



Integrating LCA into LEED
Working Group A (Goal and Scope)
Interim Report #1
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Integrating LCA into LEED Working Group A Interim Report

1 Introduction

This report summarizes work to date on a project to integrate life cycle assessment (LCA) into the LEED rating system. The focus is on the activities of *WORKING GROUP A*, which was charged with the task of defining the goal and scope of the project, but it also includes the background to the project as a whole and the mandates of other working groups.

The report reflects the results of five meetings between April 12, 2005 and September 13, 2005 and a meeting on August 14, 2006. The working group comprised stakeholders representing material and product manufacturers, related trade associations, and LCA tool and database providers.

1.1 Background

On September 29, 2004 a meeting was convened in Washington D.C. by the USGBC to begin the process of determining how best to integrate LCA in the LEED assessment system. The Athena Institute prepared a discussion paper as a backgrounder for meeting attendants. Following the meeting, USGBC issued debriefing notes that contemplated six Working Groups with specific tasks as summarized below. Only Working Groups A, B and D have actually been established to date.

GROUP A

Task 1- Defining the LCA Goal and Scope

This task involved considering how to define LCA goal and scope in relation to the different LEED rating system products and the corresponding decision points that should be awarded by LEED credits. Working Group A was also asked to consider the analysis timeframe of a project, and the relevant mix of materials taking account of operational energy, emissions, maintenance, repair and transport.

It was envisaged that early discussions of the sub-group might establish a matrix of LCA scope definitions against LEED product relevance. Completion of this would enable the Task 6 sub-group (group D) to commence its work.

GROUP B

Task 2- Inventory Analysis and Allocation

This task focused on the way data is processed to ensure a consistent treatment of materials and products, including whether data provide the level playing field needed for LEED. Issues the group was asked to consider (non-exhaustive) were:

- Allocation of process impacts to co-products and recycled/down-cycled materials;
- Waste, recycled wastes and co-products;
- Small quantity/small impact thresholds;
- Primary energy resource use;
- Energy related emissions;

- Sequestered carbon, biomass and biomass to energy, and re-carbonation; and
- Transport modes and implications.

Task 3- *Impact Analysis*

Working Group B was also asked to critically review and correlate the available sources of characterization data and determine which impacts can be characterized with sufficient confidence from existing U.S. tools, where these may need supplementing from other sources, or where USGBC should be recommending others to sponsor further research.

Task 4- *Normalization*

The third Group B task was to decide whether LCA data need to be normalized for practical application and if so how.

GROUP C

Task 5- *Benchmarking*

This task, which depends on the scope defined in Task 1, entails either defining the benchmark or starting condition for the award of credits. The task was premised on the idea that there are 2 possible approaches to apply LCA results within LEED. Firstly, credits can be assigned based on a level of improved performance for the LEED rated neighborhood, building, element or product compared to some fixed benchmark of performance. Secondly, credit can be awarded for a percentage improvement in performance compared to some starting condition.

GROUP D

Task 6- *Weighting*

The objective of this task was to consider how LCA issues might/should be weighted for use within LEED, recognizing that no LCA-based decision can be made without weighting the results of an LCA comparison either explicitly or implicitly

GROUP E

Task 7- *Available Tools and Methods Survey*

This task was to review and assess the characteristics of existing tools and methods and determine the extent to which they provide or could provide a suitable, practical basis for LEED credits, recognizing that different tools may inform decisions at different stages in the building life cycle and therefore be relevant for application to different LEED products.

Task 8- *Definition of Required Characteristics for LEED Tools and Methods*

Task 8 was designed as a counter-point to Task 7. It entails defining the criteria for selecting LCA tools and methods that could or should be used as the basis for LEED credits within each of the LEED products. Key to this task is the fact that USGBC does not want to be in the position of recognizing single tools and methods that meet LEED requirements, and instead hopes that a series of tools might be developed using consistent data and providing diverse ways to demonstrate compliance with LEED credit requirements.

Task 9- *Pilot Test of Tools*

For any available tools that met the requirements of Task 8, a pilot test was to be conducted to determine user perceptions of their ease of use and practicality, and to analyze the outcomes to see the extent of improvement achieved by using the tools.

GROUP F

Task 10- *Design of Draft Credits Recommendations*

In this final task, the Working Group was to recommend how to implement the work done in all of the preceding tasks, and to draft credit language for consideration by the LEED Version 3 Framework Committee.

1.2 Acronyms

The following LEED-related acronyms are used in this report.

Committees

LSC	LEED Steering Committee
TAG	Technical Advisory Group

LEED Products

NC	New Construction
EB	Existing Buildings
CI	Commercial Interiors
CS	Core and Shell Speculative Development Buildings
H	Homes
ND	Neighborhood Developments

LEED Credits

EA	Energy and Atmosphere
MR	Materials and Resources
IEQ	Indoor Environmental Quality
SS	Sustainable Sites
WE	Water Efficiency
DE	Innovation and Design Process

2 Group A Points of Agreement

2.1 Long-Term Objective

The working group agreed on the following long-term objective for the integration of LCA into LEED:

To routinely and credibly apply LCA to support integrated design and ensure environmental performance at the whole building level, taking into account the complete building life cycle and subject to defined criteria.

