contribution of buildings' energy to climate change, and overestimate the cost of saving energy. Know-how and experience is lacking, as relatively few professionals have actually been involved in green buildings. Four key deficiencies create barriers to adoption of green building practices: personal know-how, business community acceptance, corporate conviction and personal commitment. There is a lack of leadership on sustainability in building."

The report describes a survey of about 1,500 owners, property managers and financial people. The consensus was that a 17% cost premium was necessary to achieve a green sustainable building. (As is often the case, neither the terms green or sustainable were defined). The report implies that owners, financiers and builders do not understand how inexpensive green is. It says that the planners, engineers and architects take the contrary position – they know "going green" is not expensive. It suggests that those who consider 16% (10% for developed countries) to be the additional cost for a green and sustainable building are ill informed.

As noted earlier LEED advocates tend to reject the high percentages and argue for smaller numbers. But a 17% cost premium may be worth it to save energy expenditures during the lifetime of a building.

In his book, *The Green Building Revolution,*[34] Yudelson repeats the refrain that many people believe green building will cost more but that green building does not necessarily have to cost more. In the chapter on the future of green building, he noted, "Still there are barriers …some of them related to real life experiences and the rest to the perception in the building industry that green buildings add extra costs." He later repeats the comment about extra costs and adds, "This is surprising because senior executives…have held positive attitudes about the benefits and costs of green building…it is surprising that the top obstacles cited in the Turner survey are perceived higher costs."

In the chapter on costs of green building he again notes "The biggest obstacle for green building is the perception that they cost more" and "In this study, the authors concluded that there was no statistical significant evidence that green building costs more per square foot than conventional projects."

Was there evidence that they did *not* cost more? In these statements Yudelson implies some kind of axiom – "a green building should not cost more." This is important and key to understanding how green building is marketed. In reality, however, if buildings are truly effective in *substantially* reducing operating energy use, their initial cost *will* be greater. (Over time, the incremental costs may decline as better technologies focused on energy savings are developed and trades people improve their skills in making tight, efficient buildings.)

In a January 2009 article entitled "Data dispels 'green' building cost myths"[35] published on the USGBC web site, Elena Babaeva notes that there is a perception that green buildings are more expensive than traditional ones and refers to a California study (not referenced) that most developers estimate the costs of building LEED-certified buildings to be 10-15% higher than conventional buildings. Greg Kats has recently made the same point, noting that green buildings cost less than 2% more (back to using the median rather than the average) and labeling the unpopular 17% cost premium "public misperception."[36] He references the opinion survey by the World Business Council for Sustainable Development, discussed previously. But it is not accurate to call the

17% estimate "public misperception." This number comes from a survey of professional investors and owners, and it cannot easily be dismissed.

This theme of extremely low cost (or no extra cost) green buildings is so common from LEED advocates that it deserves close inspection. Those who promote this theme are unconsciously dividing the building community into two camps – the "green is easy" camp and the "green is not so cheap" camp. On one side are green architects, green engineers, LEED AP consultants and LEED training businesses. The general conclusion that comes from reading their estimates of cost premium and energy performance for LEED buildings is that a 0-3% cost increment achieves a 33-55% energy savings. On the other side are the investors, owners and builders who, according to the Turner survey, estimate a 17% cost increment. But it is the investors who finance the buildings, the owners who have to rent and maintain them (and pay the heating and cooling costs) and the builders who have to bid and build them.

This dichotomy has persisted for decades. Whenever a building is designed by one group of people (architects) and built by another group (builders) different views exist. Architects specify a feature and estimate a price. But the final price is set by the builder, the person who has the experience and must bid the job – and pay for his or her bidding errors. Anyone who has ever had a home built experiences this. The architect estimates the price of a feature and the builder bids a higher price. Finger-pointing may follow and the owner is never really sure if the architect is under estimating the cost or the builder is over-estimating.

What's Up?

LEED supporters are typically "puzzled" as to why builders don't bid what they say the additional green features should cost. Builders, by temperament and experience, are suspicious. They will evaluate the green requirements and will often quote a price higher than that estimated by architects or LEED AP professionals. Then the sighs and "puzzlement" of the designers and engineers follow, underlain by an unspoken implication that the builder is unintelligent or unscrupulous.

