

Optimal LCA : State of Health on end-of-life automotive systems and their reuse

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Most regions in the world have a roadmap to reduce the CO₂ footprint of transportation. The most cost effective way to reach this goal is to apply a multi-technology approach. Light passenger cars can be driven by a battery electric powertrain. However, some vehicle segments, such as commercial vehicles, are very hard to electrify. They have mainly kept their diesel powertrains, and are expected to keep them also in the years to come.

A full LCA assessment covers the excavation and harvesting of raw materials through the production of systems, their use in the field, disassembly and end of life treatment. Every part of this cycle contributes to the CO₂ footprint of the vehicle, and is therefore to be studied.

CO₂ neutral Well to Wheel mobility can be reached with various energy carriers. Each of those require specific powertrains and specific energy storage and distribution systems.

Liquid fuels (eFuels, biofuels, ...) can be stored in conventional fuel tanks. Such fuel tanks represent a best in class LCA of 3.0 gCO₂/km (240 000km, 15 years). This can be further reduced to 2.95 gCO₂eq/km by an efficient recycling and reuse of the tank materials.

Diesel combustion engines need SCR to reduce NOx. AdBlue® is stored in an SCR tank equipped with an AdBlue® delivery module (ADM). It represents an LCA of 1.08 gCO₂/km (240 000km, 15 years). By using 25% recycled material for a new tank and by completely reusing the ADM, this LCA can be reduced by 5% to 1.03 gCO₂/km.

The reuse of the ADM can only succeed if the condition of the ADM is still good enough for an entire new vehicle life cycle, covering the newest requirements of pressure and flow, and after a successful State-of-Health verification.

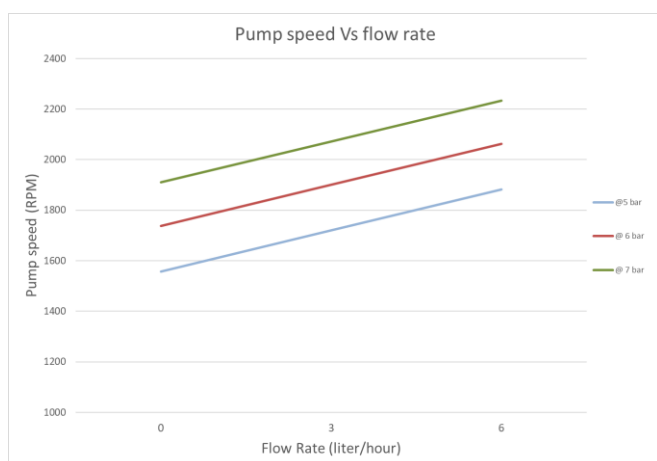


Fig.2 Gen-II ADM pump after 12 years and 257,000 km : characterization at 5 to 7 bar and 0 to 6 liter/hour



Fig.1 Gen-II ADM pump after 12 years and 257,000 km, ready for a next vehicle life

Gen-II ADMs have undergone only minor changes, and are able to meet the latest pressure up to 7 bar and flow rates up to 6 l/h.

Old ADMs from the field demonstrate a similar to new performance, and extended durability testing beyond 30,000 hours has been successfully passed.

Only by applying a misuse test, the ADM can be brought to overspeeding and loss of pressure.

Digital twins are a great asset to know and track the State of Health of the energy storage system and decide on the next step in its usage.