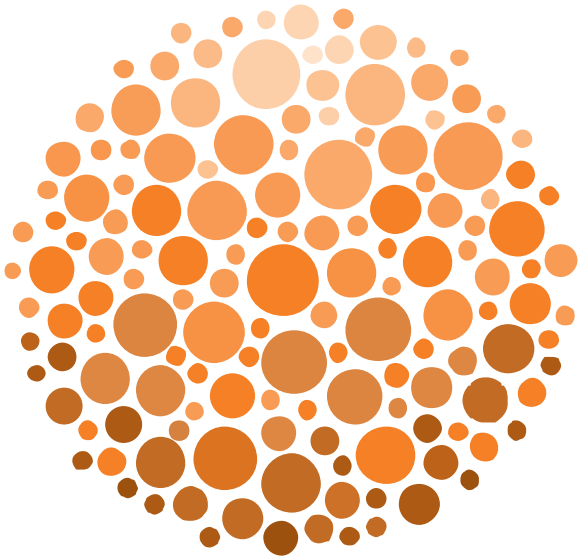

15 August 2012

Life Cycle Assessment in Green Star Energetics response to the GBCA's Discussion Paper

energetics

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Life Cycle Assessment in Green Star.

Energetics welcomes the Green Building Council of Australia (GBCA) seeking feedback on the use of LCA in Green Star (Materials category). Energetics is actively involved in assessing the environmental impacts of building materials and buildings in Australia. Energetics strongly believes that a life cycle approach is essential for making better decisions (deliver better environmental outcomes) and we look forward to the day quantified life cycle metrics are included in the Green Star tools.

Please find hereafter Energetics' feedback in line with the structure of the GBCA's discussion paper (version 1.0; date 16/05/2012).

1. Executive summary

No comments.

2. Introduction

No comments.

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?

Energetics sees the GBCA as a crucial driver for the uptake of LCA in the Australian building and construction sector. As such, we believe it is appropriate for the GBCA to undertake this project. Nevertheless, other stakeholders such as the Australian Life Cycle Assessment Society (ALCAS) and stakeholders from various parts of the building industry should be invited to take part in what will be a multi-faceted project in order to achieve a workable methodology.

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?

The Australian market has had ample time to get ready for the use of LCA, given that this technique has been increasingly applied for this purpose for more than a decade in other regions of the world.

However, we do expect that some sectors or elements of the Australian market will need to speed up their preparations. Realistically, we believe the GBCA is at least one to two years away from having a functional LCA methodology in its tools. It is therefore important to start communicating implications of this policy and what various stakeholders (designers, manufacturers, suppliers, building owners, facility managers, consultants, etc.) need to do between now and 2013/2014 in order for them not to be caught out.

Manufacturers of key building materials in Australia have been involved in LCI and LCA projects for a number of years through the Building Products Innovation Council (BPIC) Life Cycle Inventory (LCI) project. This project should have prepared the manufacturing industry to be able to provide more specific life cycle data that can substantiate any claims for Green Star points. Smaller manufacturers and producers of niche materials might have some catching up to do.

It is important that the GBCA devices an efficient, uniform and robust way for manufacturers to communicate the environmental performance of their products to Green Star project teams. This will allow anyone in the Australian market to catch up relatively quickly. Energetics recommends setting up a type III Environmental Product Declaration (EPD) system according to ISO21930:2007 (Environmental declaration of building products), as this standard is specifically written to communicate environmental impacts of building products to designers of buildings, manufacturers of building products, users of buildings, owners of buildings and other stakeholders.

Furthermore, ISO 21931-1:2010 provides a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings and their related external works. It identifies and describes issues to be taken into account in the use and development of methods of assessment of the environmental performance for new or existing buildings in their design, construction, operation, maintenance and refurbishment, and in the deconstruction stages. Energetics advices the GBCA to take this standard into account when developing a building assessment method.

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

One of the key issues for the GBCA will be to develop an assessment methodology that is relatively easy to apply, while maintaining the complexity and level of detail that is inherent to a good LCA.

To this end the GBCA will have to extend and potentially adjust existing LCA methodologies (e.g. AusLCI methodology) to suit its needs. As existing methodologies are typically developed for generic purposes, additional detail is required to reduce the degrees of freedom in a model and thereby improve on its consistency and ease to use.

