GBCA

LCA in Green Star - Discussion Paper Feedback

Date: 05/07/12

Executive Summary

Thank you for providing the opportunity to offer commentary regarding the incorporation of LCA based methodology into the Green Star Materials category.

We felt that the discussion paper was well composed and sets the framework for a positive introduction of LCA into Green Building standards in Australia. Further to this, we feel that success in Australia will assist in the development of similar standards globally.

Understandably, eTool is motivated to see LCA propagate as a standard design philosophy for all of the built form as fast as possible and hence we take a comprehensive and progressive stance. The following comments reflect this.

We feel that for LCA to be applied successfully to the built form that it shouldn't be restricted to analysing materials alone. To minimise instances where such a scheme may produce "perverse outcomes" LCA should be expanded across several categories or be implemented in its own section. It should be utilised as a powerful design tool to optimise operational, maintenance and design life impacts

That said eTool is also pragmatic in its approach and understands the difficulties in achieving a mass take up of such an important design methodology.

eTool has always had a strong belief that sharing of information, collaboration and mutual cross promotion is the key to improving green building and to that end we hope that our input into this process will be beneficial to GBCA.

"3. Provide your Feedback"

Is it appropriate for the GBCA to undertake this project or would any other organisation be better placed to do it. If yes, which organisation?

It is appropriate for any organisation that wants to "rate" buildings to use LCA if they intend following best practice in environmental management. Now that LCA is becoming easily accessible, any other rating system is fast becoming inferior. It should also be noted that LCA is most powerful in improving green design when used as a comparative design tool. The methodology behind any rating system should allow for ease of use, fast design feedback, minimise perverse outputs and be cost effective.

Is the Australian market ready for LCA as a tool for assessing the environmental impact of materials? If no, in how many years time do you think the market would be ready?

We think the industry is ready. Corporations are voluntarily undertaking their own LCAs on commercial, residential and community building projects (with or without Green Star). Any project that is capable of incurring the fees associated with Green Star can easily afford LCA optimisation of their building.

What do you see as the main barriers to implementing LCA as an assessment methodology for materials in Green Star?

Good LCI data, potentially customised to manufacturers who go the extra mile to provide low carbon products.

Second to this a general trend in the LCA industry to over complicate methodologies will lead to a difficulty in acceptance.

If the GBCA decided to introduce the methodology described in this paper, how much notice would you recommend the GBCA give to the market?

We don't have an opinion on this as we are unaware of the market reaction to change within Green Star. Given that there are already very easily accessible, affordable and user friendly methods of conducting LCAs of the built form, we would assume it could be implemented quite quickly.

"5. Objectives"

- GBCA invites feedback from stakeholders on the objectives of the project.

Objectives are:

1) **Develop a transparent and consistent methodology for assessing the environmental impact of construction materials using life cycle assessment.**

   This is a sensible objective. It does however, fall short of the real crux of LCA of the built form, that is, conducting an LCA on the whole building (design, planning, materials, construction, maintenance, operations). Restricting the scope of the LCA to materials only, would potentially drive decisions with worse environmental outcomes than a more comprehensive scope. For example, a low carbon carpet may be a better floor covering option than ceramic tiles when the building is initially constructed. If you trace the impact of these two choices over time though, the tiles may last 50 years whilst the carpet is likely to be replaced every 15 years. This alone may result in the tiles being the better product for the environment. Furthermore, and potentially of greater importance, the floor coverings may have different thermal properties affecting operational energy inputs. The assembly effort of each floor covering option should also be considered (trade staff, equipment and travel) for similar reasons. Without a broader scope than simply looking at materials, the wrong decisions may be made.

2) **Continue to assist and facilitate the uptake of best environmental practice product and materials selection in the Australian construction market.**
   This is a good objective when the aim is to ensure the product selection is fit for the use, lifespan and operational energy profile of the building.

3) **Facilitate the use of ISO 14025, Environmental Product Declaration (EPD) for materials assessment in Australia.**

Good objective, the GBCA should be encouraging the use of EPDs.

4) **Deliver better environmental outcomes.**
   A great objective, however this may not necessarily be fulfilled with the current proposal.
5) **Deliver these outcomes in a cost effective manner.**
   Great objective. Historically we feel this has been an issue with LCA. However, this is changing quickly as there are now affordable LCA software and services options for commercial building projects.

