

Batteries Included

At the International Motor Show in Frankfurt, Porsche is presenting the first prototypes of the Cayenne Hybrid, which will go into production in this decade. At the Weissach Research and Development Center, journalists from around the world were given detailed insight into the new concept, which provides up to a 25-percent reduction in fuel consumption as well as improved acceleration and flexibility.

By
Reiner Schloz

Photos by
Christoph Bauer, Porsche AG

Can you trust this tachometer? We're cruising along at between 50 and 60 km/h (30–35 mph), but the needle is as still as the surface of a lake. Zero motion. The tachometer, of all things! In a Porsche! The visible symbol of boisterous strength and power! That's what it has always been in the 911. And in the Boxster. And in the Cayenne, too—so far.

Only now, we're sitting in a prototype Cayenne Hybrid. It drives like a Porsche, it otherwise seems like a Porsche, if that's what you're after—but somehow the tachometer isn't playing along. The reason: the hybrid management computer—no, not the driver!—has “shifted off” the internal combustion engine. A maiden voyage in the Cayenne Hybrid does hold a couple of surprising lessons in store, such as the silence when you start the car and get it moving. Or the fact that, in the driver's seat, you're constantly being informed visually as to which unit is just then being supplied with power, and which one is feeding it in. Or the fact that the warning light for the alternator is not even there, for the

simple reason that the alternator is not even there. Or the fact that this vehicle can “sail”—another technical term. Primarily, you don't have to change your driving habits at all, and yet you will still use about 25 percent less gas.

For a Cayenne with a 3.6 liter six-cylinder engine, that means considerably less than 10 liters per 100 kilometers instead of 12.9 liters (24 mpg instead of 18 mpg), according to the New European Driving Cycle. The target to be reached by market introduction is 8.9 liters—26.43 mpg. That will all come true in this decade, when Porsche puts a Cayenne on the market in which the internal combustion engine is only part of a very complex drive system. It is called “parallel full hybrid,” and is being developed together with Volkswagen and Audi, and has never yet been implemented in this way. Porsche decided in favor of this concept for a number of reasons. For one thing, in contrast to the power-split hybrid, the electric engine in the parallel full hybrid is integrated into the drive train. The hybrid module is located ▶



Exposed!
The hybrid components
in the Cayenne



between the transmission and the internal combustion engine, to which it is attached with a decoupler. The solution offers a space-saving advantage that minimizes restrictions on trunk volume and all-wheel drive.

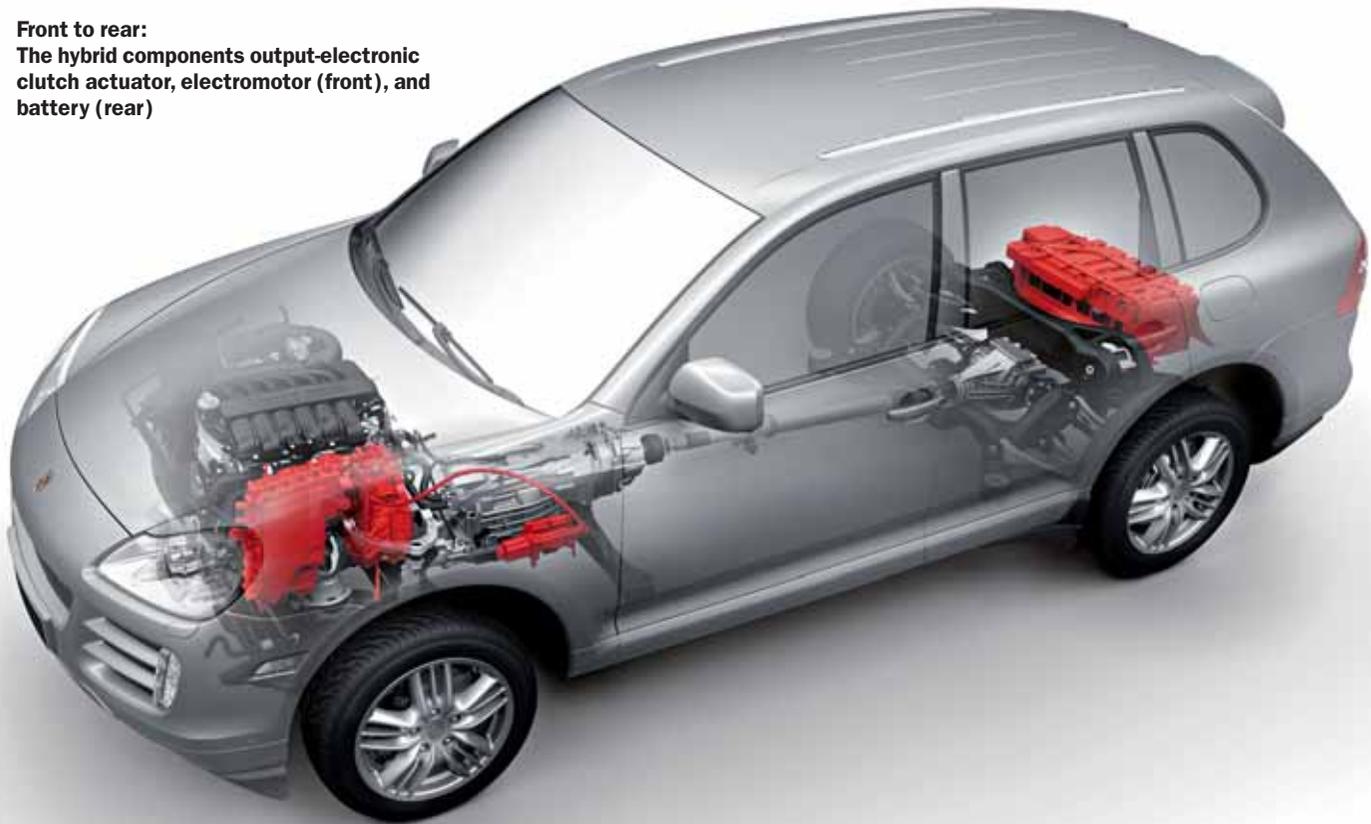
It also enables better fuel consumption values to be achieved in highway driving. The Cayenne Hybrid can “shift off” the internal combustion engine up to a speed of 120 km/h (75 mph). It then “sails,” or glides, along the road. And because—typical for Porsche—the electromotor not only can replace but also can support the combustion engine, acceleration and flexibility are considerably improved in comparison with the conventional Cayenne.