This is exacerbated by the vagueness of the design specifications for "going green." For some, green means energy efficiency and that means tighter and thicker envelopes with more and better insulation as well as higher quality and higher cost windows. It also means a higher performance and higher cost HVAC system. But for the LEED proponent it may mean only a bicycle rack or a special paint.

Furthermore, owners and builders may well be skeptical of the LEED energy savings claims. They may have done extensive due diligence regarding energy savings achieved by LEED buildings and other high performance buildings. They may think that those who argue that a 2-3% investment will yield up to 35-55% energy savings have insufficient evidence. They may have experience in building a truly energy-efficient structure but lack the knowledge to build a "green" building when energy efficiency is removed from the equation.

Arguing about the difference of opinion will do little good. Instead, well-documented case studies, which are few and far between at this point, need to be done in an objective manner. Although some newer energy-efficient products and materials may not have higher initial costs, builders may still reasonably resist implementing them because of the additional time required to train workers to install them. And until a builder gains experience with these energy-efficient materials and products, they will be considered risky. There is always higher cost involved with learning new techniques and changing practices.

As an ex-builder, it is hard for me to consider any significant improvement to a building that does not add construction cost. Such cost may be very worthwhile and in future times, when energy is very expensive, will become even more important. But insisting there is no cost increase or that the additional cost is inconsequential appears to be "greenwash." I recently completed a deep energy retrofit of an existing building, planning for a budget of 30% of the cost of a new building and going 50% over that. This is the cost of gaining experience.

Why do the USGBC and other LEED advocates continue to insist that green buildings with significant energy savings do not "have to cost more?" One possibility is that if energy-efficient green buildings do cost more (and maybe significantly more), then fewer owners and builders would take the financial risk, being unsure of a market. If this is correct, the appropriate public policy response may be government intervention. When new requirements are placed in the building code the playing field is leveled since all builders must provide the feature and thus the bidding risk is avoided. If LEED promoters acknowledged that it actually does cost more to be green (let's say 7-10% for dark green rather than 0-3% for light green) and voluntary participation was not forthcoming, then pressure might build for enforcement by new building codes – which would probably be strongly resisted by the building industry since the industry is conservative and, like the car industry, resists government environmental standards.

However, our situation is grave. Global warming demonstrates that resistance to environmental regulation is now dangerously short-sighted. Such resistance is a pattern of the past with many industrial products, including air bags in automobiles or miles per gallon standards for car engines. Today new financial requirements are being implemented in response to the public harm done by the failure of the financial industry to regulate itself. The U.S. building industry, both designers and builders, have not done a good job of protecting the public against CO_2 emissions from buildings. Government legislation may be the only solution.

The issue of investing in the building to save energy has been part of green building for a long time. In a 2003 article (early in the LEED program) "Not Building Green Is Called a Matter of Economics"[37] author Michael Brick says that commercial developers have not adopted the principles of what is commonly called green or sustainable building because a compelling case demonstrating the economic rewards

has not been made, according to specialists in real estate, finance, design, construction and environmental health and safety.

He notes that, "A movement is under way to promote green development as economically compelling, complete with a trade organization that sets standards and awards certifications to buildings under the Leadership in Energy and Environmental Design program administered by the private U.S. Green Building Council. This amounts to the early stages of an effort to create a marketable brand of buildings." He further says, "And the Green Building Council's certifications, created as a marketing tool for developers and building owners, have even in their infancy become less than compelling to their intended audience, corporate tenants, according to brokers and developers across the country." He then quotes Edward W. Caulkins, a board member of the Green Building Council as saying "It can be very costly, and at the end of the day, you get a plaque."

The continued debate has become more acrimonious. The NAIOP and CoSol study is the most recent example of these differing world views. LEED has accommodated the staid slow history of the building industry and has not risen to the planetary challenge.

