

## **ASTM Symposium on Common Ground, Consensus Building and Continual Improvement: Standards and Sustainable Building**

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### **Standards vs. Recommended Practice: Separating Process and Prescriptive Measures from Building Performance**

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#### **Abstract**

Rating systems in North America are experiencing a fundamental shift in the way they approach sustainable design, away from a prescriptive methodology toward one that emphasizes quantifiable performance. They're maturing, placing more importance on issues such as life cycle assessment and how to strengthen the link between design forecasts and actual building performance over the long-term. But they remain an inherent mix of objective and subjective elements—of process, prescriptive measures and performance—which makes it difficult for them to evolve in their entirety into sustainable building standards.

This paper will focus on fundamental issues related to the standardization of sustainable design principles in the context of assessment and rating systems, drawing on the experience of the Green Building Initiative (GBI) American National Standards Institute (ANSI) Technical Committee for Green Globes™. The GBI is the first national organization to take a green building rating system through the consensus-based ANSI process, and its technical committee will examine how process, prescriptive and performance measures fit in a standard of this nature.

For example, experience shows that an integrated design process tends to result in higher performance buildings. However, while it is recommended practice, can it be mandated as part of a standard if it isn't a measure of the building's actual worth? Indeed, can any process be dictated, or would this risk penalizing an exceptional building for something that has nothing to do with sustainability?

Likewise, prescriptive measures such as favoring building materials with recycled content don't always deliver the benefits they're widely assumed to have. They are means to an end and should not be treated as objectives in their own right. It is tempting to include prescriptive measures in a standard because they're easy to verify. But do we not then risk perpetuating points of view that, while deeply entrenched, do not contribute positively to actual building performance?

## Introduction

There is no question that building assessment and rating systems in North America, Europe, Japan and other parts of the world have been, and continue to be, central to the rapid increase in awareness of sustainable building. Governments at various levels have seen rating systems as a seemingly straightforward, positive step toward demonstrated concern for and action with regard to the environment. The presumption is that mandating the use of one or more rating systems automatically gets the job done, while concurrently providing a good sound bite. Users of the systems naturally expect high ratings to go hand in hand with high performance. Unfortunately, the evidence that performance expectations are being met is not as clear as one might expect or hope; there are highly rated buildings that perform up to their billing, but there are also highly rated buildings that do not perform well at all.

There can be a number of reasons for the divide between expectation and outcome, a divide referred to in UK studies as the ‘credibility gap’.<sup>1</sup> The gap is probably most evident on the energy front, where post-occupancy performance is easily tracked. But there can be other failures damaging to the environment that are not so easily tracked. To some extent, those problems reflect the natural tendency to want simple answers and prescriptive, easy-to-follow directions to what are actually very complex issues. Materials selection is a good example; it is much easier to specify prescriptive paths involving recycled content, the use of rapidly renewable materials, or transportation distances than it is to require a life cycle assessment that focuses on the true environmental performance implications of material choices.

The problem is complicated when rating systems incorporate well-meaning but sometimes questionable requirements, and put them on the same or close to the same level as critical issues such as global warming. Bicycle racks are a good idea in terms of occupant mental and physical well-being, but they are not likely to have energy use and global warming impacts remotely close to those associated with building operations. That fundamental difference in importance has to be explicitly recognized and dealt with in implicit or explicit weighting given to different credits in a rating system.

The problem is further complicated when we use the word ‘standard’ in relation to assessment and rating systems. A rating system encourages and rewards best practices across several fronts (e.g., site selection and water use), but not all best practices should be classified as a standard in any regulatory sense of the term. We can think of a rating system standard in the sense of an agreed level of quality or attainment, but not necessarily in the sense of a required level. The guidelines developed for the State of Minnesota have clearly recognized this problem by avoiding the idea of rating altogether. The state’s Sustainable Building Guidelines instead comprise required and recommended practices for all state-funded buildings.

This paper explores these issues—the relative weighting of ‘good ideas’, prescription versus performance, and the place for standards setting processes—from the perspective of the current Green Building Initiative™ (GBI) effort to take the Green Globes™ environmental assessment

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<sup>1</sup> “Energy Performance of Non-Domestic Buildings: Closing the Credibility Gap”, Bill Bordass, William Bordass Associates, Robert Cohen, Energy for Sustainable Development Ltd., and John Field, Target Energy Services Ltd., *Advanced Building News*, November 2005.

and rating system through a formal consensus-based American National Standards Institute (ANSI) process. As the first national organization to take this step, GBI and its technical committee are examining how process, prescriptive and performance measures fit in a standard of this nature.

