

# DESIGNATION OF ENVIRONMENTALLY PREFERABLE BUILDING MATERIALS FUNDAMENTAL CHANGE NEEDED WITHIN LEED

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## **Designation of Environmentally Preferable Building Materials**

### *Fundamental Change Needed Within LEED*

#### **Introduction**

Green building recognition programs have been developed in Europe and North America over the past 10-15 years with an objective of shifting the built environment toward a more sustainable mode. Such programs are important – certainly in concept – in focusing building designers and construction firms on more efficient use of energy and water, improvement of indoor air quality and occupant safety, development of more liveable and environmentally sustainable communities, and reduction of environmental impacts in the construction and operation of buildings.

Because green building programs have the potential to significantly influence builder and architect behaviors, it is important that these programs be free of bias and any political pressure that could compromise their ability to improve environmental performance. Those responsible for developing, managing, and implementing private green building recognition programs do, of course, have the prerogative of identifying priorities that express their goals and interests. However, as the influence of green building programs grows it is critical that guidelines and requirements of these programs be rational, realistic, comprehensive, and science-based to assure they actually achieve positive outcomes.

An example of non-scientifically based standards is provided by the leading green building program in North America – LEED (Leadership in Energy and Environmental Design). In this program, designations of environmentally preferable materials are often prescriptive and largely made without the benefit of systematic, comprehensive analysis. Moreover, despite the reality that the production of a full range of building materials, such as plastic, steel, concrete, and wood, results in significant environmental impacts, only wood is held to standards linked to extraction. The result is designation of “environmentally preferable materials” using single attributes that don’t often stand the test of rigorous assessment, that fail to require systematic consideration of environmental impacts through the product life of all materials, and that ignore fundamental aspects of sustainability.

Recently proposed changes to the LEED building materials rating system, if approved, are a step in the right direction. However, more fundamental changes are needed in systems used to identify green building materials. Without such change, LEED cannot legitimately maintain a leadership position in this arena.

#### **LEED**

##### *Program Scope and Size*

The LEED (Leadership in Energy and Environmental Design) Green Building Rating System is a program of the U.S.-based Green Building Council (USGBC) (USGBC, 2006). The USGBC was founded in 1993 and is a national, not-for-profit, membership

organization. By May 2006, the USGBC had more than 6,300 member companies and organizations. The LEED program was initiated in 1998 as a voluntary, consensus-based national standard for developing high performance, sustainable buildings. The program originally focused on new construction (LEED-NC), but has since expanded to include commercial interiors (LEED-CI) and existing buildings (LEED-EB). LEED for core and shell (LEED-CS) and for homes (LEED-H) are currently in pilot stage. A sixth program, LEED for neighborhood development, (LEED-ND) is in very early stages of planning.

By early 2006, more than 24,000 LEED professionals had been certified worldwide, with 512 projects LEED certified and over 3,750 additional projects, including over 100 outside the U.S., registered for certification. Today, there are LEED-registered and certified projects in all 50 states and in 12 countries, including Canada, China, and India. The value of LEED-NC registered projects alone was estimated at \$7.73 billion by mid 2006.

*For more background on LEED, please refer to the previous Dovetail Report from April 2005: A Beginner's Guide to Green Building – What the Forest Sector Needs to Know About USGBC and LEED<sup>1</sup>.*

### *Factors Considered in LEED Certification*

The LEED program uses a point system in rating buildings, with points awarded in a number of environmentally-related categories, including site factors, water efficiency, materials and resources, and indoor air quality (Table 1). Only four to seven percent of points focus on characteristics of the materials used, with additional materials-related points awarded for below average structure size and for use of locally sourced materials. The number of points earned is used to determine attainment of certification levels (Table 2).

**Table 1**  
**Point Distribution within Several LEED Programs**

	<b>LEED-NC, Version 2.2</b>	<b>LEED-H, Version 1.72</b>
Sustainable sites	14 points, 1 prerequisite	14 points, 3 prerequisites
Water efficiency	5 points	12 points, 1 prerequisite
Energy and atmosphere	17 points, 3 prerequisites	14 points, 3 prerequisites
Materials and resources	13 points, 1 prerequisite	24 points, 4 prerequisites
Indoor air quality	15 points, 2 prerequisites	29 points, 6 prerequisites
Innovation and design process	5 points	4 points
Location and linkages		10 points
Homeowner awareness		1 point
<b>TOTAL</b>	<b>69 points, 7 prerequisites</b>	<b>108 points, 17 prerequisites</b>

<sup>1</sup> <http://www.dovetailinc.org/DovetailLEED0405.html>

**Table 2**  
**Points Needed for Project Certification Under LEED**

Level	LEED-NC, Version 2.2	LEED-H, Version 1.72
	69 Points Possible	108 Points Possible
Certified	26	30
Silver	33	50
Gold	39	70
Platinum	52	90

*Identification of Green Building Materials Under LEED*

Of the points that may be awarded under the LEED rating system (69 under LEED-NC and 108 under LEED-H), only 5 under LEED-NC and 4 under LEED-H relate to “environmentally preferable materials.” Under these two LEED programs, building materials can receive points according to the criteria shown in Table 3.