Greenwash

Greenwash is a derivation of the word whitewash, which means to cover up or to exonerate by means of a perfunctory investigation or through biased presentation of data. Greenwash is a term used to describe the practice of people and companies overstating or misrepresenting ideas or products to persuade the public that their products and policies are "environmentally friendly." Typically it includes "puffery," a legal term that refers to promotional statements and claims that express subjective rather than objective views, such that no reasonable person would take them literally. An example might be Charles Lockwood's point that LEED is "the best thing since the skyscraper." This is not to be taken literally. But there are statements that are less clear such as "it costs no more to be green" that could be puffery in the mind of the speaker but taken literally by a listener.

To say that LEED buildings are greener than non-LEED buildings disguises both the seriousness of the problem and the small changes that LEED really aims for.

How has LEED sold itself? Jerry Yudelson opens his 2008 book *The Green Building Revolution*[38] with an essay by USGBC president Rick Fedrizzi. It is filled with excited language, beginning with the first sentence, "A revolution is going on all over this land, and it's about time! It is transforming the marketplace…" Fedrizzi further says, "To our delight and somewhat to our surprise, by 2006 LEED had taken the country by storm." In the remainder of the introduction he says energy savings are in the range of 30-55%. (The reader should know by now that the most recently quoted numbers [many from USGBC data] are closer to half that range).

Jerry Yudelson continues the puffery when he writes, "Green building …is the fastest growing phenomenon to hit the building industry since the Internet." The word "revolutionary" is included in most of the titles of his book's chapters. Yudelson writes, "The green building revolution is sweeping across not only the United States but most of the world." (Under the legal definition of puffery, none of these statements need be true). The 55% energy savings claim can be made under the rubric of "puffery," while the NBI report gives savings closer to 25%, according to LEED's "father," Rob Watson.

Deciding if LEED has a high greenwash component is very important. Obviously many energy experts, including Henry Gifford and Joe Lstiburek (who both express very serious concerns about the issue) would say that it does. This is not unexpected from those who take climate change seriously. The USGBC LEED has failed to adequately address this issue of setting such low energy savings goals.

USGBC seems to be following the model of the car companies, oil companies and others who oppose change to our way of life, calling for industry self-regulation and constantly fighting government regulation. USGBC, and others speaking for LEED, have not set high standards for honest communication, nor do they seem to want to make any significant departure from business as usual. The LEED approach is acknowledged to be a compromise position – being for "market transformation" means taking a "go slow" attitude and builds in a willingness to ignore external forces that indicate the need for rapid change.

It is timely to recall Lstiburek's paper whose title began with the word "Mis-LEEDing." Using the LEED ratings system to confuse the public is a tragedy. To say that LEED buildings are greener than non-LEED buildings disguises both the seriousness of the problem and the small changes that LEED really aims for. The use of the sports-oriented certification ratings rather than a scientific terminology which implies specified measurements, is clearly a choice to mislead.

USGBC officials contend that they are trying hard, listening to critics and improving the program. They argue that they have brought "green building" to the consciousness of the American people and the government. But their messages, such as "it's easy being green" and "it costs very little extra to be green, if anything," are misleading and overly simplify a more complex problem.

Such messages have confused the public and allowed the industry to set the parameters of change far too low. More importantly, they impede the more substantial efforts of others to reduce building energy use. USGBC criticizes its opponents and continues a path that leads to incrementalism, gradualism and tokenism. As long as LEED takes the position of being the industry leader in environmental considerations (with the prestige, power and good jobs that come with leadership) but avoids pushing for significant changes that are needed now, they are little different than

car companies who put green roofs on their SUV manufacturing plants.

