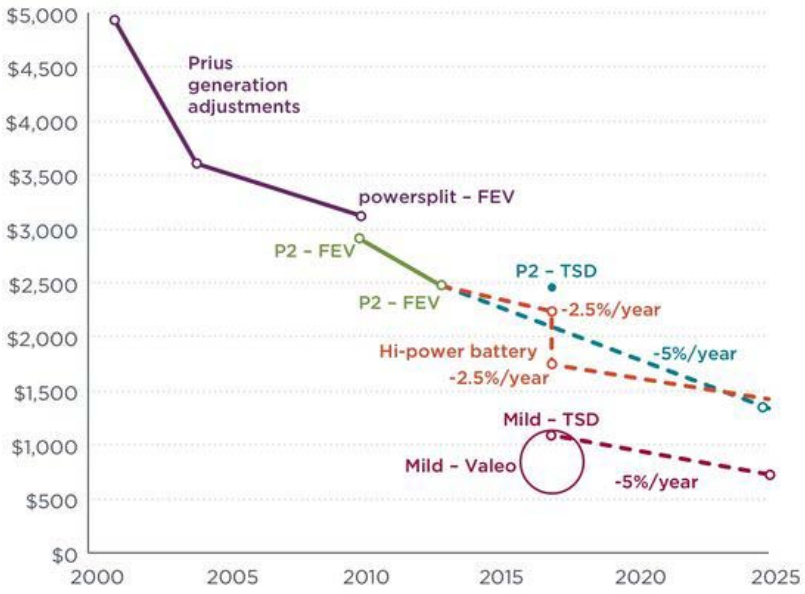
Advanced HYbrid Powertrain – AHYP with torque vectoring

Author: Liviu Giurca

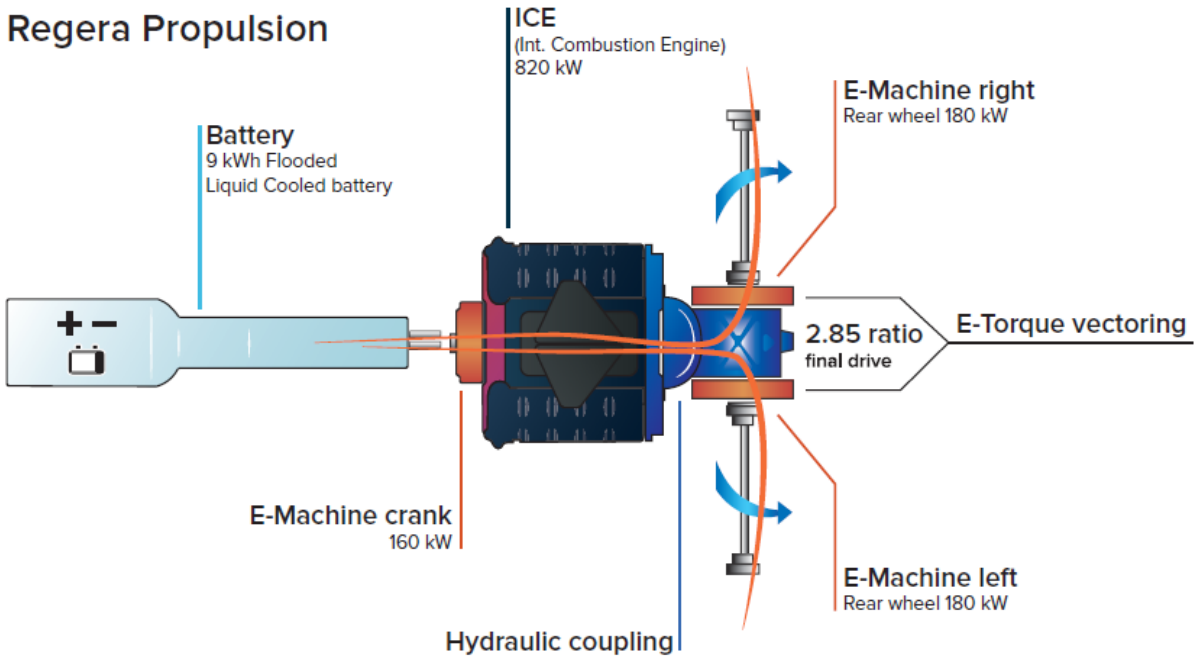
Hybrids are far from a mature technology, and innovations and improvements are coming rapidly. Improved batteries designed with high power density for hybrid applications will start arriving soon. Hybrid systems other than the input power-split design pioneered by Toyota 17 years ago are still in early stages of development, and present huge opportunities to reduce cost through better designs, learning, and economies of scale.

