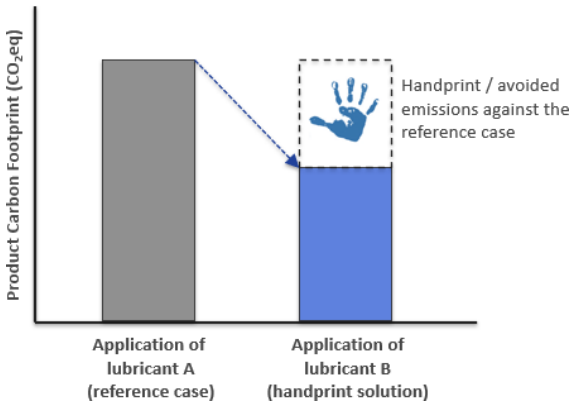
Understanding the product carbon handprint of lubricants

The UEIL Sustainability Committee was established with the intention of providing guidance to define, develop and measure sustainability in the European lubricants industry. The objective is to lead the whole lubricants value chain to become more sustainable. To reach those objectives, it is critical to understand the main elements of sustainability. In a previous white paper[1] the product carbon footprint was addressed; this white paper focusses on the **product carbon handprint**.

Footprint versus Handprint

To understand the handprint, it is best to start with understanding the footprint first. The product carbon footprint is the total mass of all GHG (greenhouse gas) emissions and removals over the whole life cycle of the product. This means from the extraction of raw materials through end-of-life. For lubricants, the product carbon footprint in simple terms means: the sum of all emissions and removals (expressed in CO2 equivalents (CO_2e or CO_2eq)), which were induced by all activities related to the production, use and disposal of the lubricant. That means assessing all used energy as well as resources and emissions to air, water and land and translating those into emission values.

While the product carbon footprint describes the sum of all GHG emissions and removals across the life of that product, the use of the product may bring about changes that are not accounted for in the product carbon footprint. These may only be determined by considering the before and after, for example the replacing of a product A with a product B. The sum of the of the changes in GHG emissions and removals occurring because of this change is what is considered the handprint. In general, the focus is on the positive change that the handprint brings about, but it can also be negative. Other terms used for carbon handprint include avoided emissions, scope 4 and climate positive. This comparative aspect of the product handprint is illustrated in the figure below.



Environmental benefits

Lubricants are products which are designed to reduce friction, heat, and wear and tear between mechanical components that come into contact with each other. There are various reasons why lubricants contribute to the carbon handprint.

[1] Understanding the product carbon footprint of lubricants, UEIL, April 2022

The three main reasons are:

- lower energy consumption
- increased product and application lifetime
- increased application performance

These can be translated into positive environmental benefits that end-users and consumers expectto see from lubricants. Examples of such benefits are:

- Improved fuel economy due to the use of low friction/viscosity lubricants
- increased equipment lifetime due to clean technology lubricants
- reduced lubricant consumption and/or longer drain intervals

The value of the handprint can often be expressed in avoided emissions and reported as CO_2e or CO_2eq.

Determining the reference case

The handprint is always determined by comparing against a reference case. Measuring a product's positive impact is challenging as it is mainly achieved in the lubricant's use-phase, through the application of the lubricant. However, due to the wide variety of lubricant applications, that use- phase assessment (versus a reference case) will differ from lubricant to lubricant and may even differ for the same lubricant depending on its application.

A critical part of the handprint assessment is to determine the service being provided by the lubricants, ensuring equivalency between the product and the reference case. In carbon footprinting (and handprinting) this equivalency is termed the declared, or functional, unit. This is why product and application specialists' knowledge is needed as part of the assessment.

Within the UEIL sustainability workgroups these use-phase evaluation of different applications isbeing discussed in order to support the creation of a uniform approach and methodology.

Example case

To clarify the potential handprint benefits of lubricants, a typical example of hydraulic equipmentwith a 10 kg lubricant oil capacity is considered.

When comparing oil A (*reference case*) with oil B (*handprint solution*), the declared unit could be

Lubrication required for operating the hydraulic equipment for a period of 10,000 hours.

