LEED v4:
Understanding the Changes and Implications for Use of Wood as a Building Material

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13 August 2014

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Introduction

In 2013, the US Green Building Council (USGBC) released the latest version of the LEED green building rating program, LEED v4. Described as a "quantum leap," LEED v4 is said to speed up the credit submittal process for design teams and encourage building owners to better understand building maintenance and operation. New standards and credit categories have been developed as part of LEED v4, with the list of standards expanded to include data centers, warehouses and distribution centers, hospitality facilities, existing schools, existing retail, and mid-rise residential projects. Two credit categories – *Location and Transportation*, and *Integrative Process* – were also added.

Other changes in LEED v4 include introduction of prerequisites requiring metering of energy and water use, and establishment of specific energy performance requirements. In addition, minimum point floors (or requirements) were established in the *Energy and Atmosphere* and *Location and Transportation* credit categories.

Perhaps the most substantial changes in the LEED program are to the *Materials and Resources* credit category. Brand new in LEED v4 are optional credits related to life cycle assessment (LCA), LCA-based environmental product declarations (EPDs), material ingredient verification, and transparent reporting of raw materials sourcing. In addition, the list of environmentally preferable products has been redrawn so as to narrow the definition of locally sourced products, exclude rapidly renewable materials, and add a new bio-based products category.

This report examines three of the standards within LEED v4: 1) Building Design and Construction: New Construction and Major Renovation, 2) Interior Design and Construction: Commercial Interiors, and 3) Building Design and Construction: Multifamily Midrise. For all of these standards, changes to the *Materials and Resources* and *Indoor Environmental* categories are identified, and ways in which changes may impact the use of wood in building construction are discussed.

Major Changes in LEED v4:

- Expanded application to data centers, warehouses, existing buildings, etc.
- 2 additional credit categories (*Location & Transportation*; *Integrative Process*)
- Prerequisites for metering energy and water use
- Energy performance requirements
- Minimum requirements for *Energy & Atmosphere and Location & Transportation* categories

Major Changes in *Materials & Resources (MR)* credit category for LEED v4:

- Added prerequisite for Waste Management
- New optional credits related to:
  - Life Cycle Assessment (LCA),
  - Environmental Product Declarations (EPDs),
  - Ingredient verification,
  - Transportation and sourcing reporting
- New "locally-sourced" definition with a 100 mile limit
- New list of 6 responsible sourcing criteria, including bio-based materials, certified, reused and recycled materials
- Removal of credits for "rapidly-renewable materials"

LEED v4 Certification Level	Required Points
Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80-110

What is a ½ product?

Within LEED v4, some credits are awarded based upon having a minimum number of qualifying permanently installed products. Permanently installed products that meet certain requirements are counted as "full products" (i.e., valued at full cost). Products that meet criteria judged to be less rigorous may count as only *½ product* or even *¼ product.* For purposes of calculating credits, if a point is offered for the use of 20 permanently installed products from five different manufacturers that meet certain guidelines, the point may be achieved using a combination of ¼, ½, or full products adding up to an equivalent of 20 full products in total.

Basic Framework

In LEED v4, as in previous versions of the LEED green building rating system, areas of focus are defined as credits or credit categories. Within each credit or credit category there is an opportunity to earn one or more points by meeting various criteria. The number of possible points within each LEED standard remains at 110 in v4.[1] Thresholds for attainment of various certification levels also remain as previously, with 40-49 points needed for certification, 50-59 for silver, 60-79 for gold, and 80-110 for platinum.

Within some sections of the various standards, permanently installed products are counted as less than a full product or valued at less than full value for purposes of credit achievement. For instance, under several credit categories a point is awarded for the use of 20 permanently installed products from five different manufacturers that meet certain guidelines. Products that meet criteria judged to be less rigorous may count as only *½ product* for purposes of credit achievement (meaning that in this example the use of 40 permanently installed products would be needed to gain award of a point if all products met only the less rigorous criteria).

Transitioning to LEED v4

The fourth version of LEED, originally referred to as LEED 2012, was initially scheduled for release in November 2012. However, due to the nature of proposed changes, having been described as "too much, too fast,"[2] the USGBC decided to amend the standard and postpone the release date – hence the change of name to LEED v4. LEED 2009 and LEED v4 will both be operational and supported until June 1, 2015. Thereafter, LEED 2009 will be fully replaced by LEED v4.

