Hydrid versus hybrid

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The French are considering introduction of an emission tax, the European Commission has recently issued a carbon dioxide emission regulation for passenger vehicles. Will Europe soon be driving small, light-weight cars only? No need to, says Dutch company Innas.

Innas developed a full hydrostatic transmission to replace the conventional mechanical transmission of cars. The Dutch engineering company call their series hydraulic hybrid drive train 'the Hydrid'. It could turn out to be the long-awaited breakthrough in the world of hybrid vehicles.

Rob van Malsen, responsible for marketing and technology licensing with Innas, explains how the Hydrid is an improvement to hybrid electric cars.

F055 Image 1

Floating cups

But first let us reveal the main secret of the Hydrid's fuel efficiency. Standard combustion engine cars actually operate very inefficiently. Their engines were built to be able to go uphill at great speed, but maximum engine performance is seldom needed. Driving in the city or motorway cruising often requires less than twenty per cent of the maximum torque. When the engine is running at such low loads, fuel efficiency is poor.

In the Hydrid the series hydraulic hybrid drive train forces the engine torque to always vary between fifty and a hundred per cent of its maximum. This is how it works: four motors, placed in the wheels, act as pumps during braking, thereby recuperating energy. The energy is redistributed through a so-called 'common pressure rail system', ensuring constant high pressure in the accumulators. Hydraulic transformers control the in-wheel engine torque, which is directly related to the pressure in the accumulators.

Hybrid versus Hydrid

The Hydrid is set to become a serious alternative for mechanical transmission. Similar to electric vehicles the Hydrid offers power management, energy storage and flexibility, but the Hydrid has more than double the regenerative efficiency of an electric series hybrid. And whereas the extra parts on hybrid electric cars are usually heavy, a hydrid car weighs the same as a conventional combustion engine car. The mechanical transmission of the latter, is 'simply' replaced by a hydrostatic transmission. Also, the hydrid car has no size restrictions and it has the same trailer load capacity, acceleration performance and maximum speed as a standard car.

F055 Image 2

"Electric hybrids are hot," says Rob, "but a technical breakthrough is necessary to take the technical and economical hurdles. The Hydrid can facilitate this breakthrough. Our hydraulic drive system can easily cope with the heavy power fluctuations that go with acceleration and braking of a vehicle. Instead of by a combustion engine the hydraulic system can also be powered by an electric motor. This E-motor and battery can then be designed for the average load, instead of peak load, allowing for less expensive battery packs and motors. This way the dependence on battery technology is minimised and high cost penalties are avoided."

High battery costs stem from the use of scarse materials. Rob: "The price of materials like nickel and copper fluctuates heavily with changing demand and there is a debate going on whether lithium shortage will become a problem or not." (Read our Burning Issue for more on this subject.)

Switched off

How does the Hydrid perform? Cycle analysis according to the standard New European Driving Cycle (NEDC) showed that, combined with start-stop operation, fuel efficiency is much better: the engine needs to be in operation only eleven per cent of the cycle and can be switched off during the other 89 per cent. No idle losses here! Frequent on-off operation is made possible by the hydraulic accumulators. The complete system not only requires extremely efficient hydrostatic pumps, but equally efficient motors and transformers. Innas developed such parts, based on the 'floating cup' principle.

All in all, as Innas states on their website: "Simulation by the German Institute for Fluid Power Drives and Controls (IFAS) at RWTH Aachen University proved that an average fuel consumption of 3.1 liter per 100 km (or 77 MPG) is possible for a mid-sized (1450 kg) passenger car."

Rob: "With our rudimentary prototype forklift truck of a few years ago we already managed thirty per cent fuel economy."

An SUV, which will probably become the first prototype, easily weighing 2.2 tonnes, certainly has something in common with a forklift truck.