**Table 3**  
**Credits Related to Characteristics of Construction Materials**  
**Under the LEED-NC and LEED-H Programs**

Materials and Resources	
LEED-NC	LEED-H
Credit 2.1 and 2.2 - Reduction of construction waste	Credit 2.2 - Advanced framing techniques
Credit 3.1 and 3.2 - Use of salvaged, refurbished, or reused materials	Credit 3 - Materials extracted/manufactured within 500 miles
Credit 4.1 and 4.2 - Use of materials with recycled content	<b>Credit 5</b> <b>Environmentally preferable products</b> Credit 5.1 - Tropical hardwoods, if used, must be FSC [prerequisite]  Credit 5.2 - Select environmentally preferable products from list.
Credit 5.1 - Local/regional materials (manufacturing)	
Credit 5.2 - Local/regional materials (harvesting)	
Credit 6 - Rapidly renewable materials (10-year or less harvesting cycle)	
Credit 7 - FSC certified wood	
<b>Indoor Environmental Quality</b>	
Credit 4.4 - Low-emitting materials, composite wood & agrifiber	

Listed in Table 4 are specifications for environmentally preferable products as defined within LEED-H. Those specifications that pertain to wood and related products are highlighted in yellow; note also that insulation related credits could apply to wood if cellulose insulation were used.

**Table 4**  
**Specifications for Environmentally Preferable Products in LEED-H**  
**(yellow highlighting denotes specifications that pertain to wood or related products)**

<b>Specifications Related to Indoor Air Quality</b>			
<b>Assembly</b>	<b>Component</b>	<b>Qualifying EPPs</b>	<b>Specifications</b>
Other	Cabinets and trim	Low-VOC	Wood and agrifiber products contain no added urea- formaldehyde resins
Other	Counters	Low-VOC	Wood and agrifiber products contain no added urea- formaldehyde resins
Floor	Flooring	Low-VOC carpet and pad	Must comply with Carpet and Rug Institute's Green Label Plus Program
Floor	Flooring	No carpet in house	
Roof + floor + wall	Insulation	Low-VOC	Must comply with State of California, DHS, Practice for Testing of VOCs from Building Materials Using Small Chambers
Walls, ceiling, trim	Paint	Low-VOC	Must comply with Green Seal Standard GS-11, Paints, First edition, 1993.
<b>Other Environmentally Preferable Products</b>			
Foundation	Cement	Cement replacements	Minimum 30% fly-ash as replacement, not addition to, cement content
Roof	Framing	FSC-certified	
Floor	Framing	FSC-certified	
Floor	Flooring	- Recycled content carpet and pad - linoleum - bamboo - FSC certified wood - recycled content tile - sealed concrete	For 50% of house (sf), carpet and pad minimum recycled content 25%
Floor	Flooring	- Recycled content carpet and pad - linoleum - bamboo - FSC certified wood - recycled content tile - sealed concrete	Additional 0.5 point for 100% of house (sf), carpet and pad minimum recycled content 25%
Exterior wall	Framing	FSC-certified	
Interior wall	Framing	FSC-certified	
Walls + ceilings	Gypsum board	Recycled content	For 100% of gypsum board in house, minimum recycled content 25%
Roof + floor + wall	Insulation	Recycled content	For 100% of insulation in house, minimum recycled content 25%
Roof + floor + wall	Insulation	Recycled content	For 100% of insulation in house, additional 0.5 point for recycled content of 70%+
Roof	Roofing	- Recycled content - Vegetated	- minimum recycled content 25% - minimum 200sf if vegetated
Roof + floor + wall	Sheathing	- Recycled content - FSC-certified	minimum recycled content 25%
Exterior wall	Siding	- Recycled content - FSC-certified	minimum recycled content 25%

Assembly	Component	Qualifying EPPs	Specifications
Landscape	Decking	Recycled content	minimum recycled content 25%
Other	Doors and windows	- Recycled content - FSC-certified	minimum recycled content 25%
Other	Cabinets and trim	- Recycled content - FSC-certified	100% recycled/ recovered, 25% min post-consumer
Other	Counters	Recycled content	minimum recycled content 25%

**Unless otherwise noted, 90% of the selected component must meet the specifications shown - 0.5 point for each; total points – 4 maximum.**

Examination of the credits for environmentally preferable materials shows that points are heavily concentrated in three areas: low emission products, products with recycled content, and Forest Stewardship Council (FSC) certification (for wood products only). Not evident in Table 4 is that preference is given to bio-based products, especially if “rapidly renewable” (meaning renewable within 10 years or less); bamboo is especially favored using such criteria.