Building Design and Construction: New Construction and Major Renovation

Materials and Resources

There is significant change from LEED 2009 to LEED v4 in the *Material & Resources* (MR) section. Other than the *Storage and Collection of Recyclables* prerequisite and the *Construction and Demolition Waste Management* credit that are largely unchanged, everything else is new or has been significantly altered. One change is addition of a *Waste Management Planning* prerequisite that encourages recycling of materials and requires monitoring and reporting of waste during the construction and demolition processes.

[1] The main sections of the standard include 100 points. There are 10 additional points offered for other project considerations, including: work with a LEED Accredited Professional (1 pt), compliance with provisions that match areas of regional priority (4 pts), and innovation (5 pts).

[2] http://www.buildinggreen.com/auth/article.cfm/2012/6/4/LEED-2012-Postponed-to-2013-Renamed-LEED-v4/

Emphasized in the new standard are credits related to life cycle assessment (LCA), LCA-based environmental product declarations (EPDs), material ingredient verification, health product declarations (HPDs), and transparency regarding raw materials sourcing and extraction. Also, new locally sourced (100 mile radius) criteria replace the previous regional materials (500 mile radius) credit, with local sourcing no longer awarded stand-alone credit, but now recognized in conjunction with attainment of other criterion. Prescriptive measures related to materials reuse, recycled content, and wood certification that have been a part of previous LEED standards are retained within this section of LEED v4, although individual credits for each of these have been eliminated. Reference to rapidly renewable materials has also been eliminated and replaced with responsible sourcing criteria that include bio-based materials, certified forest products, reused and recycled content products. There are four new credits in the MR section of LEED v4 that replace seven credits of the MR section of LEED 2009 (Table 1).

Table 1.
Comparison of *Material & Resources* – Prerequisites and Credits in LEED 2009 and v4

LEED 2009 – New Construction and Major Renovations *(14 total possible points)*			**LEED v4 – BC& C: New Construction and Major Renovations** *(13 total possible points)*		
MRp1	Storage and collection of recyclables	Required	Prereq	Storage and collection of recyclables	Required
MRc1.1	Building reuse- maintain existing walls, floors and roof	3 possible points	Prereq	Construction and demolition waste management planning	Required
MRc1.2	Building reuse – maintain interior nonstructural elements	1 possible point	Credit	Building life-cycle impact reduction	5 possible points
MRc2	Construction waste management	2 possible points	Credit	Building product disclosure and optimization – environmental product declarations*	2 possible points
MRc3	Materials reuse	2 possible points	Credit	Building product disclosure and optimization – sourcing of raw materials*	2 possible points
MRc4	Recycled content	2 possible points	Credit	Building product disclosure and optimization – material ingredients*	2 possible points
MRc5	Regional materials	2 possible points	Credit	Construction and demolition waste management	2 possible points
MRc6	Rapidly renewable materials	1 possible point	*If products meeting criteria for this credit are also locally sourced (i.e. extracted, manufactured, and purchased within 100 miles of the project site) they are valued at 200% of actual cost for purposes of credit calculation.		
MRc7	Certified Wood	1 possible point			

Source of information: USGBC, LEED credit library, http://www.usgbc.org/credits/new-construction/v4/material-%26-resources

New Materials & Resources (MR) Credits in LEED v4, New Construction & Major Renovations

As shown in Table 1, the MR section of LEED v4 includes new credits. The intent of these credits is to encourage the use of products and materials for which life-cycle information is available and to reward project teams for selecting products from manufacturers that have verified improved environmental and social life-cycle impacts. Each of the new credits is described below.

- **Building Life-Cycle Impact Reduction** (up to 5 points).

  This credit focuses on optimizing the use of materials and resources through the reuse of existing parts of buildings or the use of Life Cycle Assessment (LCA) to inform building design and materials selection.

  A project can be awarded 5 points for reusing either an historic or abandoned/blighted building. Alternatively, 2 to 4 points may be obtained if 25 to 75% of the total surface area of a structure is made of repurposed building materials (whether from on or off site – with the exception of window assemblies and hazardous materials). Three (3) points can be earned by conducting an LCA of a project's structure and enclosure that demonstrates a reduction of at least 10% (compared to a baseline building) in global warming potential and two other impact categories.[3] Any increase in impacts in any category is limited to 5%.

- **Building Product Disclosure & Optimization – Environmental Product Declarations** (1-2 points).

  This credit recognizes the use of products that have a fully developed Environmental Product Declaration (EPD).

