

# Operating truck fleets with lowest possible emissions

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Alternative powertrain systems reduce greenhouse gas emissions in freight transports: Migros operates hydrogen and biogas trucks. Credit: Migros

Converting truck fleets to renewable energy is a goal of many fleet operators worldwide. This has also been recognized by HERE, a global navigation software company; the company is a joint subsidiary of German automakers Audi, BMW and Daimler. Intel, Bosch, Continental and the Chinese Tencent Group are also shareholders. HERE supplies cartographic material to logistics groups worldwide, including for route planning for the approximately 800 trucks of the Migros cooperative.

The software tool now acquired by HERE is based on a collaboration between Migros and Empa. As part of its decarbonization strategy, Migros sought scientific support to convert its truck fleet to [renewable energy](#). Migros and Empa then jointly developed software to support the transformation of Migros' truck fleet to low-CO<sub>2</sub> powertrains. With the help of the software, the use of trucks with alternative and renewable fuels such as hydrogen, electric, biogas and biodiesel can be analyzed in terms of performance, range, payload and costs for individual routes, while at the same time calculating the CO<sub>2</sub> savings to be expected in real terms compared to diesel trucks. Thanks to a link to life cycle assessment databases, synthetic fuels can also be integrated.

## **Test phase until March 31, 2022**

The ISO- and DIN-certified software has already been in use at Migros for several months running under the name "M Opex Tower." As the HERE Group announced at the CES in Las Vegas at the beginning of January, it will be included in HERE's software program from now on under the name "CO<sub>2</sub> Insights." In this way, Migros and Empa know-how will become available to logistics service providers from all over the world. Until March 31, 2022, the software can be used and evaluated free of charge by all HERE customers.

But the story actually began ten years ago. At a scientific conference of the Society of Automotive Engineers (SAE), Christian Bach, head of the

Vehicle Propulsion Systems department, presented an Empa study on the efficiency of vehicles. He showed that the energy consumption of vehicles for any given journey can be calculated using a simple mathematical function. The underlying mathematical approach is known as the Willans approximation and is still used worldwide in many studies in the field of energy converters. It is named after its inventor Peter Willans from England, who presented his observations on steam engines in this form in the late 19th century. Researchers at Empa had used the approach to evaluate vehicle consumption data, demonstrating that it could be applied not only to [internal combustion engines](#) or [electric motors](#), but also to complete vehicles.

## **From the steam engine to the electric car**

Since then, Empa has used this approach more and more frequently, for example in the EU's "eLCAR" project to study the life cycle assessments of electric vehicles, in a [doctoral thesis](#) at ETH Zurich for analyses of Switzerland's entire vehicle fleet, and in a book project with the German Coburg University of Applied Sciences and the car manufacturer Audi in the area of evaluating the real climate impact and total costs of vehicles with different drive systems. As part of the strategic collaboration between Migros and Empa in the area of decarbonization, the idea then arose to use this approach for a software-based fleet transformation of Migros trucks to low-CO<sub>2</sub> powertrains.

"Transforming entire fleets is much more complex than testing individual trucks with alternative powertrains or fuels," says Bach. The heterogeneity of transportation tasks is high and cannot be mapped with sufficient accuracy using median value models, he says, so each individual trip must be considered individually.

## **Certified environmental impact**

Bach expressly praises the good cooperation with the project partner: "Migros invited the Empa team to internal meetings with the fleet managers, which was enormously important for finding a solution and ultimately led to the joint development of the [software tool](#)." For several months, the [software](#) was tested on the Migros truck fleet and validation measurements were carried out on diesel, biogas, electric and hydrogen trucks. Finally, the tool was certified according to the DIN EN 16258 and ISO 14040 standards, as well as by the CO<sub>2</sub> offsetting consultant myclimate.

Migros' CO<sub>2</sub> reduction targets are very ambitious. Currently, Migros operates eleven hydrogen trucks, 78 biodiesel and biogas trucks and 13 electric trucks. Soon, there are to be even more.

**More information:** Christian Bach et al, CO<sub>2</sub> Reduction and Cost Efficiency Potential of Natural Gas Hybrid Passenger Cars, *SAE International Journal of Engines* (2011). [DOI: 10.4271/2011-24-0110](https://doi.org/10.4271/2011-24-0110)

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