The GBCA will also require a comprehensive set of agreed data. This could be done in partnership with AusLCI. BPIC data have been published, but there are some roadblocks that need to be removed before these data could be used by the GBCA (or others).

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

Energetics recommends that the GBCA defines a sufficiently outlined trajectory for the market to understand how the methodology will develop over time. This methodology is likely to be introduced over a number of distinct phases, during which the GBCA can learn and seek feedback from users. A transparent and open process will increase acceptance by market parties.

4. Materials category and LCA

No comments.

5. Objectives

The specific objectives of this project are to:

- develop a transparent and consistent methodology for assessing the environmental impact of construction materials using life cycle assessment
- continue to assist and facilitate the uptake of best environmental practice product and materials selection in the Australian construction market
- facilitate the use of ASO14025, Environmental Product Declaration (EPD) for materials assessment in Australia.
- deliver better environmental outcomes; and
- deliver these outcome in a cost-effective manner.

Energetics supports these overall objectives.

6. Methodology

6.1. 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?

Yes. Energetics agrees that it is practical to start with a limited list of inclusions.

In order for the GBCA to determine which items should be included or excluded, Energetics recommends that the relevancy (materiality) of each item is tested. This will allow the GBCA to communicate its decision in a transparent manner.

Please provide feedback on the list of inclusions and exclusions.

We expect that “cabling, pipes, conduit and related fittings used in the provision of water and waste water services, electric and data services, ventilation and air conditioning” can be excluded for the following reasons:

- Accurate data for specific products and systems are hard to come by at the moment,
- The variation in these systems between different building designs is likely to be limited, and

- The contribution of these systems on the overall environmental impact is likely to be limited for most environmental impact categories.

We suggest considering for inclusion (depending on materiality):

- Elements associated with the construction process
- Ceiling systems
- Non-load bearing internal walls and partitions
- Shading structures and other elements that form part of the external skin
- Flooring.

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

Doors, balconies should perhaps be included.

Energetics recommends defining the final list with help from stakeholders.

6.2. Boundary definition

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

Energetics recommends the GBCA applies a whole-of-life approach where possible. As the boundary definition cannot be considered separate from the overall design of the scheme, we recommend the GBCA aligns its approach with ISO21930:2007 (Sustainability in building construction -- Environmental declaration of building products), Figure 2. This standard provides appropriate guidelines for which life cycle stages are mandatory and optional in particular applications. The GBCA can apply a whole-of-life approach by defining scenarios for generic life cycle stages.

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. As indicated in the previous answer, it is quite acceptable to apply scenarios (qualified assumptions) to transport and other generic steps.

Furthermore, Energetics' experience shows that for many building materials transport only generates a relatively small amount of the overall environmental impact. For materials where transport does matter, you'll find that these are typically transported over smaller distances. Energetics recommends the GBCA prepares an initial list of materials, typical transport modes and transport distances that stakeholders can comment on. The aim is not to get a perfect overview, but a default assumption that allows quicker analyses.

6.3. Functional unit

Energetics recommends that a functional unit includes the following elements as a minimum:

- Amount (i.e. 1)
- Unit (i.e. m^2 GFA)
- Function (missing; e.g. low-rise office building that complies with the local Building Code)
- Timeframe (missing; e.g. for the duration of 40 years)
- Geographical aspects if relevant (e.g. city or climate zone) (missing; e.g. in Sydney)

The GBCA will have to consider the relevance of all these elements of a functional unit in relation to the GBCA's purpose. Energetics believes all elements will be important.

Is $1m^2$ of GFA an appropriate unit?

$1m^2$ of GFA could be an appropriate unit, but there are other examples that might be better depending on the function of the building (e.g. 1 m^2 of NLA). Energetics recommends that the GBCA consults stakeholders to determine which units are most appropriate in various cases.

Are there constraints to using this unit?

See previous comments.

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

ISO21931 (Sustainability in building construction -- Framework for methods of assessment of the environmental performance of construction works -- Part 1: Buildings) provides further guidance on the use of a functional unit for the assessment of environmental impacts of a building:

The functional unit of a building may include information on the following:

– type and use of building (offices, factories, public housing, etc.);

– occupancy (period and pattern of use);

– floor area and volume;

– expected service life;

– adaptability.