  One point is awarded for using "*at least 20 different permanently installed products sourced from at least five different manufacturers that meet [the USGBC's] criteria.*"[4] A second point is available for multi-attribute optimization. The first point is awarded for simply collecting the required number of EPDs. The second point (multi-attribute optimization) is awarded for selecting permanently installed products that demonstrate impact reduction below industry average in at least three of the impact categories specified under the *Building Life Cycle Impact Reduction* credit. Such products must also account for at least 50% of the total value of permanently installed products in a given project.[5]

  Woven into the multi-attribute optimization segment of this credit is recognition of local sourcing. This shows up in the credit achievement calculation wherein products sourced (extracted, manufactured, purchased) within 100 miles of the project site are valued at 200% of their base contributing cost.

[3] Specified impact categories, in addition to global warming potential, include stratospheric ozone depletion, formation of tropospheric ozone, acidification potential, eutrophication potential, and depletion of non-renewable energy resources.

[4] It is important to note that for purposes of credit achievement, EPDs are *fully valued* if the product manufacturer is explicitly recognized by the program operator as the sole participant in the EPD development. Industry-wide EPDs are valued as *one-half* of a product for purposes of credit achievement, and in this case the product manufacturer must be explicitly recognized as a participant in the EPD development process. Products for which there is a publicly available, critically reviewed life cycle assessment of at least cradle to gate scope are valued at *one-fourth* of a product for purposes of credit achievement. (http://www.usgbc.org/node/2616376?return=/credits/new-construction/v4/material-%26-resources)

[5] This second point may also be earned independent of EPD collection as long as product impact information is third party certified. Obtaining both points effectively requires development of manufacturer and product specific EPDs or LCAs as a basis for comparison to industry averages for impact measures.

- **Building Product Disclosure & Optimization – Sourcing of Raw Materials** (1-2 points).

  This credit rewards the use of products that publicly report supplier and extraction locations. Prescriptive measures that were part of LEED 2009 – for materials reuse, recycled content, and rapidly renewable materials – have been replaced by this section.

  One point is awarded for using "*at least 20 different permanently installed products sourced from at least five different manufacturers that have publicly released a report from their raw material suppliers which include raw material supplier extraction locations, a commitment to long-term ecologically responsible land use, a commitment to reducing environmental harms from extraction and/or manufacturing processes, and a commitment to voluntarily meeting applicable standards or program that address responsible sourcing criteria*."[6]

  One point is also available for the use of products that meet one or more of six responsible sourcing criteria and that account for at least 25% of the total value of permanently installed building products.[7]

  The **6 Responsible Sourcing Criteria**[8] are:

  1. *Extended producer responsibility. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility qualify. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purposes of credit achievement calculation.*
  2. *Bio-based materials. Bio-based products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Excludes hide products, such as leather and other animal skin material. Products meeting bio-based materials criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
  3. *Wood products. Wood products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood products criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
  4. *Materials reuse. Reuse includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
  5. *Recycled content. Recycled content is the sum of postconsumer recycled content plus one-half the pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposes of credit achievement calculation.*
  6. *USGBC approved program. Other USGBC approved programs meeting leadership extraction criteria.*

  See Box 1 (following page) for glossary of terms used in the responsible sourcing criteria.

[6] For purposes of credit achievement, each product that is accompanied by a third-party corporate sustainability report (which includes reporting of environmental impacts of extraction operations and activities associated with the supply chain) is valued as one whole product. Recognized sustainability reporting frameworks include the Global Reporting Initiative, OECD Guidelines for Multinational Enterprises, the UN Global Compact, ISO 26000 compliant reports, and other programs as approved by USGBC. Products sourced from manufacturers with self-declared reports are valued as one-half a product for purposes of credit achievement. (http://www.usgbc.org/node/2616388?return=/credits/new-construction/v4/material-%26-resources)

[7] A caveat here is that structure and enclosure materials may not constitute more than 30% of the total value of building products for purposes of credit achievement.

[8] Cited from: http://www.usgbc.org/node/2616388?return=/credits/new-construction/v4/material-%26-resources

Box 1. USGBC, LEED v4 – Glossary of terms referenced in the Responsible Sourcing Criteria:

Extended Producer Responsibility: measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life. Producers recover and recycle the materials for use in new products of the same type. To count toward credit compliance, a program must be widely available. For carpet, extended producer responsibility must be consistent with NSF/ANSI 140–2007. Also known as closed-loop program or product take-back.

Wood: plant-based materials that are eligible for certification under the Forest Stewardship Council. Examples include bamboo and palm (monocots) as well as hardwoods (angiosperms) and softwoods (gymnosperms)

Reuse: the reemployment of materials in the same or a related capacity as their original application, thus extending the lifetime of materials that would otherwise be discarded. Reuse includes the recovery and reemployment of materials recovered from existing building or construction sites. Also known as salvage.

