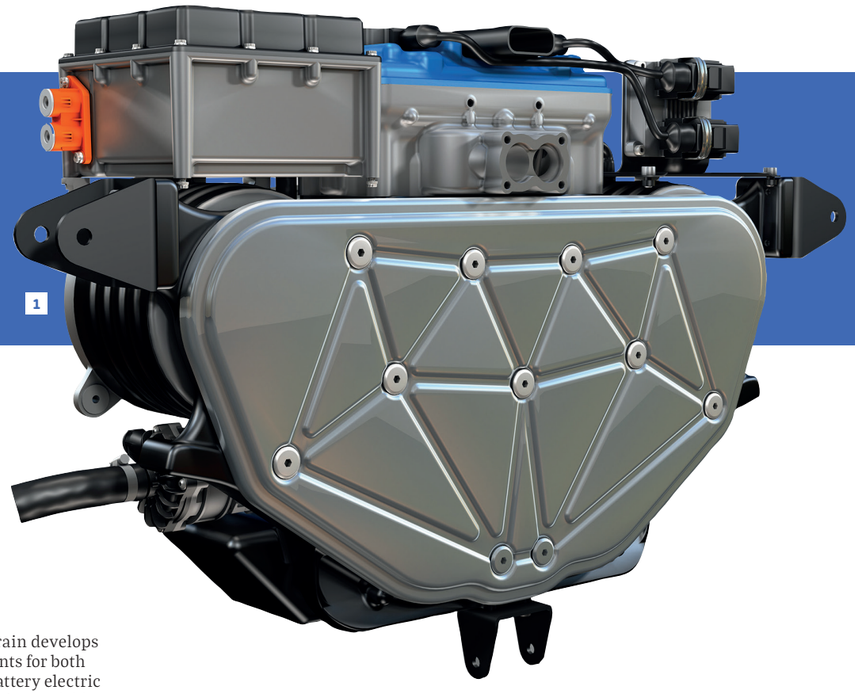

1. It's possible to run the compact Obrist Powertrain zero-vibration generator on e-fuels, CNG, LNG, ethanol or conventional gasoline

2. Obrist's vacuum fixation technology compresses the cells of the battery to ensure high energy density

3. The HyperHybrid system comprises a vehicle control system, a li-ion battery and a zero-vibration generator

Alternative energy

In a post-Covid-19 world, developments in e-technology will play an even more important role than previously imagined

Words: Karl Vadaszffy

Obrist Powertrain develops key components for both hybrid and battery electric vehicles, offering scalable, affordable, mass-market mobility solutions as well as solutions for premium vehicle segments. At an investment of €40m, the company's HyperHybrid comprises four elements that together increase efficiency while reducing CO_2 emissions: a zero-vibration generator (ZVG), a low-cost li-ion battery, an e-drive, and a vehicle control system.

The company's CEO, Frank Wolf, notes, "The biggest problem in today's combustion engines is that they have to provide excellent performance, clean emissions, and efficient economy, and all of this while they have to operate over the complete RPM and throttling range." He explains that this leads to very complex, expensive, and heavy machines. Obrist Powertrain's ZVG system, however, is -generally - a two-crankshaft, two-cylinder engine with 40kW of electrical power. And weighing 95kg without fluids and measuring 677x498x188mm, the powerplant is both light and highly compact. It can even be run on gasoline, ethanol, LNG, CNG, or e-fuels.

There is also a high-performance version available, offering 85kW of electrical power, which is achieved through the addition of a turbo. Wolf says that the main goal of this engine, besides being super efficient, is to have no vibrations, and hence provide the outstanding driving experience of an EV, "which means no vibration and no noise."

CONTRA-ROTATING CRANK

To overcome typical NVH issues, a contra-rotating crankshaft has been included to compensate F1 and M1. The generators turn with twice the RPM of the crankshafts, which compensates F2 and M2. Due to this configuration, the powerplant has a rolling moment, and all startups, acceleration and deceleration, happen without provoking outside torque, which usually has to be compensated by the engine fixings. "On the B-sample, by the end of December, we will also be able to cancel F3, F4, M3, and M4, due to a newly invented linear mass balancing system on the camshaft," he adds.