## **The GBI ANSI Process**

The mission of the GBI is to accelerate the adoption of building practices that result in energy-efficient, healthier and environmentally sustainable buildings by promoting credible and practical green building approaches for residential and commercial construction. In 2005, the GBI became green building's first ANSI-certified Standards Development Organization and proceeded to put the Green Globes rating system through the rigorous ANSI process following pre-set procedures.

A balanced thirty-person committee was structured from a list of applicants representing government, the academic community, industry and other stakeholders. Ten members of the committee are from the producer sector, ten represent users of the system, and ten represent the general interest category of stakeholders. ANSI procedures dictate that votes can only be held when the committee is balanced, with specific quorum and affirmative vote percentages required to pass resolutions. For a 'no' to be considered persuasive, it must be accompanied by a reason and overturning such a 'no' vote requires a larger than normal percentage of 'yes' votes. Once the full rating system has been through the committee and affirmed, it will be subjected to public review with clear provisions for an appeal process in the event of negative reactions to any part of the system. This full ANSI committee meets a minimum of four times a year, three times by teleconference and once face-to-face.

After the full committee was struck and had met, it was agreed that a series of sub-committees were required to focus the seven separate parts of the rating system. Each sub-committee is chaired by a member of the full committee, and may have two or three other full committee members. The rest of each sub-committee is made up of other interested stakeholders up to a total of 15 people per sub-committee. Balancing sub-committee interests when selecting from the list of applicants has not been as critical as ensuring the appropriate levels of expertise in each of the subject areas. However, when choices had to be made among applicants with similar expertise, an effort was made to ensure that no industry group dominated any sub-subcommittee. The chairs of the sub-committees form an executive committee under the chair of the full committee. In addition, crosscutting working groups have been formed as necessary, for example to deal with moisture control issues that potentially affect various areas of the rating system. Sub-committees may vote as they see fit, but their basic objective is to make recommendations to the full committee as the formal voting body.

The GBI/ANSI process has been underway for less than a year. However, as a result of extraordinary effort and dedication on the part of the volunteers at the sub- and full committee levels, three of the assessment areas have been tabled with the full committee for final votes and the rest are close to resolution. The expectation is that the full system will be made available for public review later this summer.

## **Weighting**

One of the critical issues rightfully raised by the full committee and by every sub-committee is the distribution of points across the various areas of the rating system, as well as across credits within each area. Green Globes has seven assessment areas—project management, site issues, energy use, water use, resource use, indoor environmental quality, and emissions, effluents and other impacts—across which 1,000 points are distributed. The points allocated to any given area are then distributed among the individual credits within that area. To the extent possible, points are allocated to credits on a sliding scale so that efforts in the right direction are rewarded within a rigorous framework. The question is—“how many points should be allocated to each area and how, specifically, should they be distributed?”

To address that question, the full ANSI committee participated in a formal Analytical Hierarchy Process (AHP) at its March 2007 face-to-face meeting. (For an explanation of AHP, visit [www.expertchoice.com/customerservice/ahp.html](http://www.expertchoice.com/customerservice/ahp.html).) Under the direction of Dr. Ernest H. Forman—a Professor of Management Science at George Washington University’s School of Business and Public Management and Founder, Chairman and Chief Technology Officer at Expert Choice, Inc.—the committee used specially-designed software to rank the seven assessment areas and determine their relative importance in percentage terms. Those percentages will now be used to distribute the 1,000 points across the rating system.<sup>2</sup>

The AHP was also used to determine how points might be allocated across specific environmental impact performance measures within the life cycle assessment (LCA) part of the resource use area. The use of LCA is discussed in more detail below.

Because the number and nature of credits varies considerably depending on which of the Green Globes assessment areas one considers, the AHP process was not suitable for that level of point distribution without a very time consuming and elaborate process. It was decided, therefore, that the individual sub-committees would recommend the most appropriate distribution of points within each area based on their expertise. Those recommendations are, of course, subject to final ratification by the full committee.

