A Better Way to Rate Green Buildings

By Henry Gifford

LEED sets the standard for green buildings, but do green buildings actually save any energy?

Thanks to the public's increasing concern for the environment, one of the most desirable features a new building can have these days is to be "green". So many people want to live and work in environmentally friendly buildings that developers are able to charge a premium for them.

However, exactly what is meant by "green" is not easily defined. The promotional materials for green buildings might list features such as recycled and or less toxic materials, water saving systems, and planted roofs. Energy saving technologies are usually included, which can include energy efficient appliances, lighting, and heating and cooling equipment. As the lists of features have gotten longer, and harder for consumers to sort out, rating systems have been developed.

Many green building rating systems exist in the US, and more are being created all the time, but the green building rating system that has come to dominate is the US Green Building Council's (USGBC) LEED program, which stands for Leadership in Energy and Environmental Design. LEED has probably contributed more to the current popularity of green buildings in the public's eye than anything else. It is such a valuable selling point that it is featured prominently in advertisements for buildings that achieve it. LEED certified buildings make headlines, attract tenants[1], and command higher prices.[2]

LEED has attracted all this attention despite the fact that a relatively small number of certified buildings have actually been built, but the growth in the number of buildings seeking certification is rising exponentially. As of October 2007 only 336 new houses had been certified, but over 8,000 more had applied for certification[3]. Several state and local governments in the US are either strongly encouraging or requiring LEED certification for new buildings, and even the US Army requires LEED certification for some of its new housing[4].

The LEED system has changed the market for environmentally friendly buildings in the US, but there is an enormous problem: the best data available shows that on average, they use *more* energy than comparable buildings. What has been created is the <u>image</u> of energy efficient buildings, but not actual energy efficiency.

Can you guess which of these is a green building? See page 7
(Columbus Circle, New York City, 2AM on 28 July, 2008)

Building energy use is probably the largest field of human endeavor in which almost nobody measures anything.

Part of the problem may reside in the system's roots. The USGBC, which created the LEED system, was founded in 1993 by David Gottfried, a real estate developer, and Rick Fedrizzi, who was a marketing executive for an air conditioning company[5][6]. While the organization's name implies it is a group of independent environmental experts, membership is open to all, and includes the largest players in the construction industry. The USGBC is really the construction industry telling itself what it ought to do. Still, the system has accomplished some notable goals.

Before the LEED system existed, a company trying to sell a construction material made from recycled waste or containing fewer toxic chemicals had an uphill battle, especially if their product cost extra or required a change in construction practice. People making a choice between saving money and helping the environment were largely isolated, and got little recognition for helping the environment. The USGBC helped change this situation.

As quoted in *FastCompany*, Rick Fedrizzi, the current chairman of the USGBC, said "We realized we were getting the messaging wrong, leading with the environmental story," he says. "We had to lead with the business case."[7] This approach has worked wonders for getting environmentally friendly products into the marketplace.

By participating in the USGBC, manufacturers of environmentally friendly products have helped achieve public recognition for them, while designers and builders have achieved recognition for choosing to use them. This has been a win-win-win arrangement for companies manufacturing environmentally friendly products, for the public, and for the environment.

But, buildings actually use about 71% of the electricity[8] and about 40%[9] of all the energy used in the US, far more than the whole transportation sector, which uses only 29%.[10] Drastic reductions in energy use have been achieved by many buildings in the US and elsewhere, and of course a building has to be energy efficient to be truly environmentally friendly.

For many years, the USGBC claimed that green buildings saved energy[11][12]. But, incredibly, the LEED certification process for new buildings does not require energy use to be reported, or even kept track of![13] So nobody knew until recently how much energy LEED buildings used. Finally, after years of people asking questions, the USGBC commissioned the New Buildings Institute of Vancouver, Washington, to conduct the first broad study of how much energy LEED rated buildings actually used[14]. The results were announced in November 2007 at Greenbuild, the USGBC's annual gathering.

