A PRACTICAL GUIDE FOR MARINE SUPPLIERS



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HUB OF VERIFIED SOLUTIONS

LIFE CYCLE ASSESSMENT

Now that we have introduced the Hub of Verified Solutions and the products it brings together, it is time to look at the methodology used to assess many of them: Life Cycle Assessment (LCA).

If a customer has asked for the environmental impact of your product and you are not quite sure what they mean, or what information you are expected to provide, this guide should help.

WHAT IS A LIFE CYCLE ASSESSMENT?

A Life Cycle Assessment, usually shortened to LCA, is a method for measuring the environmental impacts associated with a product throughout its life.

Depending on the scope of the study, this can include where the materials come from, how the product is manufactured, transport between different stages, what happens during use, and how the product is treated at the end of its life.

For each stage, the assessment looks at inputs such as materials, energy and water, as well as outputs such as waste and emissions to air, water and soil. These flows are then translated into environmental impact indicators.

The main international standards for LCA are **ISO 14040** and **ISO 14044**. They provide the framework for carrying out the assessment and reporting how the results were produced.

WHY ARE COMPANIES BEING ASKED FOR LCA DATA?

For many suppliers, the first request comes from a customer. Shipyards and larger companies increasingly need information about the environmental impacts within their supply chains. That means suppliers are being asked for information that may not have been requested a few years ago.

Regulation and environmental reporting are also increasing the demand for product-level information. Companies need better evidence behind the environmental claims they make, while tenders and procurement processes increasingly ask suppliers to provide environmental data.

There is also a practical reason to carry out an LCA: product development. Without data, it can be difficult to know whether most of a product's impact comes from its materials, manufacturing, transport, use or disposal. An LCA can identify these areas and help a company decide where improvements are likely to have the greatest effect.

The same information can support environmental communication. Claims such as "more sustainable" are difficult to assess without evidence. LCA provides a documented basis for explaining environmental performance.

THE MAIN STAGES OF A PRODUCT'S LIFE

A product life cycle can generally be divided into five stages.

Raw material extraction covers the production of the materials used in the product. Depending on the material, this could include mining, drilling, farming or forestry.

Manufacturing covers the processes used to turn those materials into the finished product, including energy and water consumption, process emissions and waste.

Transport includes movement between the different stages of the supply chain, from transporting materials to the manufacturing site through to delivery of the finished product.

Use covers what happens during the product's service life. Depending on the product, this could include fuel or electricity consumption, maintenance, replacement parts or coatings.

End of life considers what happens when the product is no longer used, including recycling, reuse, incineration or landfill.

HOW MUCH OF THE LIFE CYCLE SHOULD YOU ASSESS?

An LCA does not always need to cover every stage. The stages included in the study are defined by its **system boundary.**

A **cradle-to-gate** assessment starts with material production and ends when the finished product leaves the factory. It can be useful for understanding manufacturing and supply-chain impacts, particularly when reliable information about the use or end-of-life stages is unavailable.

A **cradle-to-grave** assessment continues through the use phase and end of life. For products whose environmental performance is strongly influenced by how they are used or how long they last, this wider boundary can give a more representative picture.

A **cradle-to-cradle** approach considers how materials can return to another production cycle rather than simply being disposed of. It is often relevant when assessing circular products or recycling systems.

A **gate-to-gate** assessment looks at one particular process or production stage. This can be useful when several companies contribute to a supply chain and each is responsible for assessing its own part.

The choice of boundary can significantly change the result. Consider a hull coating. Looking only at its production tells you about the materials and energy needed to manufacture the coating. Looking across its full service life can also capture factors such as maintenance, releases during use and changes in vessel fuel consumption. For some marine products, these later stages can be much more important than manufacturing.

WHAT DOES AN LCA MEASURE?

Climate impact is usually the figure people recognise first, expressed as kilograms of carbon dioxide equivalent (kg CO_2e). A full LCA can assess a much wider range of environmental impacts.

Common categories include global warming potential, acidification, eutrophication, ozone depletion, photochemical ozone formation, human toxicity, ecotoxicity, water use and the depletion of mineral and fossil resources.

Looking across several categories helps identify environmental trade-offs. For example, changing to a bio-based material may reduce climate impacts while increasing land use or eutrophication. Looking only at carbon could therefore miss part of the environmental picture.

WHY DO WE USE CO_2 EQUIVALENT?

Several greenhouse gases contribute to climate change, but they do not all have the same warming effect. To make them comparable, their impacts are converted into a common unit: carbon dioxide equivalent, or CO_2e.

Using IPCC AR6 values over a 100-year period:

- 1 kg of CO_2 = 1 kg CO_2e
- 1 kg of methane = roughly 30 kg CO_2e
- 1 kg of nitrous oxide = roughly 273 kg CO_2e

The same general principle is used for other LCA impact categories, with different reference substances depending on the environmental effect being measured.

