Case Studies:

How Companies Use LCA Tools to Meet Packaging Goals

SUSTAINABLE PACKAGING COALITION®

TRAYAK
SUSTAINABILITY STARTS HERE

Introduction

For many aspiring companies on their path toward sustainability, being able to measure the environmental impacts of their products or packaging using data is crucial to meeting their goals. Life cycle assessment (LCA) offers one way to do just that. LCAs are a powerful decision-making tool for assessing the environmental impacts associated with a product or package over its entire life cycle (e.g. from material sourcing to disposal).[1] LCAs shed light on what are often "invisible" environmental characteristics like greenhouse gas emissions and are used by a range of industries to: [2,3]

- Identify environmental impact "hotspots"
- Visualize environmental trade-offs associated with product or system changes or specific "what if" scenarios
- Substantiate environmental marketing claims

LCAs are designed to use reputable, science-based data to produce assessments of possible environmental impacts associated with products, processes, or services. However, it's important to acknowledge that LCA results depend on the information entered by the practitioner, as well as the assumptions and system boundaries of the LCA model. System boundaries are thresholds or cutoffs that must be defined, so that environmental impacts can be reliably and consistently quantified. System boundaries may include assumptions about time, the geographic scope of the data, and exclusion of particular life cycle phases such as disposal.[4,5,6] Because of these realities, LCA results are susceptible to practitioner bias and vary depending on the LCA software used.

1 Life-cycle perspective

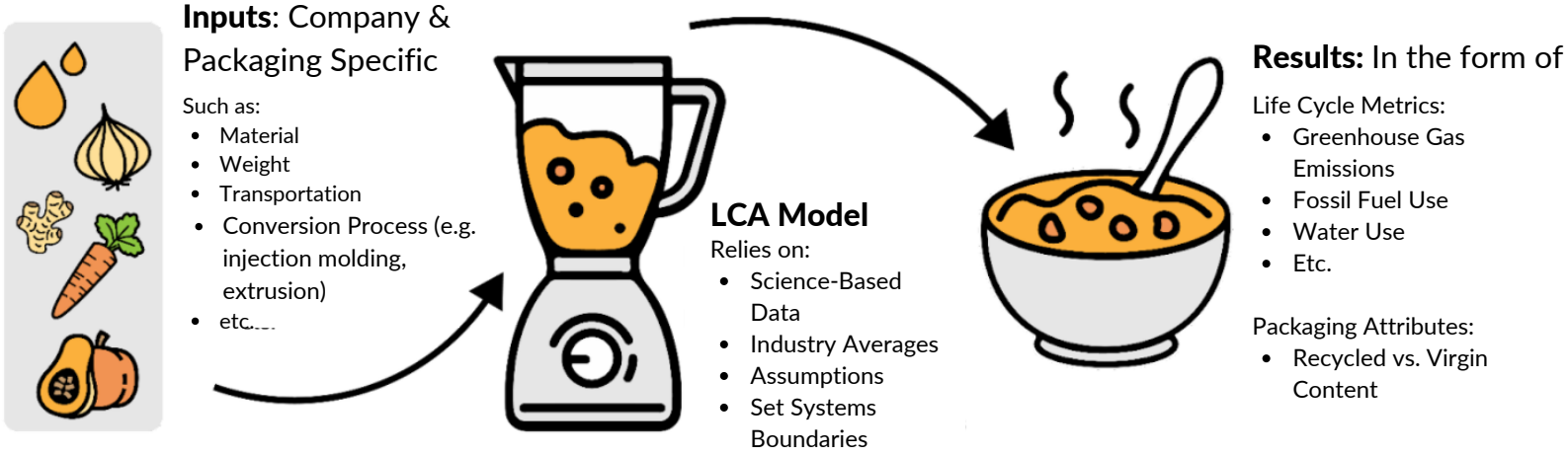
2 Sustainable Development and Other Solutions to Pollution and Global Change / Life Cycle Analysis - an overview

3 Essentials of Sustainable Packaging - Reusable Packaging | The Essentials of Life Cycle Assessment

4 A system boundary identification method for life cycle assessment - The International Journal of Life Cycle Assessment

5 Life Cycle Assessment (LCA)

6 What is included in a LCA?



Since LCAs rely on data, they cannot provide results for qualitative impacts or impacts with limited data, like ocean plastic pollution. LCAs also cannot tell practitioners which environmental impacts are the most important. For example, an LCA cannot determine if water use is more or less important than energy use. These limitations underscore what LCAs are not – omniscient decision making tools – and remind us that LCAs are one part of the decision making process that ultimately relies on people to interpret, contextualize, and act on the range of information at their disposal.