(Source: ISO/TS21931-1:2006. Note: This may have been updated in ISO21931-1:2010)

6.4. Environmental Impact Categories

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

Please note that the 14 environmental impact categories taken from the Australian Building Products Life Cycle Inventory are not all supported by the (corresponding) Life Cycle Inventory data. Ionising radiation, Nuisance and Indoor environment quality particularly stand out in this regard (as not being supported by the data). Some other environmental impact categories are only partially (inconsistently) supported. As this situation reflects the practical difficulties in retrieving good quality LCI data, Energetics fully supports a reduction in impact categories. The exact number of categories is less relevant than ensuring that the GBCA (and its stakeholders) has sufficient confidence in the indicators that it chooses.

Energetics recommends the GBCA considers the list of mandatory environmental impact categories included in ISO21930:2007 as a minimum. This will ensure alignment of the GBCA's program with international practices. Section 8.2 of this standard declares that the following environmental information shall be included in the EPD:

- Environmental impacts expressed in terms of the impact categories of LCIA:
    - Climate change (greenhouse gases)
    - Depletion of the stratospheric ozone layer
    - Acidification of land and water sources
    - Eutrophication
    - Formation of tropospheric ozone (photochemical oxidants)
- Use of resources and renewable primary energy – (Data derived from LCI and not assigned to the impact categories of LCIA)
    - Depletion of non-renewable energy resources
    - Depletion of non-renewable material resources
    - Use of renewable material resources
    - Use of renewable primary energy
    - Consumption of freshwater
- Waste to disposal – (Data derived from LCI and not assigned to the impact categories of LCIA)
    - Hazardous waste
    - Non-hazardous waste

The standard further indicates what other emissions and additional environmental information shall be included where relevant.

For a broader view on sustainability criteria it is recommended the GBCA takes note of the content of ISO21929-1:2011 (Sustainability in building construction -- Sustainability indicators -- Part 1: Framework for the development of indicators and a core set of indicators for buildings).

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?

The exact number of categories is less relevant than ensuring that the GBCA (and its stakeholders) has sufficient confidence in the indicators that it chooses.

Energetics recommends the GBCA considers the list of mandatory environmental impact categories included in ISO21930:2007 as a minimum. This will ensure alignment of the GBCA's program with international practices.

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

The exact number of categories is less relevant than ensuring that the GBCA (and its stakeholders) has sufficient confidence in the indicators that it chooses.

Energetics recommends the GBCA considers the list of mandatory environmental impact categories included in ISO21930:2007 as a minimum. This will ensure alignment of the GBCA's program with international practices.

If six impact categories are appropriate, are the six categories above the most appropriate? (Climate change, Land transformation and use, Ecotoxicity to land and water, Mineral and Fossil fuel depletion, Water depletion, Human toxicity)

Energetics would caution the GBCA against the use of Land transformation and use and Ecotoxicity to land and water as the relevant environmental flows are not always recorded properly.

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

Yes. However, the AusLCI guidelines serve a different purpose (to guide creation of a complete LCI database) then the GBCA's Green Star tools. Therefore, Energetics recommends the GBCA to consider the qualitative notes regarding the status of various impact categories as stated in ALCAS' "Best Practice Guide to Life Cycle Impact in Australia".

6.5. Weightings of Environmental Impacts

Please note the following incorrect statements in the discussion paper:

- "Weightings are essential for LCA results to be calculated." In fact, weightings are an optional step in LCA. Most LCA studies do not apply weighting.
- "… the Building Products Weighting for Environmental Impact Categories, which has been developed as part of the 'AusLCI' project." AusLCI deals predominantly with Life Cycle Inventory (LCI), although it does indicate which environmental indicators the database is expected to be compatible with. However, weighting is a controversial issue that is not a part of AusLCI.

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

Energetics believes that the BP LCI weighting methodology is fundamentally flawed. One of the major shortcomings is that the weighting factors have been determined by lay people that have insufficient understanding of the variation in uncertainty in impact assessment models and the variation in data quality in the underlying LCI data(bases). These variations in combination with the weighting method will lead to unpredictable outcomes.

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?

It is perfectly acceptable to have separate credits for each of the environmental indicators. However, should the GBCA decide that it prefers the ease of use of a single 'weighted' credit, then it is important that the GBCA understands the subjectivity involved, the uncertainty in various impact assessment models and the variation in data quality of the underlying LCI data.