At the long awaited announcement, Brendan Owens, the technical director of the USGBC, gave the audience a lot of reason to doubt the validity of the results when he said "I was really kind of cringing about what kind of data we would get. And, when Mark and I started talking about what this survey, and what this study was going to be, he asked some pretty pointed questions about what were we going to do with it, and in the back of my head it was, you know, if it's bad, we're certainly not going to tell anybody. And, and we're going to fix the problem and that will be good. But I knew he wouldn't let that happen, so in the front of my head was, if it's bad I'm going to let Cathy [Cathy Turner, the senior analyst[15] for the New Buildings Institute] publish just her graphs, with no explanation, and it'll be so statistically impenetrable to anybody who could actually articulate what was going on, that it wouldn't matter, because they, you know, could only talk to somebody else who could understand them, and there's not many of those out there. So, the fact of, the delightful fact of the results of the study being what I would consider to be overwhelmingly positive considering how bad I thought it was going to come out, are pretty remarkable.[16]" Unfortunately, Mr. Owens seems to have described exactly what happened.

The study claims that "On average, LEED buildings are 25-30% more efficient than non-LEED buildings.[17][18]" The USGBC has publicized this claim[19], and if LEED buildings really were saving that much energy, it would be a start – albeit only a modest one – in the right direction.

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Next CBECS will be conducted in 2007

Table C3A. Consumption and Gross Energy Intensity for Sum of Major Fuels for All Buildings, 2003

	All Buildings			Sum of Major Fuel Consumption		
	Number of Buildings (thousand)	Floorspace (million square feet)	Floorspace per Building (thousand square feet)	Total (trillion Btu)	per Building (million Btu)	per Square Foot (thousand Btu)
All Buildings	4,859	71,658	14.7	6,523	1,342	91.0
Building Floorspace (Square Feet)						
1,001 to 5,000	2,586	6,922	2.7	685	265	99.0
5,001 to 10,000	948	7,033	7.4	563	594	80.0
10,001 to 25,000	810	12,659	15.6	899	1,110	71.0
25,001 to 50,000	261	9,382	36.0	742	2,843	79.0
50,001 to 100,000	147	10,291	70.2	913	6,230	88.7
100,001 to 200,000	74	10,217	138.6	1,064	14,436	104.2
200,001 to 500,000	26	7,494	287.6	751	28,831	100.2
Over 500,000	8	7,660	937.6	906	110,855	118.2
Principal Building Activity						
Education	386	9,874	25.6	820	2,125	83.1
Food Sales	226	1,255	5.6	251	1,110	199.7
Food Service	297	1,654	5.6	427	1,436	258.3
Health Care	129	3,163	24.6	594	4,612	187.7
Inpatient	8	1,905	241.4	475	60,152	249.2
Outpatient	121	1,258	10.4	119	985	94.6
Lodging	142	5,096	35.8	510	3,578	100.0
Mercantile	657	11,192	17.0	1,021	1,556	91.3
Retail (Other Than Mall)	443	4,317	9.7	319	720	73.9
Enclosed and Strip Malls	213	6,875	32.2	702	3,292	102.2
Office	824	12,208	14.8	1,134	1,376	92.9
Public Assembly	277	3,939	14.2	370	1,338	93.9
Public Order and Safety	71	1,090	15.5	126	1,791	115.8
Religious Worship	370	3,754	10.1	163	440	43.5
Service	622	4,050	6.5	312	501	77.0
Warehouse and Storage	597	10,078	16.9	456	764	45.2
Other	79	1,738	21.9	286	3,600	164.4
Vacant	182	2,567	14.1	54	294	20.9
Year Constructed						
Before 1920	333	3,784	11.4	303	912	80.2
1920 to 1945	536	6,985	13.0	631	1,177	90.4
1946 to 1959	573	7,262	12.7	588	1,026	80.9
1960 to 1969	600	8,641	14.4	791	1,317	91.5
1970 to 1979	784	12,275	15.6	1,191	1,518	97.0
1980 to 1989	768	12,468	16.2	1,247	1,622	100.0
1990 to 1999	917	13,981	15.2	1,262	1,376	90.2
2000 to 2003	347	6,262	18.1	511	1,473	81.6
Census Region and Division						
Northeast	761	13,995	18.4	1,396	1,834	99.8
New England	252	3,452	13.7	345	1,368	99.8
Middle Atlantic	509	10,543	20.7	1,052	2,064	99.7
Midwest	1,305	18,103	13.9	1,799	1,379	99.4
East North Central	728	12,424	17.1	1,343	1,846	108.1
West North Central	577	5,680	9.8	456	790	80.2
South	1,873	26,739	14.3	2,265	1,209	84.7
South Atlantic	926	13,999	15.1	1,241	1,340	88.7
East South Central	360	3,719	10.3	340	944	91.4
West South Central	587	9,022	15.4	684	1,164	75.8
West	920	12,820	13.9	1,063	1,156	82.9
Mountain	316	4,207	13.3	446	1,411	106.1
Pacific	603	8,613	14.3	617	1,022	71.6