For more information on LCAs, check out the Sustainable Packaging Coalition's (SPC's) **Essentials of Life Cycle Assessment course**, which is part of the Essentials of Sustainable Packaging training program. **Courses** are available on-demand with a one-year subscription, and discounts are available for SPC members.

To highlight how companies can use life cycle assessments to inform packaging decisions and support their sustainability goals, the Sustainable Packaging Coalition and LCA software company Trayak teamed up with Microsoft and Kao to showcase LCAs in action.

Methodology

There are two types of LCAs - streamlined or screening LCAs, and full LCAs. A screening LCA only uses industry-averaged data to model the system, while a full LCA uses custom data that is specific to a company's supply chain, meaning someone is tasked with collecting the water consumption, energy consumption, chemical inputs, etc. specific to the package or product being analyzed. A full LCA is not inherently more useful than a screening LCA - it all depends on the goals for conducting an LCA. In most cases, such as internal decision-making and goal setting, a screening LCA with industry-averaged data will accomplish what a company needs.

LCAs may be reviewed by a third party, which means that an independent organization reviews the LCA, its sources of data, methods of calculation, goals, and boundaries to determine if the LCA is fair and representative. Both screening LCAs and full LCAs can be reviewed by a third party. The International Organization for Standardization (ISO) has established standards for the conduct and interpretation of LCAs. ISO-compliant full LCAs, which can be used for making external marketing claims, require third-party review.

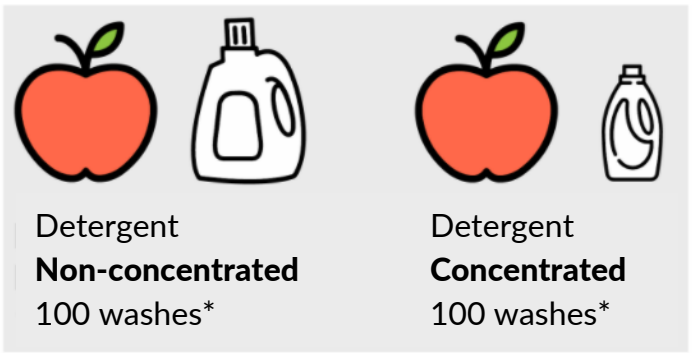
For these case studies, the participating companies utilized Trayak's screening LCA tool, EcoImpact-COMPASS, to measure environmental impacts associated with a packaging change. EcoImpact-COMPASS is a screening LCA solution which offers users an easy-to-use, cost effective, and reliable way of performing LCA.

The following case studies represent a cradle-to-grave LCA that uses industry average data to show impacts from raw material extraction (cradle) through manufacturing, transportation, and disposal of the packaging (grave). Considering what happens at a package's end-of-life is important, however, it's only one phase of a package's lifecycle. Generally speaking, the end-of-life phase doesn't have as high of an impact on a package's environmental footprint when compared to other phases of its life cycle such as raw material extraction.

EcoImpact-COMPASS uses industry average data for raw materials and manufacturing processes primarily from **ecoinvent**, a life cycle inventory database run by a Swiss non-profit organization. Other supplementary sources and published research papers are also used when necessary. End-of-life data for supported regions are used from reliable sources like the Environmental Protection Agency in the U.S. and Eurostat in Europe. Each case study features an "apples to apples", or functionally equivalent packaging system, comparison.

The packaging systems were modeled using unique package-specific information (materials, masses, conversion processes, transportation, etc.) provided by each company. This process allows practitioners to identify impact hotspots and key areas for environmental footprint reductions.

Assumptions about what will happen to a package component at its end-of-life are based on average data for a particular region. Pre-populated end-of-life percentages within EcoImpact-COMPASS guide users in designing for real-world scenarios early in the design phase. For example, a cardboard component will be prepopulated with the likelihood of it being recycled versus landfilled based on the region in question.