Although these three areas have some merit, there are several environmental impacts and attributes of materials that are not included. Curiously, there is no mention of embodied energy in products or product assemblies despite the fact that embodied energy is often equivalent to many years of energy consumption associated with a structure. Similarly, there is no mention of emissions linked to production and use of construction materials. Also not mentioned is any requirement for consideration of life cycle inventory data using common criteria as part of the materials rating system, nor is there any requirement for certification of any material or other products other than those made of wood.

### *Proposed Changes to the LEED Building Materials Rating System*

#### What is Proposed

In May 2005 LEED commissioned an examination of wood-related credits under its building materials rating system. In May 2006, following development of a draft, a subsequent comment period, and a follow-up meeting, a proposal was forwarded to the USGBC Board of Directors for approval. Action on this proposal is pending at this writing.

Two changes to the LEED building materials rating system are proposed:

- 1) To change the Rapidly Renewable Credit (Credit 6 under LEED-NC in Table 3) to a Biobased Credit.

The change is proposed based on recognition that the rapid renewability restriction cannot be justified from a Life Cycle Analysis (LCA) standpoint (the first use of LCA by LEED) since some rapidly renewable materials carry fairly heavy environmental and health burdens, and because there is “little scientific justification (*i.e. no scientific justification*) for continuing to preferentially reward rapidly renewable biobased products over responsibly-managed forest-derived bio-based products.”

Further proposed is that “Until LEED v. 3 is released, all rapidly renewable biobased materials (materials that currently comply with MR cr6 in LEED 2.2) will be grandfathered into this credit and automatically approved. This includes bamboo, cork, sisal, coir, and all agricultural products.” [Note that what is proposed here is continued reward for use of rapidly renewable products despite information indicating that there is no scientific basis for doing so].

With regard to wood, proposals for change are based on the statement that “The intent of MRc6 would be to approve all wood products that have undergone some level of certification that ensures that they are not derived from illegal logging. Likely certification systems would be the Sustainable Forestry Initiative (SFI) certification with third-party verification, the Canadian Standards Association (CSA) wood certification, and the American Tree Farm System (ATFS).” Then outlined is the concept of “Tier 2” wood certification systems that “are more rigorous than Tier 1 systems.” Only FSC certified wood would currently qualify as a Tier 1 certification program under the change proposal.

It is unclear what basis is being used to determine if a certification program can assure the wood is not the result of illegal logging. Traditionally, chain-of-custody has been the most commonly used measure. The SFI, FSC, and CSA programs all offer chain-of-custody programs. The ATFS currently does not.

- 2) To modify MRc7 to establish a basis for adoption of certification systems but maintain the FSC Certification requirement for wood products at this time.

Here the idea is to leave room for development of certification systems other than FSC that are comparable or even more rigorous. A part of the proposed change involves development on the part of USGBC of a set of minimum criteria that any certification system would need to meet before being approved as an MRc7 referenced standard. With regard to bamboo it is envisioned that this material be accepted as satisfying Tier 1 certification criteria without the requirement for certification based on the argument that it meets “certain prescriptive criteria.” A vague reference is made to the possibility of certifying materials other than wood and bio-based materials in the future.

An additional facet of this recommendation is that waste agricultural materials, such as a particleboard made from wheat straw be approved by definition for MRc7. It is noted that “such materials currently satisfy both the recycled-content credit (MRc4) and the rapidly renewable credit (MRc6); if also approved by definition for MRc7, they could satisfy three different credits – thus providing a strong incentive for their use in LEED projects.”