The objective was further clarified as follows:

1. Who does it is an implementation issue;
2. ‘Routine’ and ‘credible’ imply consistency, practicality, level playing field, etc.;
3. Supporting design and ensuring performance does not pre-judge whether it is in the background informing LEED credit development or in the design process foreground using “friendly” tools;

4. The definition of ‘long term’ is left open, and the definition of life cycle in the context of a whole building requires further clarification (e.g., does it include building demolition, reuse of materials, etc.); and
5. The phrase “subject to defined criteria” is not clear, but was retained as a placeholder for the time being.

One immediate objective was to provide guidance to the other work groups. There was general agreement that the working group should identify an ultimate or ideal approach to the integration of LCA in LEED, and then focus on shorter term practical steps that will advance the process while moving toward the longer term ideal.

2.1.1 Short- and mid-term steps

Section 2.2.1 sets out an immediately actionable step to begin the process. Section 2.2 sets out options for integrating LCA into LEED, with option 1 as a practical mid-term step.

2.2 Integration Options

The following three options for integrating LCA in LEED were retained from a list of five options for future consideration. Award points for:

1. Selecting highly ranked products or assemblies from a pre-rated list based on the use of LCA (similar to UK Green Guide to specifications) – this is a likely mid-term solution;
2. Making decisions based on the use of an LCA tool by the design team, which may require the establishment of benchmarks as a basis for awarding credits as well as language to prevent gaming; or
3. Achieving specific performance levels relative to defined impact indicators, which requires the use of environmental performance benchmarks.

It was understood that options 2 and 3 would ultimately be subject to Group E work on tools and the practicality for design teams.

The following 4th option was added to the list:

4. Using LCA in the LEED TAGs and Product committees as a way to identify holes in and properly balance LEED, without explicitly requiring LCA to be done by the building designer.

It was agreed that this 4th option should be adopted irrespective of any other actions or approaches, and that a recommendation to that effect should go to LEED Steering Committee in the near term.

2.2.1 Draft recommendation to LSC for the Early Use of LCA to Inform LEED Credit Development and Rating System Structure

Working Group A agreed on the following draft recommendation to the LSC for the early use of LCA by USGBC:¹

Irrespective of other decisions regarding the use of Life Cycle Assessment (LCA) in LEED, the TAGs and Product Committees should use LCA to inform the ongoing process of:

- assessing the efficacy of credits where LCA is relevant, given defined environmental performance objectives (e.g., reduce greenhouse gas emissions, reduce toxic releases to air, water and land);
- developing or revising prescriptive requirements to ensure they meet performance objectives;
- assessing the relative importance of credit categories from an environmental impact perspective, and adjust the weighting as necessary to ensure a balanced system; and
- reducing overlap in LEED credits.

Pending completion of the LCA in LEED process as a whole, the above recommendation can be implemented by:

- using building-oriented LCA tools that use level playing field data and methodology; and
- referencing the results of international product and whole buildings LCA assessments.

To support this activity, the Working Group further recommended that USGBC compile a basic annotated bibliography of acceptable international studies, taking account of such factors as relevance to the North American situation, vintage, and overall quality. The bibliography should include a user's guide to ensure that international results are reasonably interpreted and applied in the U.S. context.

Clarifying Notes:

1. The use of LCA should not supplant other methods of analysis that may more accurately handle human health and other types of effects. For example, risk assessment and LCA are complementary methods, and one should not be used to the exclusion of the other.
2. There should be a structured feedback mechanism so that the experience of TAGs and Product Committees in the use of tools, data, references, etc., is properly reflected in the ongoing process of integrating LCA in LEED.
3. USGBC has not endorsed any specific tool or database, and TAGs and Product Committees should therefore be advised to exercise caution in their use.

¹ In a subsequent meeting on September 13, 2005, Nigel Howard indicated this recommendation was not yet ready for the LSC, in his opinion, and should be discussed at a later date.

2.3 LEED Product and Credit Focus

It was agreed in the April meeting that the initial focus should be on LEED NC and CS. Committee members were asked to complete a credit matrix indicating their opinions about the applicability of LCA to individual credits. The matrix summary and subsequent discussion indicated agreement that the EA and MR credits should definitely be included and given priority within the LCA scope, with the following exceptions:

- Prerequisites — EAp1, EAp2 and MRp1, which deal with basic commissioning, minimum energy performance, and storage and collection of recyclables;
- Any other credits that deal with design or management activities (e.g., EAc3, EAc5, and MRc2); and
- MRc7, discussion of which was deferred until USGBC's wood certification reassessment project has been completed and decisions made about the future of that credit.

Credit SSc4 (commuter transportation) was discussed as a good candidate for LCA, but it was agreed that it should not be an early priority.

SSc3 (Brownfield development) and SSc7 (heat island reduction) were also set aside on the grounds that they are quite complicated with questionable benefits from the use of LCA.