Energy Information Administration
2003 Commercial Buildings Energy Consumption Survey: Consumption and Expenditures Tables

However, for a number of reasons, the publicized figure is not only wrong, it appears that the reverse is actually true.

First of all, the buildings studied were not a random sample. Letters were sent to the LEED representatives for all 552 buildings that had been certified at that point. Two hundred fifty responses were received, but complete energy data was obtained from only 121 of the respondees, leaving a sample of only 22% of the total number of certified buildings. This sample appears to constitute only those owners or operators of LEED certified buildings who were willing to divulge their energy use data, which is a little like making generalizations about drivers' blood alcohol levels from the results of people who volunteer for a roadside breathalyzer test. Yet, the USGBC uses it to back up their claims of 25 – 30% energy saving[20].

There is nothing in the report to support the 30% claim, which appears to be a simple exaggeration. The buildings that were included in the study were determined to have an energy use index of 69[21], meaning that they use a total of 69,000 BTUs of energy per square foot per year. The study then compared this to the US Energy Information Administration's Commercial Buildings Energy Consumption Survey's index of 91,000 BTUs per square foot per year for existing buildings. As 69,000 is 24% less than 91,000, this is the basis of their claim that they are saving 25%[22].

However, this is based on one of the unfair comparisons made in the study. First, the LEED buildings were all built or renovated after 2000, which means they automatically benefit from recent advances in the energy efficiency of lighting fixtures, cooling equipment, etc. The New

Buildings Institute chose to compare to the USEIA/CBECS energy use index for all buildings in the database, including those built before 1920[23]. When asked during the presentation about the vintage of the buildings that are in CBECS, Cathy Turner said “I knew we didn’t have enough graphs, we took that one out. But if you could have seen the graph of CBECS energy use by building vintage it doesn’t really make that much difference. There is some suggestion in the most recent batch that the brand new study had a few post 2000 buildings and it looks like maybe they were doing better, but you know it’s kind of early to know that[24].”

It is actually not too early to look at the newest CBECS report, which was published in 2006, and there is more than a suggestion that some post 2000 buildings are included; there is a separate category for buildings built between 2000 and 2003. They are down to using 81,600 BTUs per square foot per year[25]. It would have been meaningful to compare new buildings with new buildings, which would have shown a saving of only 15%. That is still a saving, but the study wouldn’t have shown any saving at all if it didn’t make one more unfair comparison.

The CBECS index is based on the mean, or *average* energy use per square foot[26], while the LEED energy use index of 69,000 used in the study is something very different: the *median* value[27], which is the number separating the higher half of a group of measurements from the lower half. Comparing the median value of one dataset to the mean value of another dataset is a worthless comparison, but in this case it made the LEED buildings look much more energy efficient than they actually are. The truth can only be found by comparing mean values to mean values.