Postconsumer recycled content: waste generated by households or commercial, industrial and institutional facilities in their role as end users of a product that can no longer be used for its intended purpose

Pre-consumer recycled content: matter diverted from the waste stream during the manufacturing process, determined as the percentage of material, by weight. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. The designation excludes rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them (ISO 14021). Formerly known as postindustrial content.

Source: http://www.usgbc.org/glossary

Within the responsible sourcing criteria, there are several important points regarding the use of wood and bio-based materials:

- The Sustainable Agricultural Network Sustainable Agriculture Standard referenced for bio-based materials encompasses agriculturally derived bio-based products but not wood products. It replaces the previous "rapidly renewable materials" designation from LEED 2009.
- As in previous versions of LEED, only wood certified by the Forest Stewardship Council (FSC) qualifies under the wood product criteria.[9]
- As in previous versions of LEED, calculation of recycled content is based on the full percentage of post-consumer recycled content and one-half the percentage of pre-consumer recycled content. Further, only the percent of cost directly related to recycled content can be counted; i.e. if steel studs costing $1,000 are used and if the recycled content of these

[9] Casual reading of this provision would suggest that other forest certification programs also qualify for credit, since wording indicates that "USGBC-approved equivalent" certification programs are recognized in addition to FSC. However, as of this writing USGBC has neither defined what would constitute an equivalent program nor given approval for use of any other forest certification program.

studs is 23%, then only 23% of $1,000 or $230 counts toward credit achievement. This approach to credit calculation also applies to bio-based materials (i.e., the percentage that is bio-based content) and wood products (i.e., the percentage that is certified content).

- No definition is provided for the other "USGBC approved programs", so in effect this criteria appears to be a placeholder for future programs, or proposals, from project developers.

As in the *Environmental Product Declaration* credit, locally sourced materials receive a bonus. Products sourced (extracted, manufactured, and purchased) within 100 miles of the project site are valued at 200% of their base contributing cost.

Combining the recycled content, materials reuse, wood certification, bio-based materials, and extended producer responsibility options under a single credit increases the possibility of obtaining credit, since the costs of materials exhibiting each of these attributes can be combined in seeking to reach the 25% of total material cost threshold.

- **Building Product Disclosure & Optimization – Material Ingredients** (1-2 points).

This credit rewards the reporting of a product's chemical ingredients.

One option, worth one point, requires using "*at least 20 different permanently installed products from at least five different manufacturers that use [USGCB-approved] programs to demonstrate the chemical inventory of the product at least 0.1% (1000 ppm*)."[10] USGBC-approved mechanisms for disclosure include publicly available manufacturer's inventories wherein product ingredients are identified by Chemical Abstract Service Registration Number (with allowance for non-disclosure of trade secrets), certification of products under the Cradle to Cradle Certified program, and products accompanied by Health Product Declarations.

A second option, also worth one point, encourages the use of products for which material ingredient optimization has been documented through Green Screen[11], Cradle to Cradle Certified[12], REACH Optimization[13], or other USGBC-approved program.

A third option for obtaining one of the possible points involves purchasing of materials "*sourced from product manufacturers who engage in validated and robust safety, health, hazard and risk programs which at a minimum document at least 99% (by weight) of the ingredients used to make the building product or building material*."[14] In this case, manufacturers must also have third party verification of their supply chain.

For the second and third options, the cost of qualifying products must collectively account for at least 25% of the total value of permanently installed products. Also, for credit achievement under these two options, locally sourced products (extracted, manufactured, purchased within 100 miles) are valued at 200% of their base contributing cost.

Also related to material ingredients, LEED v4 retains recognition of *Low Emitting Materials* in the *Indoor Environmental Quality* (IEQ) section. However, unlike LEED 2009 wherein a number of separate credits were available for use of products meeting emissions limits for specific

[10] http://www.usgbc.org/node/2616399?return=/credits/new-construction/v4/material-%26-resources
[11] http://www.greenscreenchemicals.org/
[12] http://www.c2ccertified.org/products/registry
[13] http://www.intertek.com/reach/testing/
[14] For Healthcare-related projects there are additional prerequisites and opportunities to earn points related to source reduction, selection of furniture, and designing for flexibility. Source reduction targets include mercury, lead, cadmium, and copper.

compounds, the LEED v4 program combines *Low Emitting Materials* into a single credit. Moreover, in order to receive credit, compliance with limits in at least two emissions categories must be demonstrated and emissions limits in some categories have been tightened. Untreated and uncoated wood can also receive credit in some instances. The credit includes a listing of product categories and thresholds of compliance.[15]

Interior Design and Construction: Commercial Interiors

Materials and Resources

Changes to and provisions of this section are almost identical to those in the New Construction and Major Renovation standard as outlined in the preceding section. There are differences, however, in the Life Cycle Impact Reduction credit and a unique commitment credit.