The water use credits (WEc1, c2, and c3) were identified as amendable to LCA, but would require extending the LCA analysis into municipal infrastructure. There was general agreement that they should not be in the scope at this time, but should be considered at a later stage in LEED ND. However, water use should be included in the LCI data for building product manufacturing.

The IEQ credits were generally recognized as difficult to handle within current LCA practice and should therefore be left at this point for analysis using other methods better suited to assessing human health concerns.

It was agreed that the initial LCA efforts should be on a priority basis, taking account of practicality as well as the relative importance of LCA to individual credits, with all credits revisited in the future to examine the potential for more advanced applications of LCA.

2.4 Time Frame for Assessment

The working group agreed on the use of a 60-year timeframe for whole building assessment, a decision that was confirmed as reasonable through a subsequent review by a small task group. Issues that affect building longevity and end-of-life considerations, such as adaptability, ease of deconstruction, and material recyclability can be handled through a non-LCA credit.

The assumed 60-year study may often be shorter than the actual service life of a building, but the remaining life in materials can be accounted for using a fractional service life approach. For example, existing whole building LCA software allows the user to specify a design service life for the building and then assumes that demolition and disposal at the end of the selected life will be the same as current practice. This software also takes

product-specific (e.g., aluminum vs. wood window frames) service lives into account based on empirical data, with specific maintenance and replacement algorithms operating for the assumed building service life. Replacements are assumed to be with the exact same material/product as was originally installed.

2.5 Concerns and Cautions

A number of cautions and concerns were expressed throughout the working group meetings. They are documented in the meeting notes available on the WG's eStudio online workspace. The more critical ones are summarized below.

- LCA results are often not as precise as implied by their numeric nature and the focus should be on relative results more than on absolutes.
- The inconsistent availability of data for many building materials/products.
- LCA does not yet handle various ecosystem and human health effects adequately.
- LCA has little to offer in the IEQ area at this time.
- LCA as usually practiced doesn't do a good job with local impacts.
- Other complementary tools, such as risk assessment, should not be ignored.

3 Long and Short Term Recommendations

LEED as a whole is not a prescriptive document in the sense of prescribing a number of specific steps that must be taken, other than those found in the prerequisites. Design teams are free to use a variety of approaches to achieve the credits required for certification. But many of the specific requirements to meet credit intents are prescriptive, particularly in the materials and resources category. It is those prescriptive requirements that offer the best opportunities for the initial introduction of LCA thinking and techniques. We have to be cautious that, in every area, the combination of credit intents, requirements and submissions is always moving us toward that ultimate objective.

WG-A agreed that, ideally in the long term, the affected MR and EA credits should be combined by environmental impact (i.e., there would be a combined greenhouse gas credit, one for ozone depletion, another for instance for toxic emissions to air, etc.) Prerequisites (Eap1, Eap2, and MRp1) would remain, perhaps in a separate prerequisites category, and unaffected design/management credits would also be shifted into a separate category.

By combining the relevant EA and MR credits in single impact measures such as fossil fuel use and global warming potential, credits will properly account for the relationships between embodied and operating effects; prescriptive credits will no longer be necessary. For example, in the case of energy, the use of a combined fossil fuel use measure within the impact categories can eliminate the requirement for separate renewable energy use credits. The design team objective will be to reduce fossil fuel use (embodied plus operating) by whatever means are appropriate.

This ideal long-term approach implicitly assumes whole building modeling, whereby material-related and operating effects can be rolled together in a single assessment (Option 3, as described in Section 2.2). The working group agreed in the first meeting that this was a desirable approach, and that the effort should not just focus on products, assemblies, or whole buildings as an either/or proposition. However, this ideal may not be immediately achievable for a number of reasons, including reluctance to impose another simulation requirement on design teams and the need to develop a robust set of whole building LCA benchmarks against which performance can be judged.

Recommendation: The Working Group therefore recommends that Option 1 (Section 2.2) be implemented in the short term. Under this option, LCA measure would also be developed for the relevant EA credits. The extent to which, and how, the resulting EA and MR credits would be merged as per the whole building modeling option would be the subject of further investigation as discussed below. In applying this approach, it is important to recognize and take account of the changing nature of decisions throughout the design process, and of the related differences in LCA focus and required data (e.g., from assemblies to products, and from generic to brand-specific data).

Recommendation: To implement the above recommendation, USGBC will have to undertake or commission a focused research program. At a minimum, that program should include the following steps or tasks:

- a. Definition of appropriate structure and envelope assemblies, as well as interior fit out products, including criteria to categorize assemblies within functionally equivalent categories;
- b. The selection and application of appropriate LCA tools;
- c. The development of LCA results for selected impact measures;
- d. Application of the appropriate weighting and/or scoring method as per the recommendations of Working Group C; and
- e. The development of an appropriate LEED credit structure, including consideration of the extent to which EA and MR credits can or should be combined as part of the short-term approach.

Recommendation: The Working Group further recommends consideration of an alternative compliance path approach whereby design teams could opt for either whole building modeling (the ideal approach as per point 1, above) or the intermediate approach as per Point 2. A final decision in this regard is best made when the above research work has been completed.