When someone else at the Greenbuild presentation asked why the median was used, Cathy Turner responded by saying “Average is often used as a general term to apply to any of the ways you might average mean or median or mode, and we did use the median in this data to avoid being skewed by the, the extreme results.[28]” Of course, the extreme results are part of the measured data, but neither the 66 page preliminary report on the study nor the 46 page final report ever reveals what the mean energy use index for the LEED buildings is.

However, Cathy Turner later confirmed that the actual mean value of the energy use indexes of the 121 LEED rated buildings included in the study is 105[29]. This is 29% *higher* than the CBECS mean of 81.6 for new buildings. This is still not a perfect statistical comparison, because the CBECS data is total energy use divided by total square footage, which yields a building-size weighted average, while building size is not included when calculating the mean of the reported LEED building energy use measurements.

The New Buildings Institute says that the LEED energy use was high because the sampling contained some lab buildings, but the CBECS data also contains lab buildings[30]. There are other imperfections in the comparison, such as differences in climate and weather, but the comparison was good enough for the New Buildings Institute to use and the USGBC to reference when the study made LEED buildings look good, and it is still the fairest comparison available.

Therefore, what the data actually indicate is that the 22% of LEED buildings whose owners participated in the study and reported their energy data used an average of 29% <u>more</u> energy than the most similar buildings in the dataset that the study authors chose to use as a comparison! Going to so much trouble and expense to end up with buildings that use more energy than comparable buildings is not only a tragedy, it is also a fraud perpetuated on US consumers trying their best to achieve true environmental friendliness. Worse, by spending so many years without measuring anything, and then obscuring the truth when data is finally available, the USGBC has squandered the tremendous public good will that has accumulated behind the cause of environmentally friendly buildings. This shocking failure raises the question of what could go so wrong in buildings to produce results opposite to what so many people are trying to achieve.

The answer is that attention is focused on the *appearance* of energy efficiency, not its accomplishment. The LEED system does this by rewarding designers for *predicting* that a building will save energy, not for proving that a building actually saves energy.

The LEED system asks for two predictions. The first, called the "baseline," is a prediction of how much energy a building might use over the course of a year if it were a normal building, and the second predicts how much energy it will use with the energy saving features included. The greater the difference between the two predictions, the better LEED rating the building gets. However, predicting a building's energy use is like predicting the weather: if all the relevant factors are known, it is still very difficult.

There are exceptions, such as an island in the Caribbean, where a week from Tuesday it will probably be mild and sunny with just a sprinkle of rain in the afternoon. Likewise, the energy use of a very simple building such as a parking garage is fairly easy to predict. But as soon a building gets heating, cooling, and ventilation systems, walls and windows, computers, and people occupy it, things get complicated fast. Predictions are further complicated by the fact that the best methods for making a building energy-efficient in Minnesota don't apply well in Florida, and what works in a hotel may not work as well in a school.

> The best way to rate the energy efficiency of a building is by how much energy it actually uses.

Even the study commissioned by the USGBC admits that predictions are problematic when it says that "In other words, the accuracy of individual energy use predictions is very inconsistent.[31]"

Despite the obvious problems, the rush to rate buildings based on predictions continues. Starting in January 2008, a program funded by a New York State agency pays money to developers who say they intend to build energy efficient multifamily buildings. The developer gets thousands of dollars for registering a planned development, and later, based on the size of the building and the difference between two predictions, gets additional incentives that can total well over a million dollars. A small final payment is somewhat related to actual energy use, but the building is not required to perform better than other buildings – it only has to perform better than an estimate[32].

The poor performance of buildings rated by predictions represents a tragic loss of the opportunity for real progress in reducing energy use in buildings. But, with LEED ratings for new buildings offering no credit for actually saving energy, it is no wonder that designers feel pressure to shift their focus from achieving energy efficiency to the *appearance* of energy efficiency.