The Life Cycle Impact credit offers the opportunity to earn points through the reuse or salvage of at least 50% of the surface area of interior non-structural elements (2 points); reuse, salvage, or refurbishment of furniture and furnishings to equal at least 30% of the total cost of furniture and furnishings (1 point); and/or designing for flexibility so as to increase project space flexibility and increase the useful life of the project space (1 point Interior Design and Construction, 2 points Retail Commercial Interiors). There is no reference to life cycle assessment in this case.

There is also a credit that is unique among the LEED standards: long-term commitment. Under a credit that applies to Commercial Interiors, Retail Commercial Interiors, and Hospitality Commercial Interiors, one point may be earned for making a written commitment (on the part of the occupant or tenant) to remain in the same location for at least 10 years.

In all other respects, points available under the *Materials and Resources* section of the Commercial Interiors standard are identical to those in the New Construction and Major Renovation standard.

Indoor Environmental Quality

Provisions under this section of the Commercial Interiors (CI) standard are identical to those in the New Construction and Major Renovation standard with one exception. The difference is in greater attention to acoustic performance within CI, with 2 points, rather than 1, available in this area.

Provisions related to *Low Emitting Materials* are the same as in the New Construction and Major Renovation standard.

Building Design and Construction: Multifamily Midrise

Materials and Resources

Provisions under this section of the Multifamily Midrise standard are significantly different than those in the New Construction and Major Renovation and Commercial Interiors standards, with greater similarity to LEED 2009. Required elements include development of a durability management plan and FSC certification of all tropical wood used in the project.

Points are available in the areas of: construction waste management (3 pts), durability management verification (1 pt.), and use of environmentally preferable products (5pts).

Environmentally preferable products that constitute at least 90% of each compliant building product, by weight or volume, earn 0.5 point each; no more than 1.0 point can be earned in any one product category (see below). To quality as environmental preferable, a product must meet one of

[15] http://www.usgbc.org/node/2614095?return=/credits/new-construction/v4/indoor-environmental-quality

six criteria; a product or component that meets more than one criterion does not earn additional points. The six criteria include four of those that define *Responsible Sourcing* under the New Construction and Major Renovation standard, although the criteria of only three are identical: *Extended producer responsibility, Bio-based materials, and Wood products* (see page 6). The other three criteria are listed below:

- The product contains a minimum of 25% postconsumer or 50% pre-consumer content. This is similar to the *Materials with recycled content* criterion (see page 6) discussed earlier, except that in this case recycled content is measured by either weight or volume, whereas in the New Construction and Major Renovation standard the percentage is based on the value of all permanently installed materials.
- Concrete that consists of at least 30% fly ash or slag used as a cement substitute and 50% recycled content or reclaimed aggregate OR 90% recycled content or reclaimed aggregate.
- The product contains at least 25% reclaimed materials, including salvaged, refurbished, or reused materials, with existing components considered as reclaimed in renovation projects. A similar criterion can be found under the *Materials reuse* heading (see page 6) as part of the definition of *Responsible Sourcing* under the New Construction and Major Renovation standard As with recycled content, the percentage in the multifamily midrise standard is based on weight or volume instead of value as in the New Construction and Major Renovation standard.

  The definition of reclaimed material under this criterion provides opportunities for obtaining points for wood use. Eligible for credit as reclaimed material are wood by-products which are further defined as items from secondary manufacturers; products made from felled, diseased, or dead trees from urban or suburban areas; products made from orchard trees that are cut for replacement; and wood recovered from landfills or water bodies.

Products that meet the above criteria, and for which points can be earned include floor covering materials, insulation, sheathing, framing, interior finish, concrete (cement and/or aggregate), roofing, siding, doors*, cabinets*, counters*, interior trim*, decking*, and windows*. At least three of the starred items in the previous list must be installed in order to count toward credit.

An additional 0.5 point can be earned for use of framing, aggregate for concrete and foundation, and drywall or interior sheathing that is locally sourced (i.e., where raw materials are extracted, processed, and manufactured within 100 miles of the building site).

Indoor Environmental Quality

Provisions under this section of the Multifamily Midrise standard are more extensive than those in the New Construction and Major Renovation standard, including a number of additional requirements related to such areas as venting, pollutant protection, and radon control. Provisions related to *Low Emitting Products* are the same as in the *Low Emitting Materials* section of the New Construction and Major Renovation standard.