More Greenwash

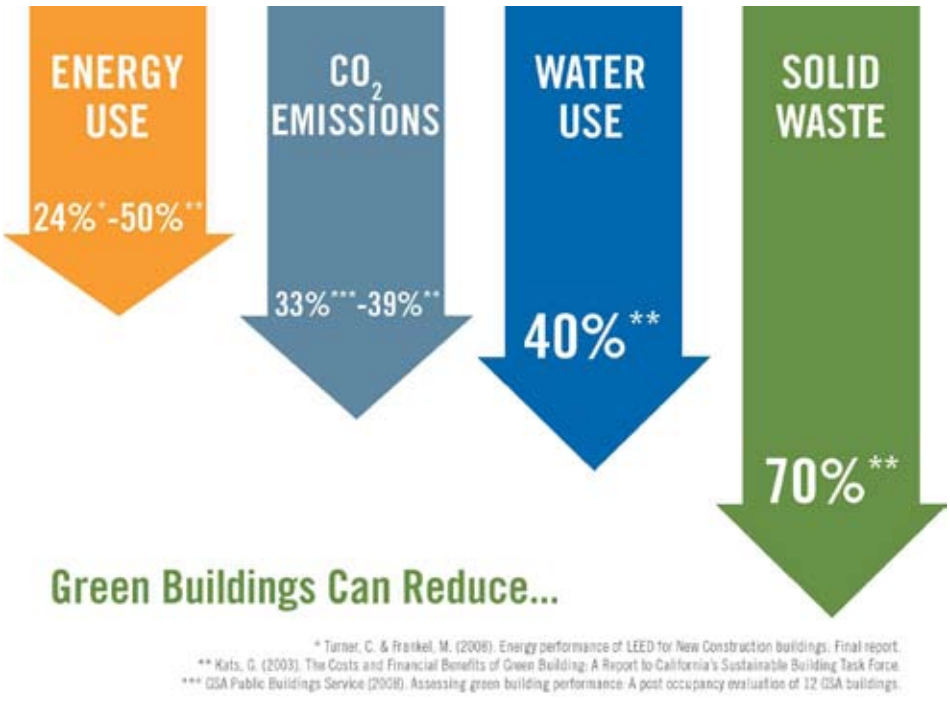
Many LEED supporters seems to have accepted and now defend the 2008 NBI report that began the performance controversy. But what is its stated position on energy savings? In May, 2009 I reviewed a presentation, "Building Impacts – Why Build Green?"[39] on the USGBC web site. It contained a chart showing energy, CO_2, water and solid waste reductions achievable with LEED. Figure 3 shows that chart. (Since the lettering at the bottom of the chart is difficult to read, it is reprinted in a larger, readable size directly below the graphic).

The Energy Use column shows a reduction of 24-50%. An asterisk next to the 24% references the 2008 NBI report. A double asterisk next to the 50% references the 2003 Kats report, which has been discussed in detail earlier. In that report, Kats gave a set of values that provide a percentage range from the mid-20s to the mid-30s. But the USGBC is using this reference as a source for its 50% number. Lower numbers than those presented by Kats were also given in the referenced reports for the other three categories (CO_2, water use and solid waste) that are displayed in the graphic.

In this figure, the referenced reports have not been accurately represented. This will mislead people who do not carefully check the sources.

Watson's *Green Building Impact Report 2008* (previously referenced) covers the LEED period through 2008. It claims to provide "the first-ever integrated assessment of the land, water, energy, material and indoor environmental impacts of the LEED for New Construction (LEED NC), Core & Shell (LEED CS) and Existing Buildings Operations and Maintenance (LEED EBOM) Standards." But this 24-page report is less a survey of the LEED history than a projection of its future success. In that sense it differs from a conventional yearly report for a program or company which normally shows the recent history of important statistics. One key element is shown in Table 7.

Figure 3: Reductions with LEED[39]



*Turner, C & Frankel, M. (2008). Energy Performance of LEED for New Construction Buildings. First Report

**Kats, G. (2003). The Costs and Financial Benefits of Green Building: A Report to California's Sustainable Building Task Force

*** GSA Public Buildings Service (2008). Assessing green building performance: A post occupancy evaluation of 12 GSA buildings.

Table 7: Cumulative Square Feet (millions) of LEED Certifications, 2008[23]

Certified LEED NC	240
"Built-to" LEED NC	223
Certified LEED CS	17
"Built-to" LEED CS	37
Certified LEED EB	38
"Built-to" LEED EB	13

This information is from the main chart on page five which shows square footage. There are two categories – Certified and "Built-to" LEED. The total Certified numbers add up to 295 million square feet and the total "Built-to" numbers add up to 273 million square feet. The Certified number is similar to the number given in the "About LEED" presentation on the USGBC web site which showed certifications up to April 2009. Both are approximately 295 million square feet.