This pressure influences every decision involved in designing what should be an environmentally friendly building, including one that every design team faces: will the building have solar panels? The panels provide a perfect photo opportunity, which makes them a publicist's dream. But money spent on solar panels can't also be spent elsewhere, and the photos don't show

how effectively they actually meet the building's energy loads.

The type of solar energy systems that make electricity, as opposed to those that heat water, currently cost about $9 per watt[33]. That is, per watt produced at noon, but it is not "noon" all day, and the noonday sun in Chicago is weaker than in Texas. A rough rule of thumb for the continental US is that for a system facing South, tilted toward the sun, and never shaded, each watt of noon capacity produces about 1,000 Watt-hours of electricity per year[34]. US utility companies call that 1,000 Watt-hours a kilowatt-hour, and sell it for an average of nine cents[35]. This makes solar electric paybacks frustratingly long.

Instead of making electricity with solar panels, a designer could choose to save electricity with more energy efficient lighting. The same nine dollars could pay the cost difference between three standard light bulbs[36] and three compact fluorescent bulbs[37]. If 100 Watt bulbs are replaced by 23 Watt bulbs, with each bulb saving 77 Watts, three combined would save 231 Watts. This means the bulbs would take approximately four hours to save about the same 1,000 Watt-hours of electricity that the solar system produces in a year.

This shocking difference shows how much more effective it can be to save electricity than it is to make it. Of course, in the long term, making electricity from the sun will probably become critically important, and the best building would have both solar panels and fluorescent-only fixtures, which work even better than screw-in fluorescents. But right now, as long as actual energy use is not measured, and appearance is more important than reality, a designer choosing between saving a lot of electricity with better lighting or producing a little electricity with solar panels is choosing between obscurity and recognition.

One building that has gotten a lot of publicity for having solar panels mounted vertically on its facades where everyone can see them[38] was built in New York City in 2003. It is billed as "America's first environmentally advanced residential tower.[39]" But, because the panels are not tilted to face the sun, they don't produce nearly as much electricity as they would if they were mounted at the correct solar angle. Worse, they are not even facing due South. Some are mounted on a facade that faces Southwest, and others face the street, which leaves them facing roughly northwest[40,41]. Still another group of panels is mounted where rooftop equipment will throw shadows on at least one of them at all times[42]. Unfortunately, when solar electric panels are wired together in a group, as they generally are, shade falling on one panel greatly diminishes the output from the whole group of panels.

The choice to not install the panels on angled brackets on the roof, where they would produce more electricity but would not be visible from the street, made the installation a colossal waste of perfectly good solar panels. Despite this, the building

These solar panels would produce much more electricity if they were angled toward the sun, and were not shaded by rooftop equipment. As installed, they represent a collosal waste of perfectly good solar panels.

is held up as an example of an “environmental friendly” building. The owners made many other efforts to improve the building, but the solar panels get most of the attention. Like any such building, the designers were under pressure to make the image of being “green” a priority over actual energy efficiency.

The design phase of a building’s life is not the only time this pressure exerts itself. A building’s energy performance also depends on important decisions made during construction, and even later, when the building is occupied. But with LEED ratings issued based on a building’s design, there is little incentive to pay attention to these other, critical areas.