The essence of this entire procedure is to transparently apply an accepted, robust consensus methodology to the thorny issue of weighting the disparate components of the rating system.

## **Prediction versus Performance**

If an energy performance label has been granted on the basis of a building design simulation, and the building fails to perform at the predicted level, then the label tends to be devalued, especially for high profile buildings. Further, legal experts active in the green building arena are warning about the potential for litigation if there is a consistent tendency for buildings to fail to live up to

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<sup>2</sup> This process had not yet been completed at the time of writing. Assuming consensus, the results will be presented at the ASTM conference and can subsequently be appended to this paper.

their advance billing. That potential escalates if a rating system label or certificate is cited as the basis for an energy tax credit or other financial incentive.

A recent post-occupancy study of several LEED® (Leadership in Energy and Environmental Design) buildings on the US west coast illustrates some of the problems associated with dependence on the rating system approach as an indicator of energy performance.<sup>3</sup> Of four new office buildings in the sample, only one had actual energy usage better than the modeled usage, while the other three performed worse than expected. In contrast, three out of four multi-unit residential buildings performed better than predicted; the one that did not perform as well was a building that offered low-income units and received the lowest level of LEED certification. The two new library buildings in the sample both performed better than predicted.

There can be a variety of reasons for these differences, including occupancy behaviour and, in the case of the library buildings, person-hours of occupancy. The relevant point is that buildings seldom perform at the simulated level, and problems can be created when performance is poor relative to the expectations created by the granting of a rating.

This is a difficult issue to resolve for new buildings unless a label is granted purely on the basis of prescriptive measures. Otherwise, simulation is the only option. The question, in that case, is—“what simulation and benchmarking approach is likely to be the more reliable?” Discussing and answering that question in any definitive way is beyond the scope of this paper, but there are clearly grounds for debate about the relative merits of an ASHRAE 90.1 approach as required in LEED versus the reference to an actual benchmark such as the Energy Star Target Finder database used by Green Globes. Growing support for the latter was underscored recently by Architecture 2030’s call for climate change legislation based on the Commercial Buildings Energy Consumption Survey (CBECS) data, which forms the basis of the Target Finder program.

A prescriptive path, whereby a system credits specific design elements and the installation of equipment, may be the appropriate approach for smaller buildings that cannot afford the more expensive energy simulation approach. There is a research basis for assuming that specific prescriptive measures, ranging from basic orientation through shading, glazing and heating, ventilating and air conditioning choices, can have predictable energy saving consequences. The difficulty of basing a rating or label on this type of measure is the variability that can occur from building to building, and the way in which various measures may combine (or fail to combine) to produce a given level of energy use. In short, how does one verify that a given performance level is likely to be achieved?

Ultimately, I believe the answer is that we have to get past the notion of fully rating buildings immediately after construction and only grant final ratings after at least one year of occupancy. An initial rating could still be granted with regard to site selection, project management, resource use or other criteria that can be fully assessed immediately after construction. But operational criteria such as energy use, water use and indoor environmental quality could be the focus of a post-occupancy assessment. This ties to the GBI concept of an assessment continuum—and specifically, that Green Globes for New Construction can be used in tandem with the new Green Globes module for Continual Improvement of Existing Buildings—whereby a system focuses on the full gamut from project initiation through ongoing operations, with a smooth transition from

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<sup>3</sup> “LEED Building Performance in the Cascadia Region: A Post Occupancy Evaluation Report”, prepared for the Cascadia Region Green Building Council by Cathy Turner, January 30, 2006.

pre-construction through construction to post-occupancy measurement and evaluation. Granting a design/construction rating would at least partially deal with the desire of building developers to get the marketing advantage that comes with a high rating, without promising more than a building may deliver.