The hybrid manager, the “brain” of the system, regulates the complicated interplay between combustion, electric motor, and battery. It receives all information relevant to driving requirements and energy balance, controlling both the electric and the combustion engine for optimum fuel economy under all conditions. That ensures that the battery is neither run down too low, nor recharged and discharged too often. The hybrid manager is a computer that must constantly manage 20,000 defined data parameters. For a normal engine control unit, 6,000 parameters are plenty. ▶



Porsche shows its colors:
The NiMH battery (photo top right) and output electronics (below) of the Cayenne Hybrid

Front to rear:
The hybrid components output-electronic clutch actuator, electromotor (front), and battery (rear)



There are a few other challenges that still have to be mastered in order to optimize the parallel full hybrid. First among them is the decoupler between the combustion engine and the electromotor. It does hard, but very delicate, work. The hybrid manager shifts the combustion off or reconnects it, whichever is best for the vehicle at a given moment. And thanks to the internal combustion engine (which turns itself on and off in a flash in any situation, without the slightest jerk) and to the decoupler, the driver doesn't even notice. He can only hear it, in a sense, in that he hears practically nothing at all after the shift.

And then there's the 240-cell 288-volt battery, which measures 347x633x291 mm (13.7x24.9x11.5 in.) and weighs 69 kilograms (152 lbs.). It is located in the spare wheel compartment, and has an output of 38 kilowatts. It is recharged while driving via the regenerative brakes and the use-optimized load point displacement of the internal combustion engine. Because it can get pretty warm from all the recharging and discharging, its temperature is kept below 40 °C (105 °F) by a special air-cooling system. Fresh air is drawn in from the passenger space. In this way, the life expectancy of the battery is brought up to that of the vehicle itself.

In conventional vehicles, other components such as the power steering, the vacuum pump for the power brake, the air conditioner, and the oil pump for the automatic transmission are dependent on the internal combustion engine; in the Cayenne Hybrid, these components are supplemented or replaced by elec-



At a glance:
The combination instrument clearly shows which drive is currently operating

trically operated units. The Cayenne Hybrid thus weighs 150 kilograms (330 lbs.) more than its conventional sibling. A lot of work went into getting it that low—but Porsche developers have always been able to think of something to reduce fuel consumption. Over the past fifteen years, CO₂ emissions have been cut by 1.7 percent every year—an absolute peak in the auto industry. And for the second Cayenne generation, too, emissions have been reduced by 15 percent in four years.

With the Cayenne Hybrid, Porsche is pushing forward into new dimensions. And this concept is also being explored for the new Panamera, which is to come onto the market in 2009. ◀



Early starter:
In 1900, Ferdinand Porsche developed the Lohner-Porsche
“Mixte,” with a wheel-hub electromotor and internal combustion

The 1900 Lohner-Porsche: The First Hybrid Car

Ever since climate change has become a top sociopolitical issue, hybrid drive has been much discussed, too. And yet the idea of combining combustion with an electric engine is rather old—in fact, it’s over a hundred years old. And it was realized by company founder Professor Ferdinand Porsche. In 1896, at the age of 21, Ferdinand Porsche developed an electric wheel-hub motor while working for the Béla Egger Vereinigte Elektrizitätswerke AG in Vienna—the future Brown Boveri. Four years later, he followed that up with the Lohner-Porsche “Mixte” while working for the coach-building company Ludwig Lohner & Co., a purveyor to the Austrian emperor. In addition to an internal combustion engine, this vehicle also had wheel-hub electromotors and could already store energy intermediately in a battery. The Lohner-Porsche was far ahead of its time, and was in effect the first production car with a hybrid drive. ◀

