Sustainability and lubricants:

the next steps into a sustainable future

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No doubt, without today's high performance lubricants there would be much more wear, friction and corrosion leading to a tremendous waste of resources. The impact of the lubricant industry on helping to preserve the planet cannot be underestimated. Nevertheless, the lubricant industry continues to improve their products and production in order to minimise the resources needed to manufacture high quality products.

Alongside the ecological aspects, the optimisation of lubricant production to save costs and resources, we are confronted with requirements from external sources. First, end users ask for the "carbon footprint" of our products. They would like to know the ecological burden of the products that go into their products (e.g. cars and machinery) since their customers have the right to know the energy and other resources needed to manufacture their product. For example, in light of future e-mobility, the carbon footprint of electric vehicles are often compared with the footprint of combustion engine driven cars; a comparison in which the former does not always win.

Second, politics requires we minimise the energy needed in order to achieve the carbon dioxide emission goals. One piece of legislation in this context is the "Energy Efficiency Directive (EED)". Aside of other requirements, the EED requires energy audits and energy management systems in place for the industry. Small and medium sized enterprises (SME) are excluded for the moment, but member states are encouraged to raise awareness for SMEs. Thus, in the long run, we may expect that the vast majority of lube blenders, as well as SMEs, are included into the EED.

The German lubricant manufacturers association (Verband Schmierstoff-Industrie e.V., VSI) set up an expert group (Nachhaltigkeit Schmierstoffindustrie, "NaSch") to estimate the resources needed for producing lubricants. In a first step, member companies received a questionnaire about the energy and resources (gas, electric power, water etc.) they need to produce a certain amount of lubricant.

We distinguished between greases, general lubricants (e.g. engine oils) and cutting fluids/corrosion protection fluids, since the production of these three different types of lubricants varies strongly. The different resources can be transferred by standard equations into a "CO_2" or "carbon" footprint.

To obtain the data was not as straight forward as expected. Of course, newly erected blending facilities have all the instruments needed to measure e.g. the electric power in real time for each blending vessel. Older lube blending sites may have just a few electric metres for the whole factory, including offices.

In-depth investigation of the energy consumption and data comparison in light of the fact that lube blending is a highly standardised procedure, led to industry-wide average data for lube blending. Unsurprisingly, the production of greases requires the highest amount of energy, whereas the carbon-footprint of blending is (nearly) negligible compared to the resources needed to produce the base oils and additives.

In a second step, the workgroup invited suppliers of new and re-refined base oil suppliers and additive manufacturers to help with their data to get the whole picture. For additives, this was much more complex than expected, as an expert of an additive supplier explained. For example could chemical waste, heat generated by one additive production unit, or other "waste products" become raw material for another unit within the same factory. It turned out that, in case of the common anti-wear additive ZnDDP, the key resource is phosphorus and for a sulphur carrier the ester, representing >80% of the overall resources needed to produce theses additives. Savings by using "green" electric power (=100% renewable) is in the magnitude of 7-8% of the overall resources needed.

Thus, the scope for lube blenders and additive manufacturers for a significant improvement is rather limited. After all, the savings by using re-refined base oil is in the magnitude of factor eight, compared to conventional base oil (which is obviously needed to manufacture re-refined base oil). However, the workgroup concluded that lubricant formulations with 30% re-refined base oil and 70% virgin base oil would be a good assumption for a more general carbon footprint of lubricants.

The next step will be the creation of model formulations (engine oil, hydraulic and gear oil, cutting fluid) and to calculate the footprint of these formulations by using the additive carbon footprint and the carbon footprint of various base oils (mineral and synthetic).

We believe that based on the data of additives and base oils, the footprint of individual formulations of, for example,different hydraulic oils, varies only in small amounts and strongly depends on the base oil type used. In a later step, the data will be fed into a standard software (called "EcoChain"), that enables the manufacturers to calculate the carbon footprint of a certain lubricant formulation.

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