Oemeta
The Coolant People

Case study

Life cycle assessment of MWF systems.

The following study shows that the use of HYCUT in metal-working leads to a significantly lower level of environmental impact than a conventional, mineral oil-based coolant system used for the same purpose. Internal recycling becomes possible and leads to a significantly more sustainable use of cooling lubricants in the machining process chain.

Life cycle assessment of metal removal fluid systems in metalworking applications.

The use of cooling lubricant (MWF) is widespread in industrial metalworking, as its cooling, lubricating and flushing effects enable a high-performance and economical machining process. As a rule, conventional water-miscible or non-water-miscible cooling lubricants based on mineral oil are used for this purpose. However, the extraction, production, use and disposal of mineral oil involves a wide range of negative ecological impacts.

In addition, the selection of the respective cooling lubricants also determines how sustainable a process chain in machining works.

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Assessment of environmental impacts based on the example of crankshaft production.

A large proportion of the cooling lubricant used is removed during the process due to adhesion to the workpiece. Depending on which type of cooling lubricant is used in the subsequent process stage, a time-consuming intermediate wash has to be carried out. In order to eliminate the need for this inconvenience, Oemeta has developed the multi-purpose oil HYCUT, which can either be used as a non-water-miscible machining oil or as a water-miscible emulsion. Contrary to conventional cooling lubricants, it has been developed based on renewable raw materials, so it offers environmental benefits.

In collaboration with the Institute for Machine Tools and Production Technology at TU Braunschweig in Germany, the potential environmental impacts of Oemeta HYCUT product series was tested based on a life cycle assessment and compared to those of a conventional mineral oil-based reference lubricant system.

Application of the life cycle assessment method at an Austrian engine plant.

In order to arrive at a holistic assessment of a product's environmental impact, the entire life cycle is taken into consideration – from the extraction of raw material and production through to usage and final disposal. Both the resources consumed and the emissions produced throughout the life cycle are taken into account for all processes and converted into environmental impacts.

This LCA was carried out as a case study at a German car manufacturer's engine plant in Austria. The process chain for crankshaft production was under scrutiny here: this involves the most diverse machining processes, including milling, turning, deep drilling and grinding. The process chain also involves frequent changes between water-miscible and non-water-miscible MWFs (see Figure 1).

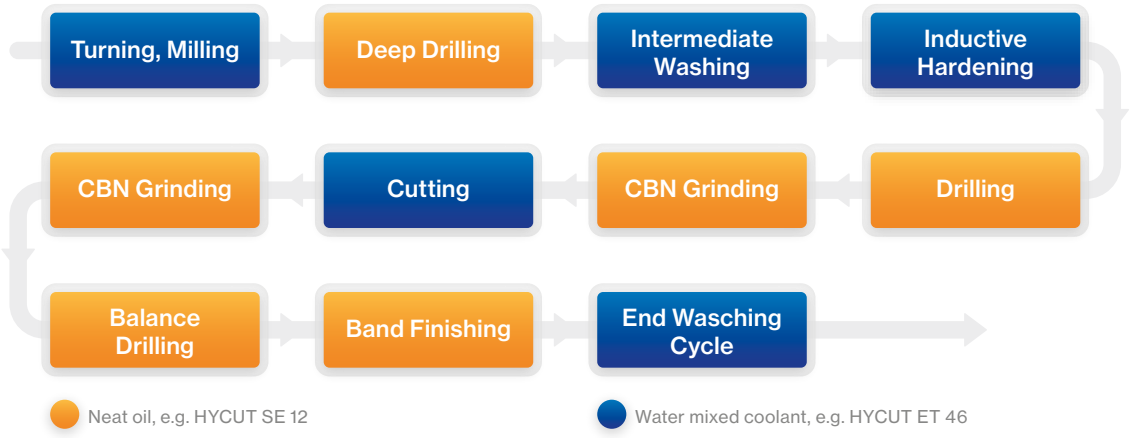

Figure 1: Process chain layout

Oemeta HYCUT offers a sound ecological balance.

In practice, the process chain already uses the ester-based multi-purpose oil HYCUT, which is formulated in such a way that water-miscible and non-water-miscible components are compatible.

A mutual entrainment of cooling lubricant adhesions on components is therefore not a problem as with conventional cooling lubricants.

Compared to mineral oil-based reference products, the use of this cooling lubricant along the entire production line is much more efficient because intermediate washing and waste of the MRF can largely be avoided.

In particular, re-use of the washing agent from the workpiece cleaning operation as cooling lubricant for the machining processes has a positive effect on the life cycle assessment. In order to take full advantage of the multi-purpose oil, planners tailored the production chain design to the specific lubricant. Normally, several systems are required to clean the workpieces, for example, but this was not necessary here. The use of the HYCUT system in all environmental impact categories under review results in significantly lower environmental impacts (40-60 %) over the entire life cycle than in the case of the reference system (see Figure 2).

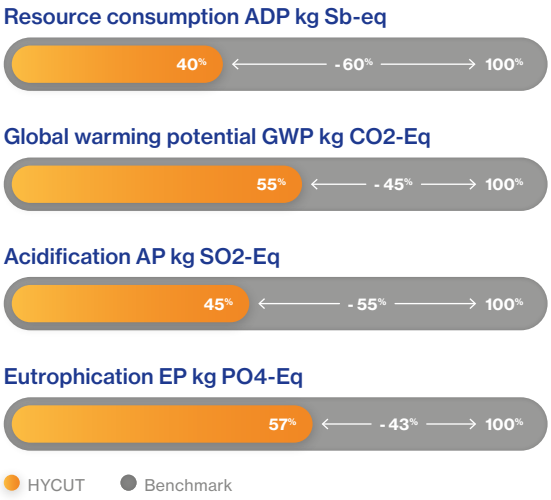

Figure 2: Overview of factors in terms of relative environmental impact potential

Comparisons regarding global warming potential (GWP) savings.

Regarding Global Warming Potential (GWP), the case in question generated savings of approximately 470 t CO_2-eq in annual production – equivalent to the environmental impact caused by driving 158 passenger cars for one year[1] (see Figure 3). The absolute figures are case-specific and depend on the comparative basis as well as the system and the processes under consideration, while the relative figures indicate the general comparative tendency.

The life cycle assessment thus showed that the use of HYCUT in metalworking leads to a significantly lower level of environmental impact than a conventional, mineral oil-based coolant system used for the same purpose.

Key Figure	Unit	Savings
Relative savings	%	45%
Absolute savings	t CO_2-eq	474
Comparison Cars	Number cars	158 [1]
Comparison People	Number people	43 [2]
Comparison Flight	Number circumnavigation	51 [3]

Figure 3: Comparisons of GWP savings

1 Driving distance of 20,000 km / year and 0.15 kg CO_2-eq / passenger-kilometre (2015)
2 Consumption of 11 CO_2-eq / year (average of a German, 2015)
3 Flight distance of 40,000 km around the world and 0.23 kg CO_2-eq / passenger-kilometre (2015)