In addition, both thermal and acoustic insulation were added to improve efficiency. As the engine supports the battery system, that means it can run in an RPM range of 1,500-5,000, depending on the battery's and vehicle's performance requirements. Prototypes have shown a brake specific fuel consumption of 210g/kWh, which results in a 40.3% thermal efficiency.

The B-sample will run on methanol, having an increased compression ratio, together with a high-performance ignition system and lean burn (lambda >1.6), with which the target is to reach thermal efficiency of more than 50%.

And what about the emissions? Wolf reveals, "Only during a cold start situation, the engine is strongly throttled. In all other conditions, the power plant is operated with wide open throttle at lambda one, minimizing air pollutants and achieving reduced CO_2 emissions. We have built a demonstrator vehicle that can achieve a fuel consumption of 2l/100km (117mpg). Cold start emissions are minimized by throttling and thanks to the electrically pre-heated catalytic converter. The HyperHybrid algorithm prepares the ZVG for a cold start by pumping air over the electrically heated catalytic converter until light-off is reached. All vehicle accelerations are handled by the high-power battery. This decoupling of the acceleration requirements from the combustion engine enables us to have the engine converted into a powerplant with a variable, highly efficient output."

"OUR PLAN IS TO PROVIDE THE INDUSTRY WITH EMISSION-REDUCING TECHNOLOGIES"

Frank Wolf, CEO, Obrist Powertrain

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The battery is cell independent and can be designed for high power or high-energy cells. In this component, the most important feature, Wolf explains, is its vacuum fixation technology, which creates a market leading module energy density of 231Wh/kg. "The vacuum fixation technology presses the battery cells together and tightens the cell to ensure stability and strength to improve thermal conductivity and heat transfer, and to achieve the highest possible energy density. The battery can be cooled by air or coolant." According to tests, the battery has a lifetime expectation in HyperHybrid mode of over 18,000 cycles.

PROTOTYPES HAVE SHOWN A BRAKE SPECIFIC FUEL CONSUMPTION OF 210g/kWh, WHICH RESULTS IN A 40.3% THERMAL EFFICIENCY

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REAL-WORLD DRIVE

The HyperHybrid algorithm is stored by the VCU. For city driving at below 65km/h (40mph), the car's energy need is handled solely by the battery. Above 65km/h (40mph) and with a 50% reduced state-of-charge, the powerplant operates and provides power for the drive, replenishes the battery, and keeps auxiliaries such as the A/C running. "Using our converted Tesla Model 3, in a real-world drive with city, highway, and countryside elements," comments Wolf, "we reached fuel consumption of 2.01l/100km and electrical consumption of 7.3kWh/100km. On long-distance highway travel at a sustained charge, the HyperHybrid demonstrator has shown a fuel consumption level of 4-5l/100km."

Wolf notes that for governments around the world, it is politically important to focus on reducing emissions in order to reduce global warming. And the HyperHybrid technology produces low CO_2 emissions during production, operation, and recycling. Applying green power in production, the recycling of a car, and using a CO_2-neutral synfuel will lead to vehicles having no CO_2 emissions. Obrist Powertain is striving to achieve that goal sooner rather than later, and will put a demonstrator that produces zero CO_2 emissions from operations on the road by year end.

Looking ahead, in addition to greater utilization of e-fuels like methanol, Wolf says the use of alternative fuels will increase, while the trend toward electrification will continue. "The EU has very strong targets regarding CO_2 emissions," he says, "and electrification in combination with the use of CO_2 neutral synfuel is a great way to reach that goal."

"Our plan is to provide the industry with emission-reducing technologies like heat pumps, highly efficient climate compressors, and the HyperHybrid powertrain. These are, as mentioned, global, affordable, and immediately emission-reducing solutions."