Detergent
Non-concentrated
100 washes*

Detergent
Concentrated
100 washes*

Detergent
Non-concentrated
100 washes*

Detergent
Concentrated
75 washes*

*Functional Unit

Case Study 1: Microsoft's Elimination of Polyethylene Bags

Background:

Microsoft has made a bold bet - a moonshot - to become carbon negative by 2030. To fund their sustainability projects and to create the right motivations, Microsoft has also implemented an internal carbon tax that each division in their business must pay.

Microsoft is committed to transparency and to sharing their goals, actions, results, and lessons learned along the way. They have aggressive 2025 and 2030 packaging sustainability goals, including the elimination of all single use plastic packaging by 2025.

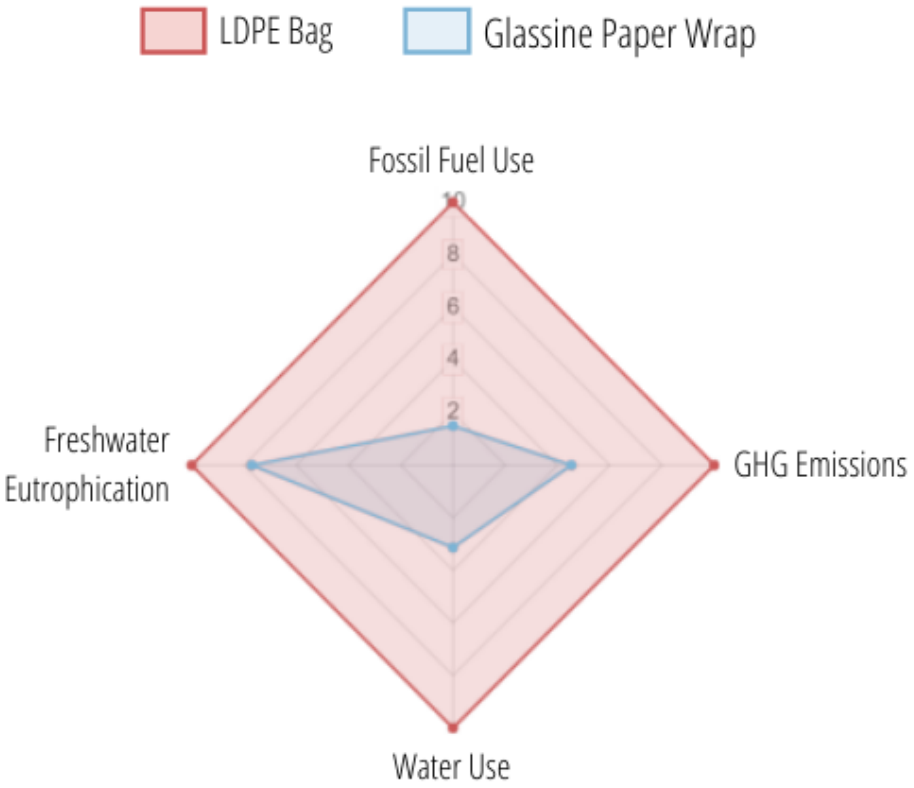
Microsoft produces a range of hardware products, mainly in manufacturing sites in Asia. The finished product packaging is completed in Asia and then shipped around the world. Historically, many of the individual retail packages were covered in a polyethylene bag when placed in masterpack corrugated shippers. This bag was used to protect the retail packages from scuffing due to rubbing against each other or the wall of the corrugated shippers. In line with the 2025 commitment mentioned above, Microsoft focused on the elimination of these polyethylene bags without jeopardizing the protection of the retail packages.