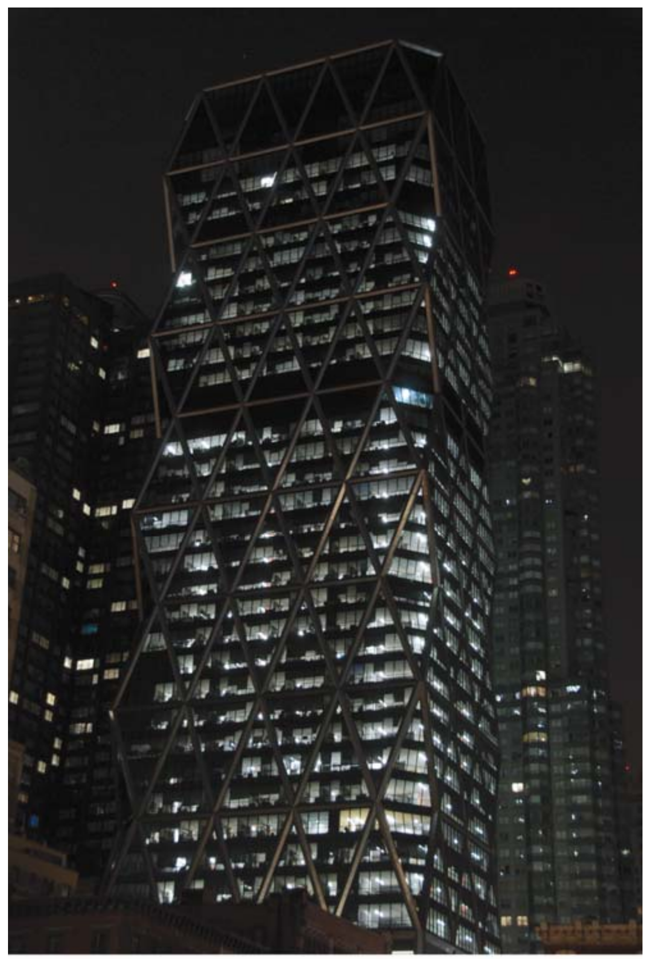
From now on, not one more building should be rated as green or environmentally friendly without its utility bills first proving that it is energy efficient

For example, a design might ask for energy efficient windows mounted in well insulated walls. A really good architect takes the design a step further and shows how the windows should be connected to the walls. But, no matter how good the design, if no one makes sure the plans are actually followed during construction, the window might not be installed properly. Air leaking through a gap between the window and the wall wastes energy, and also confounds energy use predictions. Worse, if the air leak causes someone to feel a cold draft and adjust the thermostat, even more energy is wasted, and attempts to predict annual energy use become folly.

Part of the solution is the “measure twice, cut once” approach to installing windows, which does nothing to get the building publicity because it is low-tech, and is as old as the first time a cave dweller cut a piece of wood.

The failure to measure a “green” building’s energy efficiency by publicly revealing how much energy it actually uses also influences countless decisions made after construction is finished. It is hard to walk very far down any street in the US before seeing a light turned on that doesn’t need to be on during the daytime, or that is left on unnecessarily at night. The USGBC tries to address this problem by requiring documentation promising “commissioning” of automatic lighting sensors and other control systems in all LEED certified buildings, but since the energy part of LEED is all about predictions, and not about measured achievements, that strategy is not working.

For example, a LEED rating was awarded to a 46 story office building built



If green buildings were rated by how much energy they actually used, someone would turn the lights off at night in this LEED certified office building on 57th Street in New York City in 2006[43]. The building is reportedly equipped with sensors that turn the lights off based on occupancy[44], yet lights throughout the building stay on through the night, night after night[45]. The building still has its LEED rating, and the owners still describe it as "the most environmentally friendly, or "green," office tower in New York City history.[46]"

As these examples illustrate, energy efficiency is dependent on specific procedures at least as much as on the use of special products or technologies. But, because better procedures do little or nothing to promote the image of energy efficiency, they have been mostly ignored in the rush to rate buildings as green.

There is only one realistic way to rate the energy efficiency of a building: by how much energy it actually uses after it is occupied. For any green building rating system to be truly effective it must require public scrutiny of utility bills for all rated buildings, not just a few selected examples. Any building or rating system that does not make all energy use data public, and show substantial savings relative to comparable buildings, does not deserve to be called environmentally friendly, regardless of how many supposed "green" features are included.

Part of the solution is the "measure twice, cut once" approach to installing windows, which does nothing to get the building publicity because it is low-tech, and is as old as the first time a cave dweller cut a piece of wood.