Discussion

While LEED v4 represents a significant improvement over LEED 2009, the USGBC position on forest certification remains effectively unchanged. In addition, points in some *Materials and Resources* credits will be very difficult to obtain, at least in the near to mid-term.

Recognition of Additional Forest Certification Programs

LEED v4 retains USGBC's singular recognition of FSC wood products certification. This position has long been a point of contention with previous versions of LEED. In view of language in LEED v4 alluding to recognition of "USGBC-approved equivalent" programs, it is incumbent on USGBC to publish guidelines as to what constitutes an equivalent program and to develop an appropriate review and approval process.

Reliance on Systematic Assessment

In view of the emphasis on shifting away from prescriptive, single attribute provisions to more provisions that call for holistic consideration of a range of impacts, it is a bit ironic that full credit can be earned in *Life Cycle Impact Reduction* in the New Construction and Major Renovation standard without ever conducting an LCA. Moreover, when LCA *is* used to inform design and materials selection, only 60% of the possible points in this credit category are awarded. The awarding of full credit for building restoration while not also encouraging use of LCA is short-sighted. Even when restoring a blighted building a myriad of choices are necessary that invariably have large environmental implications. In the absence of systematic assessment, critical information needed for development of environmentally better structures remains elusive.

As an illustration as to how this credit could have been structured more effectively, consider LCA provisions within the GBI Green Globes standard[16]. In the GBI standard, the use of LCA is rewarded under a performance path option where credit is available for the use of LCA in evaluating alternative core and shell designs and alternative interior fit-outs. Further, it is specified that the LCA comparison is to occur prior to the construction document phase, with documentation provided during the stage 1 review along with a narrative explaining how LCA influenced the design process. The reuse of existing structures – facades, structural systems, and non-structural elements – is recognized and rewarded in a separate section of the standard than is application of LCA. Overall, informing building design and materials selection through the use of LCA yields at least 4.8% of total points under the Green Globes standard. [17] This compares with 3.0-3.3% under LEED v4.

Environmental Product Declarations

The move to EPDs is a positive step in that these instruments replace single attribute and often unsubstantiated environmental labels with ISO-compliant, LCA-based information about multiple environmental attributes. More extensive explanation of EPDs can be found in several previous Dovetail reports[18; 19]. Much like a food nutrition facts label, EPDs provide information that environmentally conscious consumers can use in making purchase decisions.

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[16] http://www.thegbi.org/

[17] Under the Green Globes standard, buildings are evaluated using a 1,000 point scale. However, for buildings for which portions of the standard may not apply (a warehouse building, for example), points associated with the non-applicable sections are deducted from the total of points possible. In such a case, the relative importance of remaining provisions increases.

[18] Trusty et al. 2012. Environmental Product Declarations: What, Why, How? Dovetail Partners, Inc., Oct. 30. (http://www.dovetailinc.org/report_pdfs/2012/dovetailepd1012.pdf)

The shift toward EPDs has long been in the works and is reflected not only in LEED, but in the Green Globes standard as well. However, currently only the North American wood products industry has developed and published ISO-compliant EPDs for a wide range of products, and all of these are industry-wide. The cement/concrete industry is reportedly moving toward developing industry-wide EPDs but as yet nothing is publicly available. There is no apparent movement on behalf of the steel industry regarding EPD development.

As noted, industry-wide EPDs count as only ½ product for purposes of credit attainment, and even then only if the manufacturers of the products selected are explicitly identified in the published EPDs. Currently the only industry-wide EPDs available are for North American wood products – this means that in the near term, for wood products to satisfy the EPD requirement, EPDs would be required from 40 different products and from at least 5 different manufacturers. Although the local sourcing multiplier could help to reduce this number in prime forest products producing regions, gaining a point for use of EPDs is going to be difficult at least in the near term.

Environmental Product Declarations (EPDs) are available online from the American and Canadian Wood Councils for the following products:

- Softwood Lumber
- Softwood Plywood
- Oriented Strand Board
- Glued Laminated Timbers
- Laminated Veneer Lumber
- Wood I-Joists
- Redwood Decking
- Medium Density Fiberboard
- Particleboard

These North American wood industry EPDs have been independently third-party verified by UL Environment (ULE). ULE verifies that EPDs conform to the requirements of ISO 14025.

Source:
http://www.awc.org/greenbuilding/epd.php

Manufacturer-specific EPDs which garner full credit for products will be developed over time by manufacturing firms that view environmental performance of their products to be better than the industry average, thereby putting pressure on those whose environmental performance lags industry norms. However, because development of manufacturer and product-specific EPDs (or LCAs) are expensive and needed before anyone can claim optimization credits, it is likely to be some time before EPD optimization credits are realistically available, and even longer before EPD credits will actually allow informed selection of lower-impact products.

