



# With Electricity from the Tank

**HYBRID** car manufacturers would rather switch to electric power today than tomorrow. However, there are alternatives for vehicles with large and heavy electricity storages – for example the hybrid drive from Obrist.

Stephan Hauri

For more than ten years, Tesla has no longer primarily stood for the unit of magnetic flux density, but as a synonym for the new car world with electric drive, breath-taking traffic light starts and autonomous driving. The fan community of the current owner and spiritus rector Elon Musk is correspondingly large and loyal. Despite the technical avant-garde, the Tesla models still have a problem, because the electricity storage system is too big, too heavy and too expensive – and the raw materials required for the construction are also problematic. So, it's only natural that smart people are thinking about alternative technologies. With different hybrid concepts, attempts are being made to meet the requirements for drive performance and emission regulations in a sustainable and economically more compatible way.

So, for example, a Tesla with hybrid drive? This idea, which may seem weird to the typical Tesla

disciple, resulted in a sophisticated plug-in hybrid drive system for Frank Obrist, founder and president of the Austrian engineering company Obrist Powertrain. The prototype from Obrist's development department in Lustenau, one kilometre from the Swiss border, is a Tesla Model 3 with serial hybrid drive. Frank Obrist and chief technician Frank Wolf call the system HyperHybrid.

The serial hybrid drive is intended to offer the powerful and linear acceleration of an electric vehicle without the need for cumbersome recharging. Nissan also relies on such a concept with its E-Power drive. This combines a 140-kW electric motor with a high-performance battery, a petrol engine, a power generator and an inverter. Since the petrol engine is used exclusively to generate electricity, it can always run in the optimal speed range.

#### Excited about the test drive

At first glance, the Obrist Tesla is a standard Tesla Model 3. However, even a second glance shows that the front section has been changed – not to the detriment of the appearance, and it in no way resembles prototype tinkering. The apron no longer has the typical electric car look without radiator grille and air intakes. This already gives a clear indication of what is hidden behind it.

In the interior, the familiar Tesla image: tidy design with simple shapes, materials that appear to be of high quality, no switches, a large touchscreen – and leather upholstery. So visually there is little change. Due to the new drive, however, the car would have to be significantly different from an original Tesla on the road. The excitement before the first test drive was correspondingly great.

Driving off is simple: Select drive and press the accelerator pedal. Up to 60 km/h, the HyperHybrid always runs on battery power alone. With the 17-kWh battery and the permanent magnet motor from Tesla and the system output of 120 kW, this is done in a familiar manner: seamlessly, quietly and with full torque from the first metre. The vehicle weight, reduced to 1580 kilograms thanks to the small

battery pack, the balanced axle load distribution and the rear-wheel drive ensure agile handling with sensitive, precise steering.

On country roads, sufficient drive torque is available without delay in every driving situation, and in city traffic the vehicle is very comfortable. The degree of recuperation has been set to a pleasant medium level, so that it is possible to drive in single-pedal mode over long distances. The fact that at higher speeds a small internal combustion engine is also required is not noticeable during driving, as the drive is always taken over exclusively by the electric motor. The one-litre two-cylinder engine does not draw attention to itself with annoying noises. All that can be heard is a discreet whirring sound, which is not a typical combustion engine noise. At the end of the test drive, it can be said that the Obrist Tesla has no obvious weaknesses. It drives as you would expect from a powerful mid-range electric car, and at no point does it seem like a prototype in need of development.

#### Small but mighty

According to Frank Wolf, smooth running is one of the major advantages of the small unit, which is called ZVG for short – Zero Vibration Generator. With speeds of up to 5000 rpm, it always runs in the most efficient range and supports the hybrid system with up to 40 kW. The small petrol engine is the sole power generator in the serial hybrid system.

The design of the engine is technically very simple. The four-stroke two-valve engine with two co-rotating crankshafts gets by with an inexpensive valve train and a normal three-way catalytic converter. And it runs with an efficiency of around 40 percent, which is high for a petrol engine, and for the time being it is still powered by petrol. The idea, however, is to add methanol, which can then increase the efficiency to almost 50 percent. And since the exhaust gases leave the Tesla HyperHybrid in the middle of the vehicle floor, no tailpipes are visible from the outside. Measurements in everyday traffic have shown that the car gets by on two litres of 95-octane petrol and 7.3 kWh of electricity per 100 kilometres travelled.