The appendix of Watson's report includes a definition of "Built-to" LEED which says, "In evaluating the impacts of LEED we also created a category we call 'built to LEED.' Generally these are projects that register, but don't certify – approximately 25% of registered projects, according to our research. While these buildings do not achieve the environmental impacts of LEED Certified buildings, their benefits are not zero and in aggregate they are not trivial. Though we do not have measured figures to corroborate the impact of LEED on these buildings, we assume that their achievement is half that of a certified project."

This is confusing. Buildings that have not achieved certification are nonetheless credited on the basis of an unconfirmed assumption even though no measurements were actually made. Although no data is provided to justify this, by doing so the amount of LEED-certified square footage has been doubled.

A number of building professionals, many of whom are experienced in build-

ing "high performance" buildings, have expressed concern about USGBC's lobbying efforts to make LEED certification part of national and state building codes. A few municipalities have already taken that step.

Summary

The LEED program has a significant credibility problem. LEED and its supporters seem unable to deal directly and transparently with energy consumption and CO_2 generation questions. The LEED effort began before the recent energy crisis and the growing climate crisis. There is nothing wrong with the original intention – only a question about the USGBC's vagueness in using "green" and its rating system instead of actual measurable energy data.

In my opinion, USGBC should not continue to quote unsubstantiated numbers like 50% energy savings is more than unfortunate. LEED staff should use the same approach to measurements that scientists use. A mean and a median are single numbers. To use ranges that confuse the data references is unacceptable. And to push LEED as a standard for U.S. building is to give trade groups the power to set the nation's standards, groups which are not focused on the major problems of our buildings – energy consumption and CO_2 generation. A different approach is needed.

– Pat Murphy

References

1. "LEED Is Broken-Let's Fix It" by Randy Udall, Auden Schendler, August 9, 2005; http://www.igreenbuild.com/cd_1706.aspx

2. "LEED Is Not Perfect, But It's Not Broken," by Rob Watson, December 23, 2005; http://www.edcmag.com/CDA/Archives/44b973b231d98010V gnVCM100000f932a8c0_

3. *Federal R&D Agenda for Net-Zero Energy, High-Performance Green Buildings,* National Science and Technology Council, October 2008, p40; http://www.ostp.gov/galleries/NSTC Reports/Federal RD Agenda for Net Zero Energy High Performance Green Buildings.pdf

4. *Energy for Sustainability, Technology, Planning and Policy*, by John Randolph and Gilbert M. Masters, Island Press, 2008

5. *NBI Final Report – Energy Performance of LEED® for New Construction Buildings*, March 4, 2008; http://www.newbuildings.org/downloads/Energy_Performance_of_LEED-NC_Buildings-Final_3-4-08b.pdf

6. *The Costs and Financial Benefits of Green Building*; *A Report to California's Sustainable Building Task Force, California Integrated Waste Management Board*, by Kats, Greg, et al., p15, p24; www.ciwmb.ca.gov/greenbuilding/Design/CostBenefit/Report.pdf

7. *Green Building Costs and Financial Benefits*, by Gregory H. Kats, Published in USA for Massachusetts Technology Collaborative, 2003, p3; http://www.cap-e.com/ewebeditpro/items/O59F3481.pdf

8. *Energy Efficiency and Buildings: Business Realities and Opportunities, Facts and Trends, Full Report*, World Business Council for Sustainable Development, July 2008, p62, Figure 5.12; http://www.wbcsd.org/DocRoot/nPf1MZCxRjSVFOdomMAE/WBCSD_EEB_final.pdf

9. "LEEDing from Behind: The Rise and Fall of Green Building, Part 1," *New Solutions #18*, May-June 2009; http://www.communitysolution.org/pdfs/NS18.pdf

10. *Greening Buildings and Communities: Costs and Benefits*, by lead author Greg Kats, Managing Director, Good Energies; http://www.goodenergies.com/news/-pdfs/Web site Presentation.pdf

11. "Green Building Study Finds Benefits of Building Green Outweigh Cost Premium;" http://www.goodenergies.com/news/-pdfs/Green Buildings Study Press Release FINAL_5.pdf