If we turn to resource use and product selection, defining ‘sustainable materials’ and encouraging their use has been one of the biggest challenges for the developers of green building rating systems. Prescriptive requirements such as transportation distance or rapid renewability too often fail to deliver the environmental performance that underlies the requirement. We would all welcome rules of thumb or labels to tell us which products are truly green, taking all factors into account over the whole life cycle. However, we can’t get those answers without formal LCA or some equally thorough approach. In the absence of that kind of information, we should regard seemingly easy answers with caution. For example, the production and ultimate disposal of resins used in the manufacture of plastic wood have to be taken into account if that product is to be considered as one of the ‘better alternatives’ to wood treated with chemicals, or to wood from old growth forests, as may be suggested in manufacturers’ claims or well-meaning articles. Similarly, the environmental footprint of a product has more to do with the specifics of the manufacturing processes along the entire supply chain than with transportation distances to a construction site. And, in the case of transportation, the mode of transport is as relevant as a specific distance traveled.

Clearly we have to better integrate LCA techniques and LCA-based decision support tools in rating and certification systems, a goal that all of the system developers are working toward. But the application of LCA requires care that product comparisons are truly apple-to-apple comparisons. In LCA-based comparisons, we use the term ‘functional equivalence’ when referring to the problem of ensuring that two or more products provide the same level of service. Ensuring functional equivalence in product comparisons is not as easily accomplished in building applications as might be supposed. The problem is that the choice of one product may lead to, or even require, the choice of other products. Consider the following examples:

- The choice of wood, steel or concrete structural systems will likely influence, or even dictate, the choice of insulation materials;
- An above-grade structure using high mass materials may require more concrete in footings than a lighter structural system; and
- A rigid floor covering may require a different substrate than a flexible floor covering.

These are just a few examples of situations where product comparisons should take account of other material-use implications of the alternatives. In other words, comparisons should be made in a building systems context rather than on a simple product-to-product basis. Even though two products may appear to be equivalent in terms of specific criteria like load bearing capacity, they may not be at all equal in the sense of true functional equivalence. In a similar vein, we have to be careful to account for all of the components that may be required during building construction to make use of a product. Mortar and rebar go hand in hand with concrete blocks, just as fasteners, tape and drywall compound are integral to the use of gypsum wallboard.

Not all products pose a functional equivalence problem to the same degree. In general, product-to-product comparisons are more likely to be misleading when dealing with structure and

envelope materials, where the systems context is key. As we move to interior finishes, fit-out products and furnishings, product-to-product comparisons are more realistic. For example, resilient or flexible floor coverings can readily be compared to each other as long as we take account of installation materials, cleaning products, expected service life, and what happens at the end of a product's life. Even window systems, although part of the envelope, are typically delivered to a construction site as pre-assembled components that can be compared to each other in terms of thermal performance or other criteria, without too much regard for broader systems implications.

The conundrum for rating system developers is how to introduce LCA with defined performance thresholds that must be met or exceeded, without requiring design teams to undertake yet another fairly complex type of simulation. GBI tackled that problem by commissioning a new software tool for use with Green Globes. The tool was created through a contract with Morrison Hershfield Consulting Engineers in association with the University of Minnesota's Center for Sustainable Building Research and the Athena Institute. Modeled on the Building Research Establishment's (BRE) Green Guide to Specification, which has been used in the UK for over a decade, it measures the global warming potential and other environmental impacts of more than 400 common building assemblies in low- and high-rise categories. Focusing on assemblies instead of individual products deals with the functional equivalence problem discussed above.

The new tool allows a comparison of material assemblies across environmental indicators such as embodied primary energy, which stands as a proxy for fossil fuel use, global warming potential, toxic releases to air and toxic releases to water. Rather than combining LCA scores across disparate impact categories using weighting, Green Globes will attribute points to each assembly in each impact category. This approach serves a valuable educational function because it lets members of the design team more readily see where they're earning their points. The tool will be continually updated as new building product data and new assemblies emerge in the market. Manufacturers can contribute relevant data to the US LCI Database Project ([www.nrel.gov/lci](http://www.nrel.gov/lci)).

The LCA tool is currently going through the ANSI technical committee process from the perspective of its fit within the Green Globes system, including the assignment of points to that part of the resources assessment area and to the specific LCA measures. In addition, the resources sub-committee has been providing invaluable input with regard to the definition of assemblies and procedures to ensure that a level playing is maintained in the assembly comparisons and award of points under each measure.