"6. Methodology"

Scope of assessment

The list of inclusions may be expanded in the future, is it appropriate to start with a limited scope of assessment in order to simplify the LCA?

Potentially this is appropriate. There should be a real commitment to move towards comprehensive LCA of the built form however. The risks of settling on a limited scope (that is, only accounting for part of the building fabric and lifespan) are:

- Compromised environmental decisions (reduction in impacts in one part of the building measured) at the expense of another part of the building (not measured).
- Reduction in the credibility of LCA in the green building industry where "compromised" environmental outcomes are delivered.

Please provide feedback on the list of inclusions and exclusions.

The inclusions are quite limited and may open up the GBCA to criticism. There are numerous papers now detailing LCA of the built form which, when referenced, would likely lead one to question the merit of the current inclusions (or rather exclusions). When compared to the scope chosen by Treleor et al from a 1999 titled 'Embodied Energy Analysis of Fixtures, fittings and Furniture in Office Buildings', the proposed inclusions would only account for 43% of the materials used in the building (and only 24% of the materials used over the building's life).

Are there additional materials should be addressed by the inclusions and exclusions?

All building materials should be included, and considered in relation to their affect on operational energy use and maintenance of the building. Anything less may result in poor environmental trade-offs.

Boundary Definition:

Is the use of a 'cradle to constructed, sealed and serviced' building approach appropriate?

Although introducing Green Star users to LCA, this approach is limited and open to compromised environmental decisions. The GBCA discussion paper states that approach would be a "balance between the cost of completing the LCA and the credibility of the result". We would challenge this statement as we feel that a credible LCA can be achieved in a cost effective manner. The credibility of the limited boundary as described is compromised and presents too many opportunities for contradictory results. For example, replacing a building element with a low impact element without considering the design life of the building and the two product choices is very likely to lead to poor decisions. Low impact materials often have lower design lives and are initially seen as a "better" product, however over the life of the building after numerous replacements, they may become the "worse" product for the environment.

Is it practical to make qualified assumptions about the origin and the distances that material must be transported in a Green Star design submission, i.e. at a tender stage when some the specific materials are unknown?

Yes, this is entirely reasonable. Particularly in light of the likely consequence of an incorrect assumption (it is likely to be small in the overall scope of the LCA) where materials are being assessed against each other (product choices), transport determinations should be conducted more carefully.

Functional Unit:

The Green Building Council of Australia invites feedback from industry stakeholders on the functional unit:

Is 1m2 of GFA an appropriate unit?

It is appropriate but we feel too limited. The time scale of the building should also be considered. For example, if the building has been constructed in a manner that is going to contribute to a longer design life, this should be rewarded (it may take 25% more material impact but last twice as long as the alternative, so would be a better environmental choice). Similarly, the use of the building should be understood better as well. For example, for office space occupancy is critical, more so than m2.

Are there constraints to using this unit?

Yes, as explained above, it is too limited in scope.

If there are constraints or reservations about the proposed functional unit, what are the alternatives?

Measuring impacts per m2 / year is a more comprehensive measure. Measuring impacts per occupant hour - which takes account of both building size, efficiency of layout and design life - is an even better functional unit.

Environmental Impact Categories

Is it appropriate to limit the number of environmental impact categories to six?

We think this is a good compromise to start with, and for Australia these are very pertinent environmental indicators.

If more categories are to be included, which categories do you recommend be included? What method should be applied to determining the impact categories the LCA will take into account?

An existing method such as Eco-Indicator 99 should be used so the wheel isn't re-invented.

If fewer categories are to be included which categories do you recommend be removed?

Both "land transformation and use" and "mineral and fossil fuel depletion" are very limited in importance compared to climate change, so could potentially be dropped.

If six impact categories are appropriate, are the six categories above the most appropriate?

For the Australian context, these are appropriate.

Is it appropriate to refer to the AusLCI impact categories? Is there an alternative which should be used? Why?

AusLCI is still being developed. At present the data is ‘Gate to Gate’ data and hence not applicable for direct use in building LCA calculations. Without proper ‘Cradle to Gate’ LCI figures in the database, the method is irrelevant. An existing, established method should perhaps be considered such as Eco-Indicator 99.