12. "Debating the Green Building Premium," by Kate Galbraith, New York Times, November 20, 2008; http://greeninc.blogs.nytimes.com/2008/11/20/debating-the-green-building-premium/

13. "Buildings That Breathe: Green Construction is Coming of Age," by Sally Deneen and Brian Howard, January/February, 2007, E Magazine; http://www.emagazine.com/view/?3525

14. *The Costs and Financial Benefits of Green Building*; A Report to California's Sustainable Building Task Force, California Integrated Waste Management Board, by Kats, Greg, et al.; www.ciwmb.ca.gov/greenbuilding/Design/CostBenefit/Report.pdf

15. http://www.goodenergies.com/team/index.php

16. *Analyzing the Cost of Obtaining LEED Certification*, prepared for The American Chemistry Council Arlington, VA by Northbridge Environmental Management Consultants Westford, MA, April 16, 2003; http://www.cleanair-coolplanet.org/for_communities/LEED_links/AnalyzingtheCostofLEED.pdf

17. *GSA LEED® Cost Study and LEED® Applications Guide*, by Stephen Winter Associates; http://www.swinter.com/services/documents/GU.3.2_GSALEEDCostStudy_project.pdf

18. *LEED® Cost Study, Final Report,* U.S. General Services Administration, submitted by Steven Winter Associates, Inc., October 2004; http://www.wbdg.org/ccb/GSAMAN/gsaleed.pdf

19. "Costing Green: A Comprehensive Cost Database and Budget Methodology," by Lisa Fay Matthiessen, Peter Morris: Davis Langdon, July 2004; http://www.davislangdon.com/upload/images/publications/USA/2004 Costing Green Comprehensive Cost Database.pdf

20. *Cost of Green Revisited: Reexamining the Feasibility and Cost Impact of Sustainable Design in the Light of Increased Market Adoption*, by Davis Langdon, July 2007, p25; http://www.davislangdon.com/upload/images/publications/USA/The Cost of Green Revisited.pdf

21. "Lisa Matthiessen Appointed Vice Chair of USGBC LEED Market Sector Committee," March 2009; http://www.davislangdon.com/USA/OurBusiness/News-Center/News/Lisa-Matthiessen-Appointed-Vice-Chair-of-USGBC-LEED-Market-Sector-Committee/

22. *Assessing Green Building Performance: A post occupancy evaluation of 12 GSA buildings*, produced by GSA Public Buildings Service, Office of Applied Science, June 2008; http://www.usgbc.org/ShowFile.aspx?DocumentID=4308

23. *Green Building Impact Report 2008*, by Rob Watson and Elizabeth Balkan, Greener World Media, 2008; http://www.greenerbuildings.com/greenbuildingimpactreport/html

24. *New Solutions 18*; http://www.communitysolution.org/pdfs/NS18.pdf

25. "Can Green Buildings Pass Payback Tests?" by Saqib Rahim, *New York Times*, February 27, 2009; http://www.nytimes.com/cwire/2009/02/27/27climatewire-can-green-buildings-pass-payback-tests-9910.html

26. *Achieving 30% and 50% Over ASHRAE 90.1-2004 in a Low-Rise Office Building*, prepared for NAIOP by ConSol, December 2008; http://www.naiop.org/governmentaffairs/pdf/consol.pdf

27. "Green Building Industry Apoplectic Over NAIOP Commercial Energy Efficiency Study," by Stephen Del Percio, March 10, 2009; http://www.greenrealestatelaw.com/2009/03/green-building-industry-apoplectic-over-naiop-study/

28. "RICS Study: No Premium for LEED-Certified Commercial Office Buildings," by Stephen Del Percio, April 7, 2009; http://www.greenrealestatelaw.com/2009/04/rics-study-finds-no-leed-premium/

29. "Investigators: Green school claims oversold," by Susannah Frame, March 24, 2009; http://www.king5.com/education/stories/NW_032409INV-green-schools-ks.68a74a17.html#slcgm_comments_anchor

