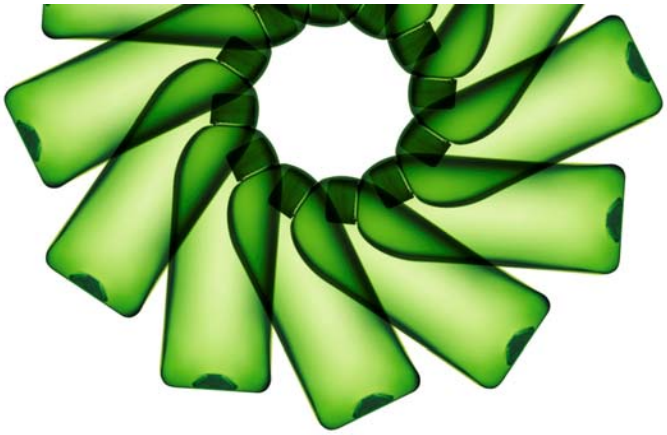


Life Cycle Assessment: The New Business Imperative

Consumer demand for environmentally responsible products continues to increase, driving more companies to create sustainable products and to improve their processes to meet consumer demand. Assessing product competitiveness has shifted from a market and quality driven approach to a more robust process that involves assessing each product's social, economic and environmental impacts. A growing number of businesses are using a Life Cycle Assessment (LCA) approach as their sustainability scorecard of choice. This paper will demonstrate how LCAs are a valuable tool in demonstrating thought leadership in any industry and integrity among customers.

Background

Several large retailers, including Wal-Mart, Kohl's, and Patagonia, have implemented a corporate Sustainability Index, which compels all suppliers to disclose how products are harvested in raw form, produced, and transported to their stores' shelves. This type of comprehensive evaluation sets the stage for an even broader approach towards environmentally and socially responsible companies, which includes assessment of metrics beyond monetary efficiency and profit.

"LCA enables the estimation of the cumulative environmental impacts resulting from all stages in the product life cycle, often including impacts not considered in more traditional analyses (e.g., raw material extraction, material transportation, ultimate product disposal, etc.)."

SCIENTIFIC APPLICATIONS INTERNATIONAL CORPORATION [1]

The creation of The Sustainability Consortium (TSC) solidified a partnership between businesses, academia, non-governmental organizations (NGOs), and government entities and is tasked with establishing a consumer-facing product sustainability scorecard[2]. This scorecard uses a Life Cycle Assessment (LCA) approach to create a cradle-to-cradle assessment of a product's impact.

While TSC is in the process of establishing a sustainability scorecard, a growing number of companies have implemented their own product sustainability initiatives and are turning to LCA as the tool of choice for addressing the environmental impacts of their products and services. LCA provides an internationally accepted (ISO 14040:2006[3], PAS2050[4]), step-by-step approach to identifying, calculating, and quantifying the many environmental aspects and impacts of products and services.

What is LCA?

Just as the term "life cycle" implies, a Life Cycle Assessment is a review of a product, process, or system from its inception to its expiration including all of the raw materials, intermediate products and processes, and outputs associated with it.

There are several widely accepted steps to conducting LCAs that ensure a comprehensive evaluation of the product/process. These steps are outlined below:

Goal Setting & Scoping

- Determine the process or product for assessment
- Define the purpose of the assessment
- Decide what type and depth of assessment is needed
- Determine the audience
- Decide on the method to be used
- Outline the type of data needed to provide meaningful results
- Determine format of delivery & procedural logistics

Inventory

- Create a data collection procedure
- Outline the life cycle of the product or process
- Determine all of the direct inputs and outputs
- Collect data

Determine Environmental Impacts

- Designate impact categories
- Allocate impacts to their categories
- Characterize each impact using appropriate modeling tools
- Normalize the data
- Weight the impacts

Evaluate Results & Report

- Identify if any data issues remain
- Identify whether results are complete, consistent, and accurately depict the level of detail required by the scoping process
- Determine significance based on goals, scope, and weighting
- Report
- Peer Review

Choosing the Right Type of LCA

There are two general types of LCAs: Attributional and Consequential. Determining which to complete is part of the goal and scoping phase of a project. This should be one of the first items considered, as it will drive many of the resulting decisions and assessments.