7. The Assessment Model

7.1. The 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?

Energetics supports the development of reference cases, as this will allow assessments of the relative environmental impacts at a building level. We believe it is important to assess environmental impacts at a building level as this will ensure designers can search for the most cost-efficient and practical ways to reduce overall impacts. This is not limited to material substitution, but also includes design optimisation (including dematerialisation).

The exact definition of reference cases will require some deliberation. Energetics recommends that the reference cases are closely aligned with the final functional units.

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?

It makes sense to distinguish reference cases for different functional units. It will require more research and market consultation to determine what the most suitable differentiation is.

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?

There are various ways this could work in practice. Energetics is happy to further discuss GBCA's objectives and the implications for the operation of reference cases.

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

LCA is a decision support tool that works best when comparing relative results (between two or more alternatives). This implies a reference of some sort is useful.

If the GBCA intends to assess the environmental impacts at building level, then using reference cases makes sense. This could mean developing generic reference cases or project specific reference cases. Both pathways have advantages and disadvantages.

With the right tools, GBCA could focus on simply setting the required environmental performance of a building without detailing the exact reference case. For transparency purposes we recommend reference cases are developed at the start of GBCA's journey.

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?

The additional time required for iterations of the LCA depends on:

- Number and complexity of alterations
- Availability of tools / calculators

Automation of this process that assists designers to make the decisions they want will greatly reduce the time required for iterations. As a general rule, we expect a 25%-50% increase in time is required for extensive analysis and alterations. This percentage will come down with experience.

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?

Note: the second column refers to reference units (declared units), not functional units.

Energetics recommends the GBCA consults with builders and quantity surveyors to determine the key building components per functional unit.

Energetics has undertaken detailed assessments for a range of building types and projects, typically for the purpose of carbon footprinting or carbon price impact assessments. The applied approach can readily be applied to determine the average building performance per functional unit, as well as the contribution of all building elements.

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

Energetics recommends that the GBCA predefines as many parameters as possible without interfering with the practitioners' ability to assess design changes. The determination of the rules should occur in market consultation.

7.2. Reporting Mechanism

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

Yes, ISO14025 is an appropriate underlying reporting mechanism. There is also a specific standard for EPD's of construction products: ISO21930:2007. This standard complements ISO14025:2006, but discusses details that are specifically relevant for construction products. Essentially, there is a whole range of standards that are aligned but deal with separate aspects of the 'environmental assessment of buildings puzzle".

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

The specific standard for EPD's of construction products: ISO21930:2007 complements ISO14025:2006, but discusses details that are specifically relevant for construction products. Therefore Energetics believes this standard should be preferred.

Please note that for the assessment of the impacts of buildings, ISO21931-1:2010 (Sustainability in building construction -- Framework for methods of assessment of the environmental performance of construction works -- Part 1: Buildings) is an appropriate standard.

7.3. Allocation of Green Star Points

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

In principle it appears appropriate, however Energetics recommends that the GBCA tests this principle in order to understand how this impacts the outcome.

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?

It is perfectly acceptable to have separate credits for each of the environmental indicators. However, should the GBCA decide that it prefers the ease of use of a single 'weighted' credit, then it is important that the GBCA understands the subjectivity involved, the uncertainty in various impact assessment models and the variation in data quality of the underlying LCI data.

Also, if weighting is applied to indicators in order to communicate a single unit environmental performance, it is important that the results prior to weighting are made available together with the weighted results (ISO14044:2006, section 4.4.3.4.3). This ensures that:

- Trade-offs and other information remain available to decision makers and to others, and
- Users can appreciate the full extent and ramifications of results.

Energetics believes any weighting method should be thoroughly tested by the Australian LCA community before it is implemented into the Green Star tools.

8. Data Inventory

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

Please note, unfortunately, the assertion that "the buildings products inventory dataset, has been published [in AusLCI] and is available for use" is incorrect. The Australian Life Cycle Inventory database (AusLCI) has created a framework for data to be published.

Energetics would urge the GBCA to devise a plan – in consultation with ALCAS (or private partners) – of how building materials data can be disclosed via AusLCI. One potential way forward would be to incorporate the Building Products Life Cycle Inventory (BP LCI) database into AusLCI and to then link these data with appropriate background data. However, this will require a significant improvement in data quality for a large number of products currently included in the BP LCI database. In its current format, the Building Products Life Cycle Inventory (BP LCI) database also lacks quality and consistency for direct use by the GBCA.