The Challenge

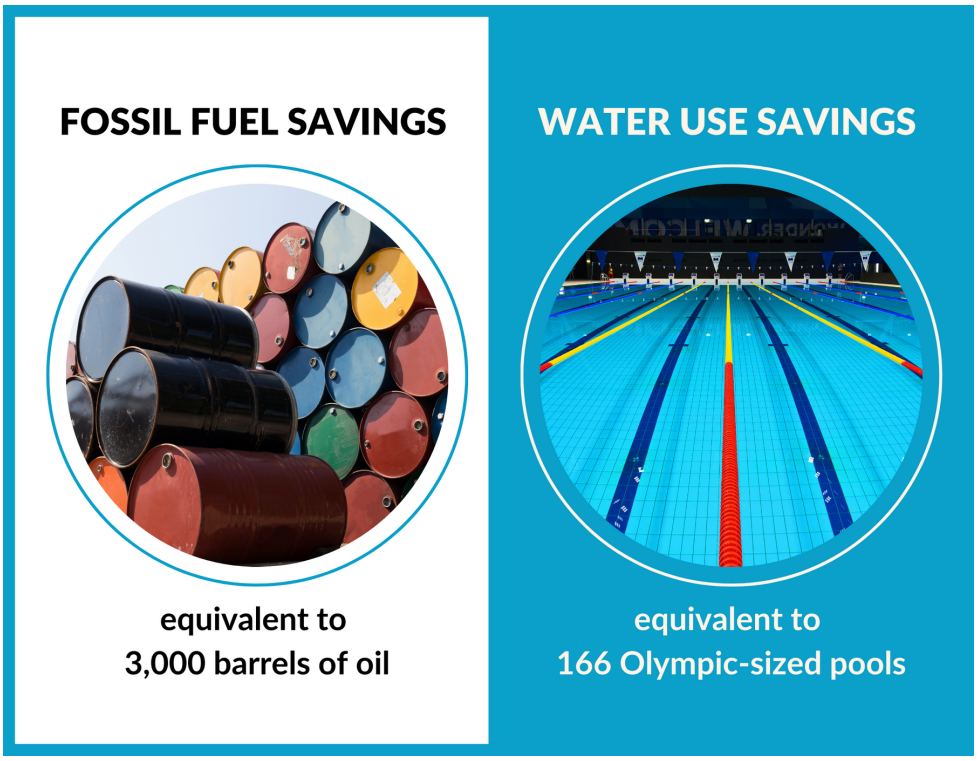
This typical low density polyethylene (LDPE) bag is similar to a bread bag, with one color print for regulatory markings. The Microsoft team first assessed a complete elimination of the LDPE bag, however they found this to be problematic in most cases. To continue to protect the retail package, the Microsoft team then evaluated alternative materials to replace the LDPE. In the search for alternatives, the team landed on a glassine paper solution. Before they made the switch they wanted to understand the environmental impacts and make sure it was the right decision. The Microsoft team utilized EcoImpact-COMPASS to run a screening LCA to compare these two materials.

Use of LCA & Results

The screening LCA analyzed the environmental impact of the two materials across four environmental indicators; greenhouse gas (GHG) emissions, fossil fuel use, water use, and freshwater eutrophication. When analyzing a one-to-one (or per unit of product) comparison between the materials, the glassine paper wrap had an 85% reduction in fossil fuel use compared to the LDPE bag. When examining water use, the glassine paper wrap had a 69% reduction compared to the LDPE bag. Moreover, the results showed the glassine paper wrap had a lower environmental impact when compared to the polyethylene bag across all four indicators.



Analyzing one polyethylene bag to one glassine paper wrap is a good design decision. However, Microsoft wanted to fully understand the overall business impact. They used approximately 25 million polyethylene bags per year. With this quantity metric taken into consideration the glassine paper wrap results in a reduction in fossil fuel use that is equivalent to 3,000 barrels of oil. Likewise, when examining water use, the glassine paper wrap results in a reduction of water use equivalent to 166 Olympic-size swimming pools.



The LCA results confirmed that the decision to make the switch in materials from the polyethylene bag to the glassine paper wrap would meet Microsoft's sustainability goals. In addition to the environmental savings, the switch to the glassine paper wrap achieved a reduction in costs for Microsoft. The packaging process in manufacturing needed adjustments, however, because the packaging process was manual, the adjustments were easy to make. Fortunately, process adjustment was not a barrier to implement the material switch.

Overall, this material switch from the polyethylene bag to the glassine paper wrap reduced the environmental impact across four indicators while meeting or exceeding the necessary functional requirements. This transition was completed in 2021.