Weightings of Environmental Impacts:

Is it appropriate to reference the BC LCI weightings? If not, what should be used instead?

Not at this stage. The weightings established in the BPIC LCI project were not scientifically based but rather value based. This is not a method we would encourage as it is highly influenced by media rather than science. Furthermore, even if the survey method of establishing the value of the weightings was deemed sufficient, the BPIC AusLCI survey was conducted to establish weightings across 15 environmental impact categories. The

results of the weightings may have been quite different if the survey participants had only to choose from the six indicators proposed in this document.

Is it appropriate to have separate credits for each of the environmental categories or should the total score be weighed together and assessed in one credit?

Possibly. Currently weightings come into play with the point allocation in the existing GBCA rating tool. Something that should be considered carefully here is that weighting is a voluntary part of an LCA process according to the international standards. Furthermore, the limitations in scope and system boundaries are such that weightings would probably only be overanalysing a poor measure of sustainability.

"7. The Assessment Model"

Standard Practice Reference Case:

Is it practical to establish a standard practice reference case for low-rise, mid-rise and high-rise buildings of different classes? If not, what other methods could be used to establish a reference case?

Yes, this is practical.

Should the reference case distinguish between new building on a green field site, refurbishment of existing buildings and fit outs? How can an equitable system be developed which acknowledges the advantages of the options from an environmental impact perspective?

No. Building owners that are using the existing structure to reduce materials should be rewarded in the LCA. This is the basis of LCA, to determine relative environmental impacts. Similarly, developers who choose to refurbish should be rewarded more than those that build on green-fields sites.

If the reference case is constructed in a similar manner to that described above, would you be able to provide your interpretation of how this may operate in practice?

The comparison should be conducted based on the total impacts of the sum of all included building elements (not each individual element). Depending on the construction method the balance between the building elements will fluctuate dramatically and only the total result should be considered. In this case the benchmark should be a total impact per functional unit for each building type (not a benchmark for each building element within a building). Once again though, the whole building should be assessed (operational energy included) in the LCA to get a fair comparison. This way the GBCA could set benchmarks for LCA impacts per functional unit for different building types including materials, transport of materials, assembly effort, maintenance effort and operational energy. For example, benchmarks could be set for CO2e / m2, Toxicity / m2 etc for a given building type.

Can LCA methodology in the Green Star Materials category operate without a reference case? If so, how do you see this working?

No, this is unlikely. International standards for LCA are quite clear that it is a comparative tool.

Is it practical to conduct two iterations of the LCA with different inputs for the project?

Yes, LCA software and services providers for this work are affordable and available in Australia now.

How much additional time would it take to do the second iteration of the LCA having completed the first one? Is it 25% more, 50% more, 100% more etc?

Using available software, swapping a given material would take less than 5 minutes (depending on the building size and complexity, this may be less than 1% of the time to conduct the original LCA). Multiple iterations could be run very easily.

Does the intended content of Table 1 include enough data to determine the input parameters for the standard practice case LCA? If not, what is missing?

Table 1 will not work effectively to ensure the total environmental impacts of the building are reduced due to limitations in scope, system boundaries and no recognition of relationships between building elements. For example, a steel building will have a totally different structural profile than a concrete building. They are only comparable when you consider the building as a whole (comparing individual building elements will not be a useful exercise). GBCA should be rewarding intelligent design as well as thoughtful materials selection.

What would be the best way to determine the rules for the input parameters in Table 1?

As explained above, we believe the table needs to be reconsidered.

Reporting Mechanism

Is it appropriate to nominate ISO 14025 as the reporting mechanism?

Yes, but the EPDs must include all of the indicators named by GBCA. In this light it may be better for them to be given the opportunity to refer to default values if they don't have data for particular environmental indicators. That is, detailing CO2e emissions is relatively simple compared to detailing land use for materials manufacturers.

Is there an alternative that is preferred or should be considered?

No.

Allocation of Green Star points:

Is percentage reduction in impact an appropriate way to award points for improvement?

Yes, however it should be based on a broader scope than just materials. That is, the impact of the whole building over its life, this way other categories would be affected as well. The points should be rewarding good design as well as good material selection.

