Mobility Blog

Is mild the new ICE: a deep dive to mild hybrid vehicles

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Mild hybrids (MHEVs) are probably the least known powertrain technology on the market, and yet they represented around 15% of European passenger car sales in 2022, slightly more than Battery Electric Vehicles! The growth trend is also comparable to BEVs, since they both accounted for 2% of the market in 2019. Market forecasts(1) see them representing more than 10% of the market until 2029, and then decrease until the 2035 ICE ban. Remarkably, this technology seems to raise only a little interest on the end user side, whereas it is in fact a remarkable innovation the more upstream you start focusing on the automotive value chain. Let's try to understand why with Stéphane Renie, Chief Sustainability Officer at ALD Automotive | LeasePlan!

How do mild hybrids work?

In the first wave of Mild Hybrid cars (MHEVs) already on the market, MHEVs are powered by their "traditional" combustion engine, a 48V electric motor generator, a 48V battery and a 48 to 12V converter (to supply the 12V network), or alternatively a less powerful 12V setup.

Like Full Hybrids (HEVs), Mild Hybrids cannot be recharged with a plug. However, unlike a Full Hybrid (HEV) system, the electric motor of a mild-hybrid system never propels the car on its own, as it is rather acting as a power booster.

Power is regenerated in the same way as for a HEV, recovering excess mechanical energy. The electric motor converts kinetic energy during braking into electricity and stores this energy in a battery. Then the energy can be reused in various ways

1. During the acceleration phase: the electric motor provides torque which helps to reduce the torque required from the combustion engine.
2. To supply electricity to the electrical devices and accessories of the vehicle, an advantage of growing importance given the increasing connectivity in cars.

Mild hybrid technology can be combined with both gasoline and diesel engines. It is a not a new solution on the market, there are chances that you could remember the Scenic HybridAssist system a while back, but many car manufacturers have introduced 48V mild hybrid technology into existing ICE vehicle portfolios. Top 10 MHEV bestsellers in 2022 were Ford Puma, Nissan Qashqai, Fiat Panda, Fiat 500, Audi A4, Mercedes C-Class, Audi Q5, BMW X3, Renault Captur and Audi A6.

What are the customer benefits of mild hybrids?

Similar to a full hybrid system, the main purpose of the mild hybrid system is to **save on fuel consumption**.

What all MHEV architectures have in common is that the ICE architecture remains mostly unchanged. Together with the fact that MHEVs do not technically require an automatic gearbox, the **cost of the additional electric setup** is therefore moderate. Altogether, typical MHEVs currently cost about €700 to €1,100 per vehicle on top of the ICE base.

Although the additional costs for MHEV technology result in a higher purchase price, the **running costs are lower thanks to less fuel consumption**: fuel saving is achieved by decreasing torque provided by the combustion engine, especially at low speeds during initial acceleration – when the combustion engine must work the hardest and therefore consumes the most fuel. It also allows the engine to switch off when the car is moving – when "coasting" for example, and uses the energy recovered during braking to supply power to all the accessories: a mild hybrid system can improve fuel economy by an average of 5%, with some car manufacturers claiming up to 10%.

The CO2 emissions are reduced correlatively, which triggers a benefit for the carbon footprint and also further reduces running costs especially in countries where taxation is CO2-sensitive.

Because mild hybrids don't require charging, and the driving is similar to an ICE, there is no change management needed on the driver or fleet manager side. Another benefit compared to HEV is the system weight and the tank size, since the smaller battery of a MHEV allows keeping the regular tank size of an ICE. This translates to no sacrifice or compromises required on the boot size or the vehicle range.

The car manufacturer's view: cost / benefit ratio of MHEVs vs other technologies

For car manufacturers, the main advantage of MHEVs is to improve CO2 emissions at a moderate cost, with a double positive impact on compliance with European CO2 targets and CO2-sentive national taxation schemes, where just a few grams can make a difference. Moreover, 48V system has been recognized as an eco-innovation in Europe giving a CO2 saving bonus to the OEM per car equipped. Relative to the investment, MHEVs provide a reasonable payback in terms of CO2.

Euro7, a decisive trigger for car manufacturers

Climate change is a pressing concern for everyone, and car manufacturers are stepping up to the plate by focusing on reducing CO2 emissions. However, there's another important issue that also needs attention: the impact of pollutants like NOx and Particulate Matter on public health. This is where the Euro 7 standard comes in, which we explored in a previous article. While the details are still being finalized, one thing is clear: to comply with Euro 7, cars will need to drastically reduce their emissions during the first 20 seconds of operation as 80% of pollutants are emitted in those first seconds. This is where an electrically heated catalytic converter (known as an EHC) comes into play. But using an EHC requires specific isolation and connectors, and eventually, a 48V technology. Luckily, mild hybrids are up to the task, offering the right mix of power and efficiency to meet these stringent standards.

Since diesel vehicles are becoming too expensive to develop and suffer from reputational issues, petrol-powered 48V MHEVs provide similar fuel efficiency at manageable additional cost (the cost for 48V MHEV technology is typically lower than the price difference between a gasoline and a diesel engine).

Are mild hybrids green? Are they useful in the fight against CO2 emissions?

Presenting MHEVs as a low emission solution is clearly an **overstatement**. MHEVs alone don’t have and will never have the CO2 saving potential to reduce emissions in line with what is needed to keep global warming within acceptable boundaries. There is also a degree of confusion created by some market players presenting them as “hybrid”, which is **misleading**, and “electrified”, which is technically correct but places them in the same basket as BEVs, when BEVs have a much stronger impact in terms of CO2 reduction!

However, it’s important to keep in mind that the general CO2 reduction cannot only rely on BEVs in the short term. The non-EV part of the market will represent more than half of the new vehicle sales during the next renewal cycle of 3-5 years, meaning half of the market will still use the combustion engine to propel the vehicle. Reducing CO2 will therefore also rely on **increased efficiency of ICE-based engines**. MHEV presents an **affordable technology** that plays its part in a portfolio approach. In the transition period during which combustion engine-based powertrains are still holding a significant market share, MHEVs will become the new standard for ICE, as they seem to be the only way for ICE powertrains to try to last until the 2035 ICE ban. They will naturally replace the ICE versions in our clients’ car policies, without anyone really noticing, with a minor contribution to CO2 avoidance, but every little step counts on the pathway to a sustainable tomorrow.

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(1) Source: EV Volumes