Recognizing its importance as a 'climate change calculator', the GBI has authorized the Athena Institute to make a generic version of the tool freely available for use by other green building organizations, government entities, trade associations and universities. Regional versions of the generic tool are also being developed to better reflect life cycle impacts based on local conditions. In fact, one of these regional versions is already incorporated in the Minnesota Sustainable Building Guidelines, and it is my understanding that GBI also intends for the new software to be used in a forthcoming online version of the National Association of Home Builders' Model Green Home Building Guidelines.

I should note that this same approach was recommended for the US Green Building Council's (USGBC's) LEED rating system in a report from the Goal and Scope Working Group of the 'LCA into LEED' initiative that was launched in September 2004. The USGBC board has now endorsed that recommendation and work is underway to examine the specifics of how it might be best implemented from the USGBC's perspective.

### **Concluding Observations Regarding Rating Standards**

An underlying implicit theme of this paper is the relative importance of design guidance versus rating objectives in building assessment and rating systems. There may be a natural tendency for organizations to focus more on the ratings side of the equation—often referred to as point hunting—at the expense of a continual effort to foster and facilitate increased performance. Perhaps it will turn out in the longer run that getting specific scores or ratings and achieving true performance are not fully compatible objectives, in which case we must surely question a continued emphasis on ratings and focus more on design guidance and performance requirements. Indeed, there may be a danger that an over-emphasis on ratings could stifle critical innovation: it's not recognized by the system, so best not to try it. At the same time, one can argue that ratings have a market value that attracts developers who might otherwise ignore sustainability criteria.

These kinds of issues have been central to much of the discussion within the Green Globes ANSI process. As well, the committees have focused a great deal of attention on the issue of minimum performance requirements, codes at various levels, and other standards that can or should be referenced in a rating system. One key related issue is the definition of 'mainstream', given that Green Globes is focused on the mainstream commercial building market. The basic position that has been taken is that 'mainstream' is not necessarily restricted to any given size, type or cost of building or to any specific group of practitioners. Nor does the term refer to a specific level of building performance. Rather, mainstream refers to the vast majority of buildings and practitioners, as opposed to buildings that are being 'showcased' for marketing, corporate image, demonstration or other reasons. Any building type of any size can, and should, be expected to perform as designed and intended within a given budgetary constraint. The goal of green building is to go beyond that point and ensure that all buildings are designed for higher than average performance across a range of energy use, water use, air quality and other environmental measures.

In keeping with this definition, Green Globes is designed to reach the mainstream by making the system as simple to use, non-bureaucratic and cost-effective as possible. Any building of any size should be able to reach exemplary levels of performance and, while achieving a third-party verified certification is highly desirable, a high performing building is the ultimate goal. To meet that objective, the system is designed to make its use as easy as possible for beginners as well as experienced practitioners. The task for the ANSI committee, and its sub-committees, is to maintain the integrity and performance expectations of the system without sacrificing the simplicity and cost advantages that it offers. The committee has therefore been careful to underscore the fact that appeal to the mainstream should not be interpreted as a reduction in performance expectations or requirements.

When it came to the question of minimum requirements or prerequisites, and the related issue of crediting performance that is essentially meeting codes, the committee generally agreed with the following principles.

1. Design teams should not be rewarded for simply meeting widely accepted codes and, further, such codes should not be used as prerequisites.
2. However, there are jurisdictional differences with regard to some codes and it might therefore be appropriate to credit meeting codes that require a higher level of performance and that have not been widely adopted.
3. The question of formal prerequisites or required minimum performance deserves continuing study, with one possibility being a requirement that design teams achieve a minimum number of points within each of the seven assessment areas.

Some of the above issues may eventually be superseded by the development of minimum high performance standards that can simply be cited and required within a rating system. The decision by ASTM E06.71 to define a minimum standard for high performance buildings is a good example, as is the work underway by an ASHRAE-led consortium. We see more emphasis elsewhere in the world on this approach, especially in terms of energy use and related greenhouse gas emissions. For example, energy performance certificates for buildings are being introduced throughout the Member States of the European Union as a result of the EU Energy Performance of Buildings Directive (EPBD). The objective of energy certification is to raise public awareness of energy use in buildings and to allow a comparison across similar building types. That directive is driving the development of processes, standards and tools in member states, with voluntarism fading as non-negotiable requirements come to the fore. In North America, we still lean heavily toward the voluntary, market-driven approach. The question is—“how long we can hang on to that approach in the face of a looming global warming crisis?”