Attributional LCA

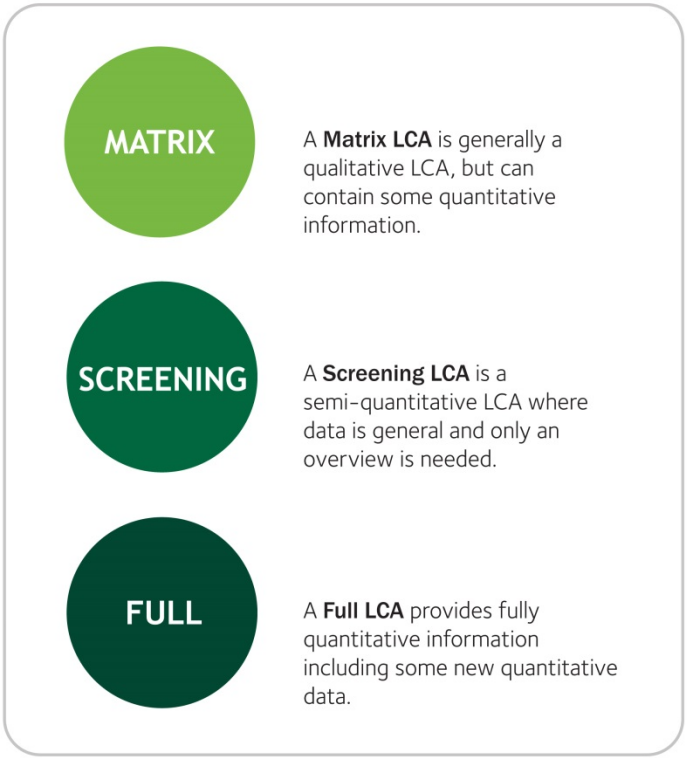
An Attributional LCA is also referred to as an accounting LCA because it is strictly a quantification of a product's/process' existing environmental impacts. No product/process improvements are to be assessed as part of the Attributional LCA.

Consequential LCA

A Consequential LCA is a change-oriented document. This type of LCA is used as a tool to improve the product/process in various ways. Several different scenarios may be played out when completing a Consequential LCA in order to identify the best course of action.

Depth of Assessment

For each type of LCA there are three levels of assessments as outlined below[5]:



Choosing the depth of assessment should be decided in the goals and scoping phase of the project.

Process Overview

LCA provides a way to calculate the environmental impacts of a product from beginning to end, including the raw material inputs, through the manufacturing or process completion, to the output and end-of-life management (see diagram below). Such full impact accounting can provide a company not only with a complete understanding of the impacts of their products but also valuable marketing and transparency gains that cannot be gleaned from any other form of analysis. By looking at the full life cycle of a product/process, a company can improve its environmental footprint as well as gain insight into how to reduce or even eliminate costs associated with environmental cleanup, disposal of hazardous materials, pre-treatment, energy costs, etc.

Developments throughout the product/process chain can help a company improve not only its bottom line, but its public image and brand reputation, two qualities that are highly coveted throughout the

business community and can only be gained through thought-leadership and methodological integrity.

"By revealing the big picture, a life cycle approach ensures that a company doesn't create improvement in one area at the expense of another. Rather than looking at specific indicators in isolation (e.g. recycling rate, recycled content), an increasingly wide-spread consensus exists that state-of-the-art LCA, based on internationally-accepted standards, is the best approach to quantify the environmental impacts a packaging might have on the environment from cradle to grave[6]."

2012 ENVIRONMENTAL LEADER. THE BENEFITS OF LIFE CYCLE ANALYSIS

Why LCA?

Provide Vital Information

First and foremost, LCAs provide the information needed by CEOs, product manufacturers, boards of directors, and other decision makers and stakeholders to identify the product/process with the least environmental impact, and from that information, to make important decisions regarding the product/process. These decisions can be pivotal in determining the direction a company takes with a product/process and its triple bottom line—its profits, its social responsibilities, and its environmental impacts.

Quantify Defensibly

LCA provides the framework and standardization needed for a company to truly quantify environmental impacts in a way that provides the data integrity needed to stand up to stakeholder scrutiny. It can also provide the specificity needed for such scrutiny throughout every phase of the process.

Make a valid comparison

Trying to assess and compare different scenarios can be confusing and unconstructive if the products or processes being examined are presented in different formats, under different frameworks, or quantified using different normalizing factors. By standardizing the process of assessment, it is much easier to identify changes in the environmental effects of a product/process anywhere in the product/process chain (whether that is the supply chain, the manufacturing chain, etc.). It also provides standardization amongst different analyses so two or more different products or processes can be compared with more accuracy.

Identify Shifted Consequences

When a process or product is evaluated on a micro scale and improved environmental and budget efficiencies are identified in a vacuum, the consequences of an action can be shifted to other areas of the process or further down or up the supply chain.

Ultimately, such shifting of the consequences can increase environmental damage and reduce budget efficiencies rather than improve them. LCAs provide a full-accounting process that can identify such impact shifting, so that the best course of action can be taken from a life cycle perspective.