TECHNICAL DATA

Tesla HyperHybrid		
Electric motor		Tesla PMS
Net battery capacity	kWh	13.8
Internal combustion engine power	kW	40
System power	kW	120
Electric range	km	96
Vehicle weight	kg	1580
Acceleration 0 – 100 km/h	s	6.6
Maximum speed	km/h	170
Continuous speed	km/h	150
Practical consumption	per 100 km	2.0 l petrol and 7.3 kWh of electricity



Photos: Stephan Hauri.

Frank Obrist and Frank Wolf present the HyperHybrid developed by Obrist Powertrain; a converted Tesla Model 3 equipped with a small, clean methanol combustion engine. The relevant parameters can be read directly on the Tesla's central screen.

Tests on the AVL test bench also show that the ZVG, when run on 114-octane methanol, runs very lean after warming up to lambda 1.6 and then produces only extremely low NO<sub>x</sub> emissions. In this way, it falls below the Euro 6d limits without an aftertreatment system. At cold start, it runs with lambda 1, so that the exhaust gases can be perfectly cleaned with a three-way catalytic converter. Particles must be retained by a filter when running on petrol. If methanol is used, the emissions are so low that they can hardly be detected.

Soon ready for series production?

Of course, the question arises as to when the HyperHybrid could be ready for series production. Frank Obrist said: "We are currently negotiating with a major licensee, and if all goes well, they are planning to start production in 2025." Obrist is now working hard to win new cooperation partners. "Of course, as a 45-person company in Vorarlberg, we can't do it alone. But by showing what we can do, by developing the engine to production readiness and driving the car, it will increasingly come to the public's attention. We have to show the global, affordable and available technology."

In addition to the performance of the powertrain, the price of the vehicle is high on Obrist's list of priorities. A model like today's Tesla HyperHybrid should be able to be sold worldwide for around 18,000 euros. The power spectrum of the hybrid system can be expanded upwards for customers with more purchasing power. The ZVG could deliver up to 85 kW, the battery up to 25 kWh and the electric motors up to 450 kW over both axles on the road.

At Obrist Powertrain, the hybrid Tesla is only the tip of the iceberg; beneath it are Frank Obrist's more far-reaching visions. Above all, the low energy density of batteries compared to liquid fuels is a thorn in his side. In his mind, acidic, synthetic fuels from "artificial forests" are therefore the future (see box). ●

Methanol from the modern forest

At Obrist Powertrain, the hybrid Tesla is just the tip of the iceberg. Beneath the surface of the water, Frank Obrist's more far-reaching ideas can be discerned. Instead of drawing driving energy from a battery weighing 500kgs or more, the weight and price of the electricity storage unit should remain low - and be partially replaced by liquid electricity, so to speak, in the form of synthetically produced methanol. Obrist has specific plans for the production of e-methanol - and has already filed a large number of patents for it.

According to Obrist's ideas, the synthetic fuel is to be produced in huge power plants in sunny areas of the earth directly by the sea; in factories that produce the alcohol methanol from regeneratively produced hydrogen and CO<sub>2</sub>, following the example of forests and photosynthesis. Because such a modern forest works faster and with better efficiency than the natural forest, it is 20 to 30 times more efficient, according to Obrist. "E-Methanol is the best hydrogen carrier; a globally usable energy carrier", he explains. "It is also easy to store and transport. In terms of energy density, it not only surpasses the battery, but also hydrogen stored under pressure or in liquid form by a wide margin." Obrist's plans for such a factory, envisioned as "The Modern Forest" battery, consist of a huge solar panel field, a water treatment plant, an electrolysis station, a CO<sub>2</sub> air filtration plant and the e-methanol synthesis plant.

In this plant, two kilograms of seawater, twelve kilowatt hours of solar energy and 3370 kilograms of air could ultimately be used to produce one kilogram of e-methanol and 1.5 kilograms of oxygen. Since both water and produced solar energy are available in abundance at the idea location, the representation of the efficiency chain is of secondary importance.

The individual process steps of such a plant are all known, but a comprehensive project is lacking. To realize such a project, Frank Obrist and Frank Wolf would like to work with financially strong and risk-taking masterminds of the calibre of Bill Gates or Elon Musk. SH