Sustainability in Action

Microsoft has taken ownership of their environmental footprint and is committed to their sustainable packaging goals in the larger context of their goal to be carbon negative. The elimination of single-use plastics is an important focus for their team because plastic is a non-renewable material, can cause harm from leakage into the environment, and this particular package format (a bag) has very low recycling rates.

A science-based tool like a streamlined LCA aided in Microsoft's decision making. EcoImpact-COMPASS is easy to use in the early design stages to evaluate the material switch across multiple environmental indicators. This allowed the team to be aware of tradeoffs or burden shifting. In this particular case no environmental trade offs were present. The team also took time to evaluate packaging attributes not considered in an LCA such as cost and manufacturing adjustments, which are important factors to consider when looking at a potential packaging change. Microsoft is taking aggressive steps towards reducing their own environmental impact while paving the way for other companies to do the same. The elimination of polyethylene bags is an incremental, but important step in their overall sustainability journey.

Case Study 2: Data Driven Packaging for Kao's John Frieda Brand

Background & Goals

Kao USA Inc., a subsidiary of Japan-based Kao Corporation, has a portfolio of personal care brands including John Frieda, Jergens, Curél, Bioré, Ban, and MyKirei. The John Frieda shampoo and conditioner products have established a strong equity over decades with a tube package. This is integral to the consumer experience and an expectation of this brand. The project objective was to drive John Frieda's commitment to improving packaging sustainability without losing visibility on store shelves or sacrificing consumer experience and expectations.

The existing package is an injection molded polypropylene tube. Consumers say the thickness of the tube material provides a premium feel, so the brand intentionally chose this material over less rigid laminate tube options.

Kao Corporation has had great success incorporating film packaging into personal care and household packaging in Japan that has been widely accepted and used by consumers as refills. As a company, they understand that by first reducing resin use, they can directly reduce their environmental impact. Because of this, they are working to implement more thin film packages in the Western markets (see MyKirei packaging).

Process & Results

Additionally, EcoImpact-COMPASS was used to compare the transportation of the empty packages as they arrive at the filling site. The benefit of shipping a pallet of flat, film-based packages as compared to a pallet of rigid tubes was shown in the comparison as a reduction of:

42%
Fossil Fuel Use

43%
Greenhouse Gas Emissions

47%
Water Use

The John Frieda brand focused on the Tube-Like Pouch which offers many benefits compared to the current injection molded tube, including a 50% reduction in plastic. Development of the Tube-Like Pouch is in line with corporate prioritization of thin film packages. It improves the efficiency of inbound materials and reduces material use, fossil-fuel use, greenhouse gas emissions, and water use. Kao understood these benefits existed, but EcoImpact-COMPASS helped quantify the environmental significance of the potential packaging change.

The Kao Package Development team utilized EcoImpact-COMPASS to quickly model and compare the two packages. The assessment of the two package systems showed a reduction of fossil fuel use by 48%, GHG emissions by 25%, and water use by 24%. Additionally, EcoImpact-COMPASS was used to compare the transportation of the empty packages as they arrive at the filling site. The benefit of shipping a pallet of flat, film-based packages as compared to a pallet of rigid tubes was shown in the comparison as a reduction of fossil fuel use by 42%, GHG emissions by 43%, and water use by 47%.

Going Beyond Life Cycle Assessment

Creating data-driven sustainable packaging by quantifying environmental impact is important; however, packaging attributes also play a role in packaging decisions. In addition to a decreased environmental footprint, the Tube-Like Pouch provides a unique benefit to the consumer experience. The package form allows the consumer to dispense every last drop of product. The dispensing of the Tube-Like Pouch provides additional value to the consumer that can help ensure adoption and provide an incentive beyond the sustainability attributes.

The John Frieda Tube-Like Pouch package was launched as a test market at 187 Walmart stores and at Walmart.com. This will be the first of more efforts to reduce the carbon footprint of the brand, while delighting consumers with products that they love.

Conclusion

These are two of many cases where companies used EcoImpact-COMPASS LCA data to help inform their packaging-related decisions. As demonstrated, LCAs shed light on what are often “invisible” environmental characteristics like greenhouse gas emissions and fossil fuel use, and can be used to both optimize new package designs, as well as inform decisions about which materials have the lowest environmental impacts.