There are alternative ways forward, but these should not be explored until the opportunities for the GBCA to work with ALCAS/AusLCI have been exhausted.

Should a European LCI be used?

Using European LCI data is not ideal and should only be considered as a short term intermediate solution. This option could bypass most of the difficulties currently experienced in Australia – most notably the lack of public funding for the development of a national LCI database. It would therefore allow the GBCA to get on with the job without being dependent on developments outside of its control.

Still, Energetics would urge the GBCA to explore how it can use its status and influence to further the development of AusLCI.

Are penalties needed?

Penalties are not necessarily required, but can be used as an incentive for laggards. Energetics recommends the GBCA considers the need for penalties in line with the availability of good quality Australian LCI data.

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

There are a range of credible data sources available. These data sources (e.g. ecoinvent) often reside in LCA software. The GBCA will have to consider the availability (and limitations on public use) of data sources in line with its preferred calculation and reporting format.

Energetics believes there is an opportunity for the GBCA to work with ALCAS in creating a freely available Australian Life Cycle Inventory database (AusLCI). The structure for AusLCI is virtually complete, although it has proven difficult to attract providers of primary data. As a start, GBCA and ALCAS could define acceptable generic LCI data for key materials.

9. Applicable Green Star Rating Tools

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

Energetics agrees that from a practical point of view GBCA will have to start with a limited LCA based tool. Consideration could be given to which (fit-out) elements are ready for inclusion. For example, it might be feasible to include flooring materials, while furniture might still prove to difficult.

10. Other matters for discussion

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

Yes. Generic LCA software (e.g. SimaPro, GaBi) is able to accommodate virtually any model and methodology. However, if only generic guidance on the building assessment methodology is provided, it is likely that by using these tools different practitioners will get different answers for the same situation.

Energetics believes that the GBCA will have to consider either developing a tool that aligns with its purpose, or it will have to endorse results from third party tools at some stage. Either way, purpose-built tools are better placed to allow for a consistent assessment across practitioners.

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

Please refer to ALCAS for an answer to this question.

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?

Before the assessments can take place, a comprehensive system needs to be set up that will allow product suppliers to communicate the environmental performance of their products and materials. Energetics believes a type III EPD scheme (based on ISO21930:2007) is most suited for this purpose. It would then make sense to incorporate new products into a database and potentially a design tool. The costs for the assessment will vary greatly depending on the availability of such a design tool.

Another contributing factor will be the extent to which designers will want to make changes to their design. The big ticket items are usually easy to find and address. Smaller marginal improvements can be harder to find.

Based on the current status of the discussion Energetics cannot provide a reliable indication of costs.

Is the requirement to adhere to international standards necessary?

Yes. Energetics believes that adhering to international standards is necessary. These standards have typically been developed by a wide range of stakeholders and provide a balanced view of the best practice consensus.

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

The underlying international standards for all LCA studies are ISO14040:2006 and ISO14044:2006.

Other standards, such as ISO21930:2007 (based on ISO14025) can provide valuable guidance to EPD's. GBCA might also want to consider the latest European standard in this context: EN15804:2012. For assessment of buildings, ISO21931:2010 is the accepted international standard.

Is the requirement to use recognised software necessary?

Ultimately, it is unthinkable that assessments can occur efficiently without recognised software tools. In the short term alternatives (e.g. spread-sheets) might be used to test certain principles.

Energetics believes it is important that the GBCA tests each tool or software package for consistency. Ideally, there should be no significant difference in results when modelling for example reference buildings and pre-defined alternatives.

Should the GBCA recognise particular softwares?

Yes, accreditation of tools & software is essential to guarantee compliance with the GBCA's scheme.

Which software should be recognised, and why?

The GBCA's scheme requires further development before particular software can be recommended.

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?

LCA software predominantly applies relatively simple calculation rules. The underlying methodology for the model is what generates differences between software. The compliance with the overall methodology is what needs to be tested.

Is the requirement for peer review necessary?

Yes, peer review is essential in a developing sector. It also increases confidence in the results.

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

Compliance with international standards where possible.

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