Only by rating buildings according to actual energy consumption can a rating system reward success, and encourage energy saving in not only the design phase, but also during construction, as well as after the building is occupied. Even fancy energy technologies require hard work to successfully integrate them into the building and get them to work as intended, which a rating system that doesn't measure energy use does nothing to encourage.

But rating buildings by how much energy they actually use poses a sticky problem: it requires the building to first be built and occupied. The USGBC and other rating organizations are under pressure to award valuable ratings to new buildings, or even to construction sites that are barely more than empty lots[47]. This pressure encourages the current practice of awarding those ratings based on the difference between two estimates, which is obviously not working.

The most realistic approach would be to first award a tentative green building rating that would be subject to redaction based on actual energy use, and only issue a final rating if the utility bills show the building really is energy efficient. Of course the ratings should count measured energy use as the main criteria, not a minor portion. Rated buildings should mount award plaques with removable screws, because each year the building's energy bills would

This sign is a daily reminder to every construction worker on the site that no matter how well they do their work, it will have no effect on the building's environmentally friendly rating.

Rated buildings should mount award plaques with removable screws, because each year the building's energy bills would have to be reviewed.

have to be reviewed. Buildings that did not continue to perform would lose their ratings, and those that performed well could continue to have something to be proud of.

This brings up the question of what the preliminary rating should be based on. Obviously it should be something more reliable than the difference between two energy use predictions, as currently used in the LEED system.

To be useful the rating should be based on something very simple and reliable, yet incorporate aspects of the many things that affect a building's energy use. Ideally, it would also be much easier to verify than the difference between two predictions, which are usually complicated computer models.

Fortunately, a simple solution already exists, one that is already successfully incorporated in building codes in some parts of the world[48]: the amount of source energy required to operate the heating, cooling, and ventilation systems at peak load. A big building gets a heating and cooling system that requires a lot of energy to operate, and a small building gets a small system. Anyone who proposes installing a big, powerful system in a small building has to find a way to keep the building comfortable with a smaller system, which means making the building more energy efficient.

While system capacity is not an exact predictor of energy use, it is a relatively effective proxy, and has many advantages. Equipment size and building size can be verified before, during, or after construction. The sizing procedure is nothing new in the industry, as someone already sizes equipment for every building. Using this same decision for tentatively rating the environmental friendliness of buildings would cost essentially nothing, and not even require adding a new task. It would just require a routine job to be done effectively, and carefully.

Careful equipment sizing itself would have built-in benefits: not only is smaller equipment less expensive to purchase and install, but it leads to energy saving and improved comfort, as oversized equipment can cause fluctuating indoor temperatures, poor humidity control, and energy waste. Another benefit is that the coordinated effort required to size "just large enough" equipment would encourage closer cooperation between building designers and mechanical system designers, which most people involved with the construction industry would readily agree is a change that is sorely needed. In the future, as buildings get more and more energy efficient, updating preliminary green building ratings would be as simple as changing one number.

Someday, someone might come up with a better way to predict the energy use of buildings that aren't built yet. Until then, heating and cooling system capacity limits are the best available option.

Once buildings are built and occupied, they should be rated by how much energy they actually use in the second full year after construction or renovation. Waiting until the second year for an actual rating would be frustrating, but would avoid many problems with the first year. For example, utilities are usually turned on before construction is complete, making it hard to say just when the first year starts. If counting is started from the date when the government issues a certificate of occupancy, the bills might be unrealistically low because of partial occupancy, or unrealistically high because of problems with the building that take time to fix. And, of course, ratings would have to be renewed regularly, based on actual energy consumption.

The USGBC actually does have a separate, little known LEED rating system for existing buildings, but energy is a minority of the consideration for a rating, and the requirement is that the building use less energy than 60% of comparable buildings[49]. In other words, it can use more energy than about 40% of comparable buildings, which is a low bar indeed.