Typical values[2] could be:

	Product Carbon Footprint (Cradle-to-gate) [kg CO2e/kg oil]	**Oil consumption** [kg/hr]	**Oil drain interval** [hr]
Oil A reference case	2 kg CO_2/kg lubricant	1 kg / 1.000 hr	5.000 hr
Oil B Handprint solution	3 kg CO_2/kg lubricant	0.5 kg / 1.000 hr	10.000 hr

Calculating the oil consumption and CO_2 footprint over a use-phase period of 10.000 hr gives thefollowing values:

[2] Average typical values to clarify the concept of handprint

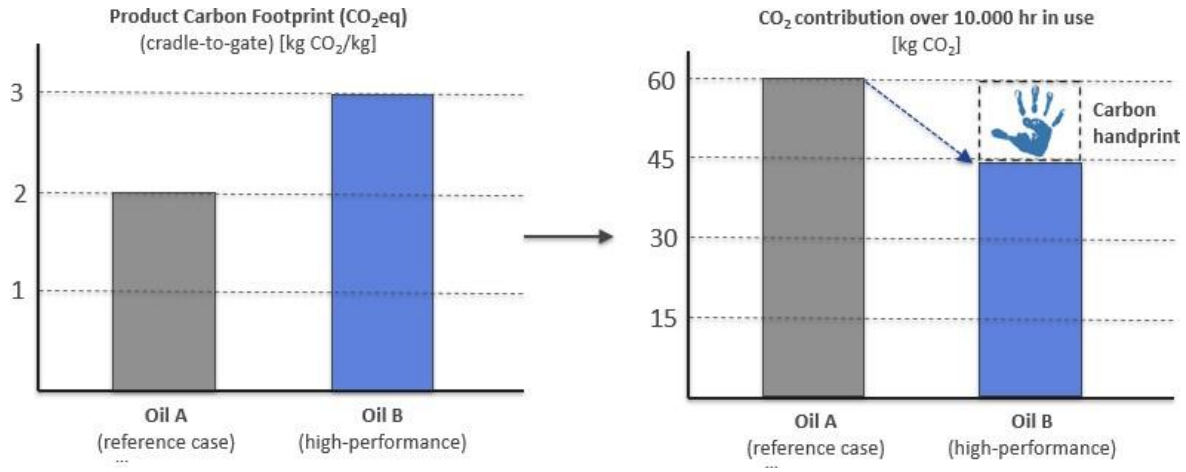
- Oil A = 2x10 kg (fill) + 10x1 kg (consumption) = 30 kg oil (= 30x2 = 60 kg CO_2e)
- Oil B = 1x10 kg (fill) + 10x0.5 kg (consumption) = 15 kg oil (= 15x3 = 45 kg CO_2e)

Note that this calculation accounts only for the cradle-to-gate emissions in the use-phase. The oilconsumed and the oil drained will have GHG emissions as well.

In this case, the handprint can be calculated as

Handprint (oil B) = 60 kg CO2e – 45 kg CO2e = 15 kg CO2e

In this example the oil B saves 25% CO_2 over the use-phase, while the product has a 50% higher CO_2footprint (cradle-to-gate). The picture below clarifies this principle.



The lubricants industry can make a difference

It is clear the carbon footprint alone does not tell the whole story of a products impact on the environment. This is especially the case for lubricants, as these are designed to reduce friction and energy consumption. Giving customers the choice to reduce emissions with lubricants can drive positive change. Note that handprint savings, resulting from the use of lubricants, can be much higher than the product carbon footprint itself. This can result in a net benefit to the environment.

Summary

Lubricants keep the world moving. They reduce friction and can reduce energy consumption. The product carbon handprint describes the positive environmental impact of the product in use against a reference case. Improved focus on the carbon handprint can identify opportunities to reduce the impact on the environment and drive change. The carbon handprint is therefore an essential part tohelp decarbonize society.

For a detailed and holistic analysis of the lubricant's handprint, a comparative Life Cycle Assessment according to ISO 14040 is recommended as it also allows insight into other environmental categoriesbeyond carbon footprint/climate change.

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