HOW IS AN LCA CARRIED OUT?

An LCA normally follows four phases.

1. Goal and scope

The first step is to define what is being assessed and what the study will be used for. This includes defining the system boundary and the functional unit.

The functional unit describes exactly what the product is expected to provide. For a deck coating, for example, it might be one square metre of coated surface providing protection for ten years.

This gives the assessment a common basis. The materials, energy, emissions and environmental impacts can then be calculated in relation to the same function.

2. Life cycle inventory

The next stage is data collection. This covers the materials, energy, water, transport, waste and emissions associated with each process included in the study.

Information collected directly from the company or its suppliers is known as primary data. Where this is unavailable, recognised databases can provide secondary data, such as average environmental impacts for electricity generation, materials or transport.

In practice, collecting and organising this information is often the most time-consuming part of an LCA.

3. Impact assessment

The inventory data is converted into environmental impact results. LCA software and recognised impact assessment methods are used to calculate indicators such as climate change, acidification and eutrophication.

4. Interpretation

The results are then examined to understand where the main impacts occur and how strongly assumptions or data limitations influence the outcome.

This stage is also where the assessment becomes useful for product development. It can show whether attention should be focused on a particular material, manufacturing process, transport route or part of the product's use phase.

The four phases are connected. During data collection, for example, a company may discover that important information is unavailable and need to reconsider part of the original scope.

WHAT INFORMATION WILL YOU NEED?

If you commission an LCA, you will usually be asked to provide information such as:

- production volumes
- a bill of materials, including quantities and supplier locations
- energy consumption
- water consumption
- waste quantities and treatment methods
- transport distances and transport modes
- process emissions, where these are measured

For many companies, much of this information already exists. The challenge is often that it is in different places: purchasing records, utility bills, production systems, logistics data and information held by suppliers.

You may therefore need input from several departments before the assessment can begin.

WHAT ARE THE LIMITATIONS OF LCA?

The quality of an LCA depends heavily on the quality of the information used. If most of the study relies on generic database averages, the result may say less about the specific product than a study based on detailed company and supplier data.

Some methodological choices also require judgement. If one manufacturing process produces several products, for example, the environmental impacts of that process have to be divided between them. There are recognised ways of doing this, but different choices can influence the result. A good LCA therefore explains the methods and assumptions used.

Care is also needed when comparing studies. Two products can only be compared properly when important elements such as the functional unit, system boundary, impact assessment method and data quality are sufficiently aligned. Two EPDs for apparently similar products are therefore not automatically comparable.

Conventional LCA also focuses on environmental impacts. Issues such as labour conditions, human rights and wider community impacts fall outside its normal scope and require other assessment methods. These limitations are part of the methodology and should be clearly reported alongside the results.

A FEW STANDARDS WORTH KNOWING

Standard	What it covers
ISO 14040 / ISO 14044	LCA principles, framework and requirements
ISO 14025	Environmental Product Declarations
ISO 14067	Product carbon footprints
ISO 14021	Self-declared environmental claims
EN 15804+A2	Environmental Product Declarations for construction products
GHG Protocol	Company-level greenhouse gas emissions, including Scopes 1, 2 and 3

One distinction is particularly useful for suppliers. The GHG Protocol is primarily concerned with the greenhouse gas emissions associated with an organisation and its value chain. LCA assesses a product or service and can cover several environmental impact categories beyond climate change. The two approaches can use some of the same underlying information, but they answer different questions.

WHERE DO YOU START?

A company that has never carried out an LCA does not necessarily need to begin with a detailed study covering every possible data point.

A screening assessment can provide an initial picture using the best information currently available, including secondary data where company-specific information is missing. The results can indicate whether the largest impacts are likely to come from materials, manufacturing energy, transport, use or another part of the life cycle.

That first assessment can then guide further data collection. Instead of trying to improve every dataset at once, the company can concentrate on the parts of the product that have the greatest influence on the result.

As the quality of the information improves, the assessment can be refined and developed towards a study suitable for external verification or an Environmental Product Declaration.

WHERE THE HUB FITS

The Hub of Verified Solutions uses LCA-based information to assess and verify the environmental performance of products and solutions used in the yachting sector.

The purpose is to establish credible evidence about how a product performs and where its environmental impacts occur. That information can support both verification and further product development.

For suppliers, an LCA can therefore be useful well before the final verification stage. It gives the company a clearer understanding of its product, highlights where improvements can be made and provides evidence that can be shared with customers when appropriate.

If you supply materials, components or systems to the marine industry and want to better understand the environmental performance of your product, the Hub can help you determine where to start.

LCA studies follow ISO 14040 and ISO 14044. Environmental Product Declarations follow ISO 14025 and applicable Product Category Rules. Global warming potential figures quoted above use IPCC AR6 values over a 100-year time horizon.



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