Is it appropriate to have separate credits for each of the environmental categories or should the total score be weighed together and assessed in one credit?

This is an emotive topic. We think the GBCA should settle on a weighting method scientifically (preferably an existing method).

"8. Data Inventory:"

Should the Aus LCI Building Product inventory dataset be used in a LCA methodology within Green Star rating tools?

Not at this stage as it is too incomplete.

Should a European LCI be used?

Potentially, however there is also a good Australasian dataset available through SimaPro which would be more appropriate.

Are penalties needed?

No, as long as a hierarchy of LCI data source preferences is established and followed.

What data sources would be acceptable for a credible LCA to be conducted?

The best person to answer this would likely be Tim Grant from Life Cycle Strategies.

"9. Applicable Green Star rating tools:"

Fit-outs:

Is it appropriate to exclude fit-outs based on the lack of an agreed functional unit for fit-out items?

No. The idea of establishing functional units for each building element is potentially flawed. If the functional unit was relevant to the whole building structure, and the scope included the

whole building structure over its entire life, then fit-outs could be effectively incorporated. There is a strong argument to include them based on the earlier mentioned paper which indicates that fit-outs result in as much as 38% of the embodied environmental impacts over the life of a building. An example of why this should be seriously considered would be the case of comparing a floor system:

a) Steel beams with plywood, acoustic insulation and carpet

b) Concrete with polished finish

Using the proposed methodology the steel option may be more highly rewarded than the concrete option. But if you look at the impact of the carpet as well, particularly over the life of the building (and the multiple replacements of carpet) then the concrete floor is likely to be the better option. Limiting the scope and boundaries as currently proposed may result in driving poor environmental decisions as highlighted in the examples above.

"10. Other Matters for Discussion"

The Green Building Council of Australia invites feedback from stakeholders on the issues listed in section, as well as any other matter you believe should be addressed:

Will the proposed LCA methodology accommodate existing LCA systems and tools?

Yes, there are definitely a number of LCA tools that can conduct this level of LCA calculation.

What constitutes an LCA practitioner, what qualifications should be required, and should the system ALCAS are developing be referenced?

We support the introduction of an accreditation process but are yet to see the details of what ALCAS is proposing. We feel that it will stand to increase the credibility of the industry. Currently it may be onerous to stipulate qualifications as LCA is a relatively new practice with few recognised courses for practitioners.

How much would you estimate it would cost to complete the assessment outlined in this paper? And how does that cost compare to the cost of demonstrating compliance with the current Materials Category in Green Star?

It of course depends on the building size. Using a software package tailored to the built form the assessment would be in the order of $5,000 for a 1000m2 building with relatively simple geometry and construction techniques (assuming $125/hr for professional labour input).

Is the requirement to adhere to international standards necessary?

Yes, if the process is to be named an LCA then standards for LCA should be adhered to.

Which are the relevant standards that Green Star related LCAs should adhere to?

ISO 14040 and 14044.

Is the requirement to use recognised software necessary?

If there is a good choice in recognised software to ensure competition.

Should the GBCA recognise particular softwares?

We are unsure as it would potentially be contentious.

Which software should be recognised, and why?

Being a software provider, eTool is not in a position to comment on this in an unbiased fashion.

The requirements of the Energy category within Green Star rating tools, stipulate that any energy simulation software used are BESTEST compliant. Does equivalent software exist for LCA?

There are a number of good packages. We are not aware however that there is a validation method for packages.

Is the requirement for peer review necessary?

We feel that methodologies for LCA's should peer reviewed. If each LCA is conducted in that same fashion and is repeatable with a quality control process then there isn't a need for individual peer review for each assessment. A better control method for ensuring quality is to ensure results are made public so they can be challenged by peers if required (a good system of keeping people honest).

What other requirements are necessary to ensure best practice LCA modelling?

The scope and boundary of the assessment should include whole of building materials, assembly, transport, operations and maintenance over the life of the building.

Further to this it should be structured in a fashion that allows it to operate as a comparative design tool and rather than just an "assessment" or "rating" scheme. While "assessment" and "rating" will assist in driving good design outcomes, it would be far more powerful if it is integrated directly into the design process.