"Life Cycle Assessment seeks to increase efficiency. And because it takes into account every phase in the lifetime of a product, apparent improvements that only shift the problem around are recognized and can be avoided."
PROCTOR & GAMBLE[7]

Determine Impacts Based on a Strong Foundation

Once the impacts have been quantified, determinations can be made based on a solid foundation. Claims regarding the impacts associated with a product/process can be made based on sound empirical data. Again, this provides a stable platform to convey the message to stakeholders regarding decisions made in the product/process chain.

Communicate Effectively

LCA is an effective way to communicate information regarding a product's environmental impact to stakeholders. This approach can provide a stable platform from which all stakeholders can hold a productive discussion on the relative merits and disadvantages of various decisions regarding the product/process as it relates to environmental impacts. It can be used for process improvement and technology selection as well as communicating with external stakeholders as a means of marketing the product/process as environmentally preferable. Finally, it can provide credibility to decisions made against product/process changes that are publicly popular but not necessarily environmentally preferable.

"Siemens also uses [...] [LCA] for representative products and/or product groups or systems to make statements about their environmental impact. The life cycle assessment provides us the opportunity to identify the potential for optimizing our products and thus to continuously improve the ecological impact of our products.

We use both full-scale LCAs and screening LCAs. If a full-scale LCA shows that energy consumption in the use phase is the most relevant parameter in the life cycle, we then also utilize screening LCAs for the following product generations and for products in the same family to get information about the environmental impact of our products. This method has proven to be sufficiently precise in delivering the essential environmental information for our products without concealing facts. However, if our experts identify environmental factors that need particular consideration, we always carry out a full-scale LCA"
SIEMENS[8]

Who is using LCA?[9]

3M	Michelin
Acme Brick	Milliken Carpet
Apple	Milliken Contract
Arcelor-Mittal	Millipore
Arctic Paper	DfE
Armstrong World Industries	M-Real
AU Optronics	Nestle Waters
Axpo AG	Nike
BlueScope Steel	Nissan
BMW	Norskeskog
Burgo Group	Osram Opto Semiconductors
CANFOR	Pepsico
Canon	PlayBack Clothing
Continental	Procter&Gamble
Daimler	Qisda
Dometic	Resopal
Dow Chemical	Rio Tinto Alcan
DSM	Rio Tinto Borax
eGGer	Rockwool
Electrolux	Rona
Exxon Mobil	SAQ
Fujitsu	Sarnafil
General Electric	SCA
General Motors	Siemens
HAG	Sto Corporation
Henkel	Stonyfield Farms
Herman Miller	Tasmanian Timber
Hewlett Packard	Taylor Wines
Interface Global	Tork
International Paper	Total
Kennecott Utah Copper	Toyota
Kimberly-Clark	Unilever
KYDEX	Vestas
Levi Strauss & Co.	Volvo
Lexmark	VSM Group
Kusch	Walmart
Loup Valley Dairy	Xerox
Mars	Yalumba Winery

How to Begin?

The thought of beginning such an in-depth review of a product/process can seem daunting at first, but careful methodical steps toward your goal will get you there.

Outline the Product/Process

Start by identifying the product/process for assessment. This process or product may change somewhat during the scoping process, but by identifying a general scope at the beginning, you can identify the parties necessary for completion of the assessment.

Assess Your Organizational Capabilities

Assess the capability of your organization to complete the LCA internally. Do you have the staff, knowledge, and access to sufficient relevant data necessary? In many cases an organization does not have the internal capability or capacity to complete the document fully in house, nor is it necessarily desirable to do so for public perception

reasons. Many organizations will hire a consultant who specializes in LCA to complete an assessment. This provides impartiality to the process, so that the public doesn't view it as a conflict of interest, as well as it frees up valuable internal staff.

Identify Internal Stakeholders

Identify the key internal stakeholders associated with the product/process for assessment. These stakeholders may be product designers, management personnel, line foremen, or others. Who will provide data and information, and who will benefit from the assessment? There must be a balance between involving people in the process and keeping the input to a manageable level. As noted above, the scope may transform at the beginning, so finding the critical number of participants at the beginning is necessary. You can determine if others need to be added to the discussion once the scope becomes finalized.

Conclusion

For many, LCA can seem a daunting feat to accomplish, but you don't have to go it alone. If you determine that an in-house LCA is not feasible for your organization, bring in outside help who can help guide you through and/or complete the process for you.