### *Observations and Questions Regarding LEED Building Materials Rating System and Proposed Changes*

Rapidly Renewable: The initial subjective judgment that led to LEED designation of rapidly renewable materials as being environmentally better than materials that are renewed over a longer time frame had no factual basis. In the May 2006 LEED white



paper (Wilson 2006) it is now acknowledged that this position is not supported by science, and that, in contrast, environmental burdens imposed by some rapidly renewed materials are much greater than those associated with longer term renewables like wood. Thus, for a number of years it would appear that LEED has given preference to at least some products that had potentially an extraordinarily high environmental impact. The proposed shift from awarding points based on rapid renewability to recognition of renewable materials in general is a positive step. However, under the proposed changes, products made of agricultural residues, cork, bamboo, and those containing recycled content would continue to be “grandfathered in” as acceptable rapidly renewable materials. LEED has not yet conducted a systematic review of any of these materials to determine their environmental impacts, nor has it indicated such a review is forthcoming. Given the fact that casual designation of rapidly renewable materials has now been shown to be faulty, with clarification gained only through the application of life cycle assessment techniques, it is worth asking a few questions:

- 1) Why would LEED grandfather any further use of materials and products based on rapid renewability without systematic evaluation of environmental attributes?
- 2) Shouldn't LEED drop the term “rapidly” renewable completely?
- 3) Why isn't LEED moving to require life cycle assessment of all materials as one part of the Building Materials Rating System?

Recycled Content: It is well known that products containing recycled materials are not necessarily environmentally better than those that do not. For instance, steel studs containing the maximum percentage of recycled steel that technology currently allows require substantially more energy to produce (and accordingly generate substantially more emissions) than do wood studs. The difference becomes even greater when expanded polystyrene is added to wall sections in an attempt to achieve insulation properties in the steel-framed wall equivalent to that of wood frame construction. The LEED system is missing an opportunity for large gains in environmental performance that might be realized through application of life cycle assessment to building design and is instead systematically promoting as environmentally preferable, products and product assemblies that are far less environmentally desirable than other alternatives.

- 4) How can awarding of points for recycled content be justified without also considering the energy and environmental implications of this credit category?

Embodied Energy: LEED does not consider embodied energy in the material evaluation process of products and product assemblies, even though embodied energy is often equivalent to many years of energy consumption associated with a structure, and even though high embodied energy products result in far higher emissions to air and water.

- 5) Why isn't consideration of embodied energy a required part of the LEED Building Materials Rating System?

Material Certification: For wood to receive a point as an environmentally preferred material within the LEED program it must be FSC certified. Under proposed changes, wood will need to be certified under some program to receive some credit, and preference



will still be given to FSC certified wood for additional credit. However, there is no requirement that any material other than wood be certified, nor would proposed changes require this.

This singular focus on wood is worth consideration. FSC certification requires assessment of a number of factors in the certification process within the following categories:

- Compliance with laws
- Tenure and use rights and responsibilities
- Indigenous Peoples' rights
- Community relations & worker's rights
- Benefits from the forest
- Environmental Impact
- Management Plan
- Monitoring and Assessment
- Maintenance of High Conservation Value Forests
- Plantations

Attention to land tenure issues, observance of indigenous people's and worker's rights, and focusing on community relations in addition to a wide range of environmental impacts linked to raw materials extraction and processing is certainly an enlightened approach to materials selection. But if these factors constitute essential elements in selection of an environmentally preferable building material, why does LEED not require compliance with such standards for any material other than wood?

For instance, growing and harvesting of many agricultural products such as bamboo are known to have all of the problems often attributed to wood and also often bear the additional environmental burdens associated with monoculture plantations and intensive agricultural practices (Bowyer et al. 2005). Why is bamboo accepted without question and even singled out by LEED as an "environmentally preferable" material both currently and in the recent proposal for change? There appears to be no logical or scientific reason for this.

With respect to non-biobased products, there is extensive evidence pointing to mining development as a major disruptive force to communities, indigenous people's rights, worker's rights, and long-held land tenure. It is also often highly disruptive of forested and non-forested ecosystems alike. In view of these realities, the World Wildlife Fund (WWF) in January 2003 took the first steps to create a Mining Stewardship Council, noting pervasive environmental, social, and economic problems linked to mining activity worldwide. There is no apparent justification for singling out only one, and possibly the most environmentally friendly construction material (wood), for a host of special requirements.

- 6) Why isn't third-party certification, either under FSC or some other certification system, similar to that now required or proposed for wood, also required for bamboo?

- 7) Why is certification not required of any material other than wood, and why is *required* certification of non-wood materials not a part of the recent proposal to modify the LEED building materials rating system?

### **The Bottom Line**

It is time to require rigor in the assessment and designation of environmentally preferable building products. Specifically, LEED needs to scrap its prescriptive system of materials assessment using single attributes and replace it with a scientifically-based system. In addition, if certification programs are to be required as part of materials assessment, then action should be taken to ensure that the same questions are asked of, and the same requirements imposed on, manufacturers and suppliers of the full array of building materials. Today LEED is in the forefront of green building programs in the United States in terms of both participation and influence. But to actually create meaningful change in the behavior of those in the construction industry it must be willing to make significant changes to itself and its systems.

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