Because most hybrid systems are at a relatively early stage of development, costs are still relatively high and manufacturers are looking to recover some of the costs by charging customers a premium for hybrid vehicles. Thus, currently the hybrid system needs to offer a major improvement in fuel economy to entice customers to pay the price premium. This favors full-function hybrids and works against mild hybrid systems. However, in the future, lower cost, mild hybrid systems will be able to compete directly against conventional technology improvements on a cost-benefit basis. Thus, hybrid market penetration will likely increase only modestly in the near term, but as costs drop hybrids will become just another technology that manufacturers sell on its positive efficiency and drivability impacts, not on the technology itself, similar to what is currently occurring with turbocharged gasoline engines. Consequently the costs of full-function hybrid systems are likely to drop to half the cost of their 2010 counterparts before 2025.



State of the art

Paradoxically, the most advanced hybrid system in term of cost reduction and efficiency was proposed by Koenigsegg on its hyper car Regera.



The patent pending series-parallel system replaces the combustion engines traditional transmission and gives the added benefit of pure EV mode. What is unique is that the Koenigsegg system manages to create direct drive to motor axle from the combustion engine without the need of multitude gears or other traditional types of variable transmissions, with inherently high energy losses.

During highway travel, for example, the Koenigsegg system reduces drivetrain losses, compared to traditional transmission or automatic transmission by over 50%, as there is no step up or step down gear working in series with the final drive - just direct power transmission from the engine to the wheels. To supplement the energy from the combustion engine and to allow for torque vectoring, regenerative braking, extreme drivers response, reverse and energy conversion, there are three electric machines (motor-generators). The combination of electrical and combustion power improves exceptionally the vehicle behavior: about 3.2 seconds between 150 to 250 km/h and under 20 seconds from 0 to 400 hm/h.

New AHYP for segment B and C segment vehicles

The proposed solution will be developed in two variants:

- For low cost 4x2 hybrid vehicles;
- For low cost 4x4 hybrid vehicles.

The new plug-in series-parallel hybrid powertrain eliminates the gear box or any power-split dedicated device without affect the performance of the vehicle. All these will be replaced by a so called "X-device". This allows reducing cost which is one of the biggest issues for the hybrids commercialization. The new drive system is less complex and requires a low maintenance level. The energy utilization of the vehicle and the thermal efficiency of the engine is high, the mechanism of the vehicle is simplified, for example a pedal clutch, a transmission and a transfer case are canceled, and therefore the failure rate and manufacturing cost of the vehicle and the complexity of a control system are reduced, the safety factor is improved, and the product has high performance cost ratio.

The electric motor and a variable speed X-device are arranged, in conjunction with control circuitry, to effect the starting and running of the vehicle at both its slower and higher speeds or when the battery is more than 1/2 charged, whereas the internal combustion engine is adapted to take over and operate the vehicle at predetermined higher speeds in those circumstances where the battery is less than 1/2 charged. Charging of the batteries is normally effected by the use of commercial electricity, but may also be effected by the generator powered from the internal combustion engine, while in motion or stationary. The engine is preferably coupled for driving the vehicle through the X-device at relatively higher speed. The ratio of the variable X-device coupled to the electric motor can be varied at wheels by a foot throttle, or else automatically changed in response to changes in the speed of the vehicle for the low range, and provision is made whereby the starting and running currents fed to the motor are kept within safe, readily-controlled limits.

Using AHYP the torque vectoring is obtained for 4x4 vehicles as a resultant of system configuration. This improves dramatically the vehicles dynamics and the active safety which is not available in the current B or C segment.

AHYP is a patent pending technology. For the interested entities an extended description of the system will be delivered.

Contact: Liviu Grigorian Giurca

E-mail: lgiurca@hybrid-engine-hope.com

Tel. 0040731015778

URL: www.hybrid-engine-hope.com