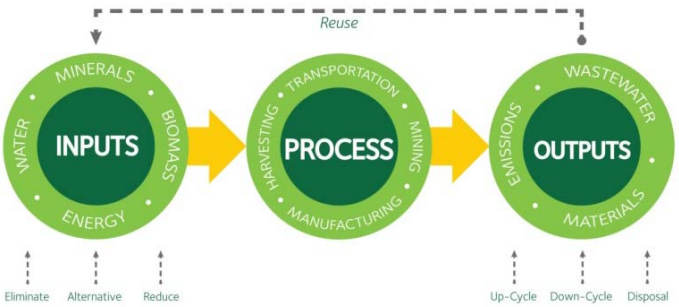
Waste Management can help guide your organization through the LCA process. Our team of sustainability professionals uses the British Standard's Publicly Available Specifications 2050 (PAS 2050) PAS2050 in our LCA processes.

PAS 2050 builds on existing life cycle assessment methods established through BS EN ISO 14040 and BS EN ISO 14044 by providing requirements specifically for the assessment of greenhouse gas (GHG) emissions within the life cycle of goods and services. These requirements further clarify the implementation of the standards in relation to the assessment of GHG emissions of goods and services, and establish particular principles and techniques, including:

a) Cradle-to-gate and cradle-to-grave GHG emissions assessment data as part of the life cycle GHG emissions assessment of goods and services;
b) Scope of GHG emissions to be included;
c) Criteria for global warming potential (GWP) data;
d) Treatment of emissions and removals from land use change and biogenic and fossil carbon sources;
e) Treatment of the impact of carbon storage in products and offsetting the carbon;
f) Requirements for the treatment of GHG emissions arising from specific processes;
g) Data requirements and accounting for emissions from renewable energy generation.

This process benefits organizations, businesses and other stakeholders by providing a clear and consistent method for the assessment of the life cycle GHG emissions associated with goods and services. Specifically, PAS2050 provides the following benefits:

a) For organizations that supply goods and services, (PAS2050):
   - Allows internal assessment of the existing life cycle GHG emissions of goods and services;
   - Facilitates the evaluation of alternative product configurations, sourcing and manufacturing methods, raw material choices and supplier selection on the basis of the life cycle GHG emissions associated with goods and is to be used as a basis for comparison of services;
   - Provides a benchmark for programs aimed at reducing GHG emissions;



   - Allows for the quantification, management and potential comparison of GHG emissions from goods or services using a common, recognized and standardized approach to life cycle GHG emissions assessment; and
   - Supports reporting (e.g., on corporate responsibility).

b) For consumers of goods and services, PAS2050 provides a common basis for understanding the assessment of life cycle GHG emissions when making purchasing decisions and using goods and services.

LCA can provide your organization with valuable insight into your product/process chain; insight which no other form of analysis can provide due to its depth and breadth of scope. No other tool provides the full well-rounded internationally accepted and methodologically sound approach that LCA provides. Not to say LCA is not the answer to all of your product/process woes, but used as part of your toolbox to assess, analyze, and improve your products and processes, LCA can provide the context and scope missing from previous analyses.

REFERENCES

[1] Scientific Applications International Corporation. (2006, May). LIFE CYCLE ASSESSMENT:PRINCIPLES AND PRACTICE. Cincinnati: Environmental Protection Agency.
[2] Arizona State University and University of Arkansas. (2012, 09 11). Members. Retrieved from The Sustainability Consortium: http://www.sustainabilityconsortium.org/members/
[3] International Standards Organization. (2012). *ISO 14040:2006 Environmental management -- Life cycle assessment -- Principles and framework.* Retrieved from ISO.org: http://www.iso.org/iso/catalogue_detail?csnumber=37456
[4] British Standards Institute. (2012). *PAS 2050.* Retrieved from BSi Group: http://www.bsigroup.com/en/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050/PAS-2050/
[5] Hochschorner, E., & Finnveden, G. (2003). Evaluation of Two Simplified Life Cycle Assessment Methods. International Journal of LCA, 8(3), 119-128.
[6] *Comere, E. (2012, 03 21). EnvironmentalLeader. Retrieved from The Benefits of Life Cycle Analysis: http://www.environmentalleader.com/2012/03/21/the-benefits-of-life-cycle-analysis/*
[7] Proctor & Gamble. (2012, 08 31). Science in the Box. Retrieved from Life Cycle Assessment: http://www.scienceinthebox.com/life-cycle-analysis
[8] Siemens. (2012, 08 31). Core Topics: Product Responsibility. Retrieved from Siemens.com: http://www.siemens.com/sustainability/en/core-topics/product-responsibility/management-approach/life-cycle-assessments.htm
[9] LCA Links. (2012, 02 13). Companies. Retrieved 08 30, 2012, from LCA Links: http://www.life-cycle.org/?page_id=11