EPD Type	LEED v4 credit calculation factor
Cradle to Gate Scope	1/4
Industry-wide *(with identified manufacturers)*	1/2
Manufacturer-specific	Full

A second aspect of the EPD optimization credit that warrants consideration is the wording *". . . selecting . . . products that demonstrate impact reduction below industry average . . ."* The meaning of the word *industry* is quite important here, with the focus in this case on comparison of similar products – i.e., wood framing from one manufacturer vs. wood framing from another manufacturer or steel framing from one manufacturer vs. another. The EPD label does not facilitate straightforward comparisons of dissimilar products such as, for example, wood framing vs. steel framing or one or both of these vs. concrete construction. These differences are readily revealed only through the use of comparative LCA studies. This is another reason why USGBC should consider greater recognition and reward for the use of LCA.

[19] Bowyer, et al. 2011. Environmental Product Declarations (EPDs) Are Coming: Is Your Business Ready? Dovetail Partners, Inc. (http://www.dovetailinc.org/report_pdfs/2011/dovetailepd0111.pdf)

Local Sourcing

Previous versions of LEED awarded points for products for which raw material extraction (or collection), conversion to products (manufacturing), and incorporation into structures all occurred within a 500-mile radius. The 500-mile local sourcing rule has been eliminated in LEED v4. In its place, a 100-mile radius is now specified as defining local sourcing, with extraction, manufacturing, and purchasing all to occur within that range. Perhaps more than any other industry, the shift is likely to benefit wood products manufacturers and distributors. The forest sector is more widely distributed across North America than other major building product types, and forest products are more likely to have the entire production process occurring within a localized area. This could also provide unique opportunities for urban forest products that may be gleaned from sources near construction sites while also meeting recycled or reused criteria (also see next paragraph).

Reclaimed Material

Widening of the definition of reclaimed material (in Multifamily Midrise standards) to explicitly include items from products made from felled, diseased, or dead trees from urban or suburban areas; products made from orchard trees that are cut for replacement; and wood recovered from landfills or water bodies provides new opportunities for obtaining points for wood use, or at least should make the job of obtaining points easier.

Use of Wood Products and LEED v4

A recent USGBC Industry Materials Brief [20]reported *"the use of forest products can contribute up to 12 potential points across 5 LEED credits – more than 10 percent of the points available for certification."* This is a bit of an overstatement in that while wood can *contribute to* a number of points, its use typically does not fully satisfy point requirements. Secondly, by our count, wood use actually contributes to 10½ rather than 12 potential points.[21] Nonetheless, there are opportunities for achievement of points under LEED v4 through specification of wood products.

Wood products use contributes to points in the following credits:

- **Building Life Cycle Impact Reduction – Life Cycle Assessment** (3 points). Life cycle comparisons of wood vs. other materials consistently show lower embodied energy and lower carbon emissions as well as significantly lower impacts across a broad spectrum of impact measures. Consequently, comparison of dominantly wooden structures with those that incorporate little or no wood will almost always point to wood as an environmentally preferable option.
- **Building Product Disclosure & Optimization – Environmental Product Declarations** (1 point). As noted previously, industry-wide ISO-compliant EPDs are available for many wood products. However, because this kind of EPD counts as only ½ product for purposes of credit achievement, wood use in itself is unlikely to satisfy the credit requirement. The second point under this credit (optimization) is effectively unavailable until such time as one or more manufacturer-specific EPDs are published.

[20] http://www.usgbc.org/sites/default/files/LEED%20and %20Forest%20Products.pdf

[21] The USGBC Industry Brief indicates that wood products certified by the Sustainable Agriculture Network (SAN) would also qualify, but a careful reading of the SAN standard reveals that points for wood use are not attainable under this standard. For example, one of the principles for SAN's sustainable agriculture standard addresses Ecosystem Conservation and requires that farmers prohibit logging, see: http://sanstandards.org/sitio/subsections/display/7

- **Building Product Disclosure & Optimization – Sourcing of Raw Materials** (1-2 points). Manufacturers of all products, including manufacturers of wood products, can qualify their products for contributing to the first point under this credit by publishing an annual Corporate Sustainability Report.

  The second point under this credit is related to extended producer responsibility, bio-based materials, certified forest products, materials reuse, and recycled content. The use of wood can contribute to this credit via the certified forest products, materials reuse, and recycled content provisions. Products that typically qualify under the recycled content provision include standard particleboard, fiberboard, and finger-jointed studs.