> Because better procedures do little or nothing to promote the image of energy efficiency, they have been mostly ignored in the rush to rate buildings as being green

A truly effective rating system would encourage ever decreasing energy consumption by simply stating how much energy the building used, instead of awarding points, stars, or other rankings. Stating how much energy a building uses also avoids statements such as "20% less than…" which is not an amount of energy.

All the energy sources supplied to a building can be converted to KiloWatt-Hours, so a rating would look like this: "The building used 180,000 Kilowatt-Hours of energy in the past 12 months, which is equivalent to 120 KWH per square foot per year."

People would soon be overheard saying things such as "My house used only110 KWH per square foot last year."

"Oh, but that's because the two of you live in a 3,500 square foot house. We used 134 KWH per square foot last year, but the four of us live in a 1,100 foot house, so our bill comes out to only 147,000 KWH for the whole year. And, with the new lights we just installed, we're hoping to get under 130,000 next year."

This sort of talk might sound too technical for the average person, but Americans didn't take long to learn how to talk about how many gigabytes and megahertz their computer has, so surely they can learn to boast about low energy use.

A significant number of buildings that have energy use low enough to boast about have been built in the US over the years. But, with no widespread system in place for measuring or reporting actual energy use, these buildings and the strategies that enabled the energy savings are as unrecognized as environmentally friendly building materials were before the LEED system popularized them. The fact that many of the most energy efficient buildings do not depend on fancy new technologies only makes it harder for effective strategies to get recognition.

It is far from the sole fault of the USGBC that fancy technologies which enhance the image of energy efficiency get most of the attention, but any system with the words "Leadership" and "Energy" in the name must, by definition, recognize buildings that have achieved measured and verifiable energy savings.

Building energy use is perhaps being the largest field of human endeavor in which almost nobody measures anything. But, the situation is actually worse than that: measurements are taken by utility companies every month, and are largely ignored. Utility company records should start to be used to rate our country's buildings immediately.

> It is time for our country to stop staking our future on energy predictions and start measuring.

An important step is the creation of a central database of energy use per square foot, where any building owner who wishes can have their building listed and compared to a very large number of similar buildings. Perhaps the US Energy Information Administration, the organization that already does the CBECS study, could do it. Since 2002 they have had the authority to get utility bills on any building, with or without the owner's consent (coupled with the requirement to maintain anonymity), which enables them to evaluate 100% of the buildings included in a green building program. Utility companies can help by making energy use data searchable on their websites by building address for anyone who gives permission. Tax assessor's offices have data on the approximate size of every building in the country, and also know if buildings are used as schools, houses, apartments, etc.

Smart realtors could give prospective buyers listings that compare actual energy use of various buildings. Or, if a seller refused to let a utility company divulge their building's energy use data, the realtor would tell the buyer "I printed out the energy use of all the properties except this one, whose owner wouldn't release the information." In the meantime, until a central database is available, realtors can start now by asking sellers for utility company account numbers, and downloading billing histories from utility company websites. As soon as this practice becomes widespread, it will serve as a powerful and equitable financial incentive to save energy.

Linking these vast databases together sounds like a lot of work, but the US currently uses 24%[50] of the world's oil, despite having less than 5% of the world's population. This situation obviously cannot continue indefinitely. The only question is how soon this will change, and how painful the change will be. With the increasing importance of energy to our economy, to the world's political and military stability, and to saving the planet from global warming, we need to have effective rating systems as soon as possible.

The true results of the study of LEED rated buildings should mark the end of the era of trying to use estimates, points systems, or checklists to rate the energy efficiency of buildings. It is time to stop squandering our country's future on the image of energy efficiency, and start designing and building buildings that really are energy efficient.

The LEED system is not only ineffective, but is harmful to the environment, to the prosperity of our country, and to effective energy saving methods which are ignored in favor of the image of energy efficiency. LEED should be abandoned immediately, and be replaced with a system that is based on actual verifiable energy use measurements.

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