30. http://www.greenbuildconsult.com/

31. http://www.greencontractors.us/pdf/EGBreport092508.pdf

32. *European Green Building Technologies: A Report on Research Conducted for the Mechanical Contractors Education and Research Foundation*, by Yudelson Associates, Jerry Yudelson, PE, Principal Investigator, September 2008; http://www.greenbuildconsult.com/pdfs/mcerf.pdf

33. *Energy Efficiency and Buildings: Business Realities and Opportunities, Facts and Trends, Full Report,* World Business Council for Sustainable Development, July 2008, p62, Figure 5.12; http://www.wbcsd.org/DocRoot/nPf1MZCxRjSVFOdomMAE/WBCSD_EEB_final.pdf

34. *The Green Building Revolution*, by Jerry Yudelson, Island Press, 2008

35. "Data dispels 'green' building cost myths," by Elena Babaeva, *American City Business Journals*; Written: 1/30/2009; http://www.usgbc.org/News/USGBCInTheNewsDetails.aspx?ID=3961

36. *Greening Buildings and Communities: Costs and Benefits*, by lead author Greg Kats, Managing Director, Good Energies; http://www.goodenergies.com/news/-pdfs/Web site Presentation.pdf

37. "Not Building Green Is Called a Matter of Economics," by Michael Brick, *New York Times*, January 15, 2003; http://www.nytimes.com/2003/01/15/business/15BRIC.html?ex=1043298000&en=a9e1cc55486e1817&ei=5040&partner=MOREOVER

38. *The Green Building Revolution*, by Jerry Yudelson, Island Press, 2008

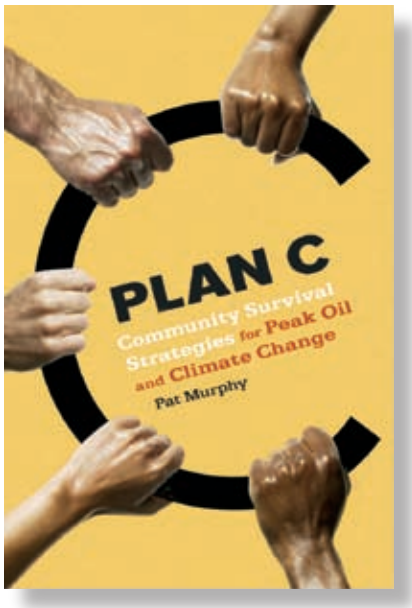
39. "Building Impacts – Why Build Green?;" http://www.usgbc.org/DisplayPageaspx?CMSPageID=1720

New Solutions
is published by The Arthur Morgan Institute for Community Solutions, a non-profit organization, that has been studying and promoting small local community for more than 60 years.

Subscribe to *New Solutions*, and become a member. Send your tax-deductible contribution of $35 (or more) to Community Solutions, P.O. Box 243, Yellow Springs, OH 45387 or visit our website. Your contributions will help us continue this work.

To receive regular email communications, send us an email at info@communitysolution.org.

Special Membership Offer



You can become a Community Solutions member ($35) and receive a copy of Pat Murphy's new book, *Plan C – Community Survival Strategies for Peak Oil and Climate Change ($19.95),* for a combined cost of just $50 (a savings of $5). In addition, as a member, you'll receive *New Solutions* to keep you up to date on what we're doing and to help you make informed decisions about how best to adapt to a high satisfaction/low-energy life.

Please send me a copy of *Plan C* and enter me on your membership roll. I authorize/enclose payment of $50.

VISA/MC number _____ Exp. Date _____

Name on card _____

Signature _____

Daytime phone _____

Street address _____

City _____ State/Province _____ Zip/Postal _____

Email address _____

Send me *New Solutions* ☐ via postal mail ☐ via email

You may also join Community Solutions via phone at 937-767-2161 or online at www.communitysolution.org. Donations to support our work are always welcome.

Community Solutions℠
The Arthur Morgan Institute for Community Solutions
P.O. Box 243
Yellow Springs, Ohio 45387
T: 937.767.2161
www.communitysolution.org

Return Service Requested

Nonprofit Organization
U.S. Postage
PAID
Permit No. 51
Yellow Springs, Ohio