  An example of a "Wish-List" of product credentials to maximize LEED v4 credits:

  - *Available EPD*
  - *Publically reported supplier information*
  - *Bio-based, recycled, reused, and/or certified*
  - *Locally-sourced*
  - *Available report on chemical ingredients*

  The USGBC Industry Brief cited earlier indicates that wood products certified by the Sustainable Agriculture Network (SAN) would also qualify under this credit, but a careful reading of the SAN standard[22] reveals that this is strictly focused on agricultural crops, designed to influence farm management. Wood or trees are not mentioned as products covered under this standard.

- **Building Product Disclosure & Optimization – Material Ingredients** (1-2 points). Untreated and unfinished wood flooring is classified as an inherently non-emitting source that can contribute to one point under the second option described under this credit. Refinished products may also contribute to an additional point if material ingredients are reported as outlined in option 1.

- **Low-Emitting Materials** (2 points). Wood products are referenced in the *Low Emitting Materials* category, which is found in the *Indoor Air Quality* section of the various LEED standards. Use of composite wood products that meet California Air Resources Board Airborne Toxic Control Measure (ATCM) for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins contribute to one of the points available under this credit. Untreated, unfinished wood flooring contributes to a second point under this credit if it does not include integral organic-based surface coatings, binders, or sealants.

- **Reclaimed Material** (½ point – Multifamily Midrise only). Wood Products that meet the *Environmentally Preferable Product* criteria, and for which points can be earned include floor covering materials, insulation, sheathing, framing, interior finish, roofing, siding, doors, cabinets, counters, interior trim, decking, and windows.

Although points are not awarded directly for local sourcing, the multiplier effect that this provides can increase the likelihood of attaining threshold levels for various credits. Since the definition of local involves raw material extraction, manufacturing, and purchasing within a 100-mile radius, this credit will be difficult to obtain. The fact that structural wood building products manufacturing is concentrated in two primary U.S. producing regions – the Pacific Northwest and Southeast – perhaps provides opportunity for attainment of local sourcing credits in these regions. The credit

[22] http://www.sanstandards.org/userfiles/SAN-G-20-1%20Agriculture%20Standard%20Guide(1).pdf
http://www.sanstandards.org/sitio/subsections/display/12

may also benefit manufacturers across the country that produce cabinets, millwork, flooring, and other permanently installed products from local wood. Certified wood is the focus of regional priority credits in some areas of the U.S. This provides opportunity for attaining additional points for certified wood use within these regions.

The Bottom Line

LEED v4 represents a major change from LEED 2009, with substantial differences in the *Materials and Resources* credit category. In LEED v4, USGBC has focused on accessibility of information and transparency, energy-savings through optimization, and building performance and operation. The new standard is sure to cause some turbulence in raw materials markets and supply chains. By asking for extraction locations and practices, and supplier commitments to responsible practices, information is being sought from raw material suppliers, manufacturers, and distributors who are largely unaccustomed to being examined so closely.

Major changes have been made in the *Materials and Resources* credit category, with the objective of encouraging the use of products and materials for which life-cycle information is available and to reward project teams for selecting products from manufacturers who have verified improved environmental and social life-cycle impacts. New to this credit category are optional credits related to life cycle assessment (LCA), LCA-based environmental product declarations (EPDs), materials ingredients verification, and transparent reporting of raw materials sourcing.

The future will continue to bring increased incorporation of green building concepts into buildings of all kinds. Buildings constructed in the future will be significantly more energy efficient than today. And, more attention will be given to minimizing environmental impacts wherever possible using increasingly sophisticated science-based tools to identify lowest impact alternatives. In this environment, wood products can become the building materials of choice. The shift is well underway.

Life cycle assessment and LCA-based tools point to the many environmental advantages of wood and the increasing array of engineered products made of wood. Low embodied energy, an already apparent advantage of wood buildings, will become more and more important as energy efficiency gains translate to reduction in operating energy. Low carbon emissions associated with production of wood and its ability to store massive quantities of carbon for long periods of time will also gain increasing recognition. A material rooted in the past, wood is recognized today as a premiere low impact building material that will become more important in the decades ahead. Buoyed by application of materials science to create exciting new engineered products for a wide range of applications, wood is poised to become dominant across the full spectrum of building construction.

This report was prepared by

DOVETAIL PARTNERS, INC.

Dovetail Partners is a 501(c)(3) nonprofit organization that provides authoritative information about the impacts and trade-offs of environmental decisions, including consumption choices, land use, and policy alternatives.

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