Technology

Where Energy Flows

By
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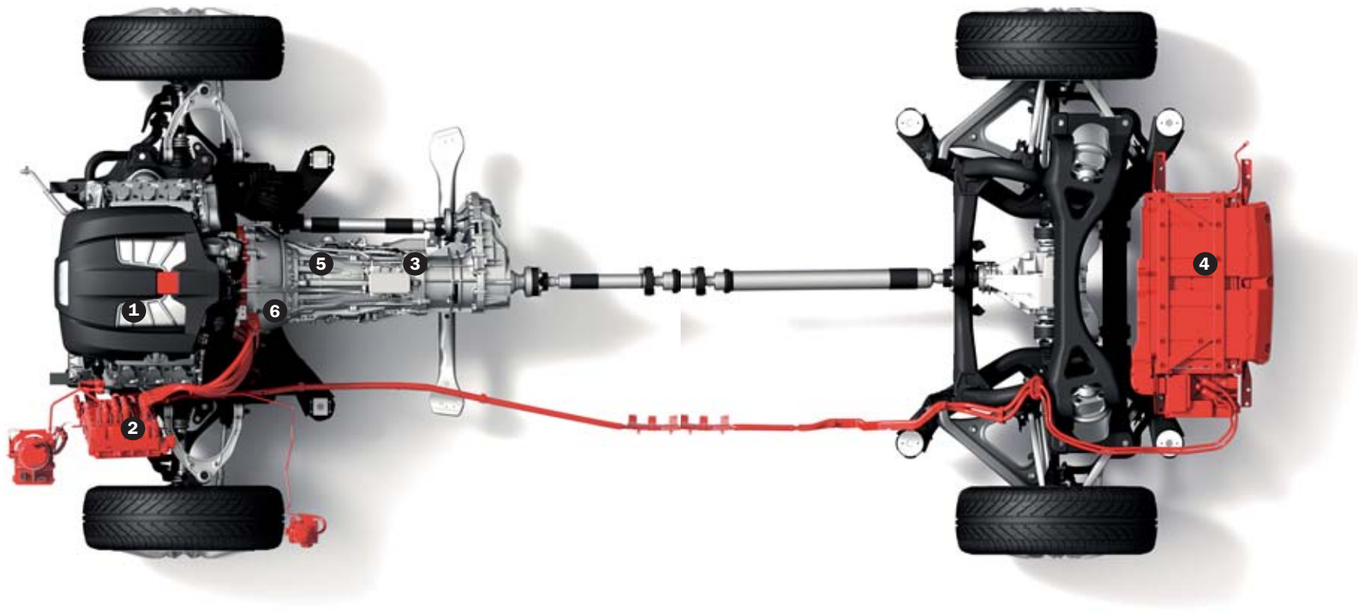
Photos by
Porsche

There's a lot going on under the hood of a Cayenne. Quietly and discreetly, Porsche has been further developing its hybrid drive over the past two years—and has succeeded in enticing the power of a V8 engine from the combination of a V6 and an electric motor, along with a reduction in fuel consumption. The high-performance, high-efficiency Cayenne S Hybrid will be available this decade.



Energy has to flow. Sometimes in one direction, sometimes in another. It's fascinating to watch as the display shows when and where energy is moving, and what it does with a body in motion. This energy—one cannot touch it, but one can feel it. Those with an esoteric bent have long had a feel for this phenomenon. Soon to be followed by curious car drivers. In a rather attractive body, namely, the Porsche Cayenne S Hybrid.

So get in, take a deep breath—and relax. Let traffic just be traffic, and concentrate completely on your vehicle. Stop and go, normal city traffic, or an open highway: don't waste your energy trying to win a prize for consuming the least fuel for the best-possible performance. The Cayenne S Hybrid will take care of that for you. There's no way your foot can be that subtle on the accelerator. Everything is a little different in a car without a generator or a starter. Driving seems like gliding, or even sailing. You hear almost nothing and catch yourself asking, "Is the car even running?"

That's what it feels like in the Cayenne S Hybrid—on the one hand. On the other, if you want to pick up speed, such as when accelerating or passing, and your right foot signals that it's time for the Porsche to show in the hybrid, then the Cayenne reveals its other self. Without missing a beat it takes off like a shot, and you suddenly hear that familiar sound—aha, the engine!

You quickly realize that the gliding phases are not periods of inactivity. Despite the low fuel consumption levels, the Cayenne S Hybrid is always standing ready for the instant when things get serious. And anyway, more is going on in this Cayenne—which the electric motor and combustion engine can drive either separately or in combination—than in any other Porsche. You may not feel it, but you can see it. On the display between the tachometer and speedometer, it's very easy to see which part of the system is providing energy at any given moment. When the green arrow points from the battery to the wheel, the Cayenne is being powered fully electrically. When the combustion engine sends a red arrow toward the wheel and a green one toward the battery, it is powering the car and at the same time charging the electric power pack. When the wheel sends a green arrow toward the battery, the regenerative braking system is capturing energy that would otherwise be lost as heat. It's an entire choreography of back and forth, although the Cayenne itself is singularly unimpressed by it all—preferring simply to drive and drive.

For those who want to know more, there's the large display on the center console. It offers a constant stream of information on energy movement through the system. And it always shows the percentage of power reserves available in the battery. The fact that the display never shows a full 100 percent—as it might in a cell phone—is not a defect of the system. Located under the trunk without reducing its space, the 38-kilowatt nickel metal hydride battery (288 V) is designed for a long service life. That is why it is not supposed to be either fully charged or completely empty. ▸

New Porsche parallel hybrid powertrain

[1] V6 engine (3.0-liter DFI, 245 kW)
[2] Optimized high-performance electronics
[3] Eight-speed automatic transmission
[4] High-voltage battery (288 V)
[5] Torque converter with lock-up clutch
[6] Cut-off clutch and electric motor (38 kW)

Hybrid development at Porsche

	2007	2009
Combustion engine	3.6-liter V6 DFI, 280 hp/206 kW	3.0-liter V6 DFI with supercharger, 333 hp/245 kW
Electric motor	38 kW (52 hp)	38 kW (52 hp)
Type	Parallel full hybrid	Parallel full hybrid
Battery	288 V, nickel metal hydride	288 V, nickel metal hydride
Sailing mode	Highway cruising at up to 120 km/h (74 mph) on electric power	Highway cruising at up to 138 km/h (86 mph) on electric power
Transmission	Six-speed automatic transmission	Eight-speed automatic transmission
Fuel consumption as per NEDC*	< 10 l/100 km (62 miles)	< 9 l/100 km (62 miles)

***NEDC = New European Driving Cycle**

Electric drive: The green arrow shows that the electric motor is currently powering the wheels

The conductor of this energy cycle is the hybrid manager; it's like a super brain among modern electronic engine control systems—a real high achiever. Instead of the usual 6,000 data parameters, it derives its knowledge from a good 20,000 of them, which enables it to make the right decisions in fractions of a second. The hybrid manager determines within a mere 300 milliseconds when the combustion engine should be deactivated or switched on again. The manager's most important sidekick in this virtuoso technical performance is the cut-off clutch. It lies on the driveshaft between the 38-kW electric motor and the combustion engine. Even at relatively high rpm levels, it ensures that the combustion engine can be switched on absolutely smoothly after being started imperceptibly by the electric motor.

The Cayenne S Hybrid is bursting with just the right degree of (technical) harmony to please its passengers. It has power in spades. Even more than ever before. Porsche presented this concept of a parallel full hybrid in a Cayenne two years ago. In comparison to conventional parallel hybrid models, it requires much more technical expertise but offers major benefits in return: for highway driving, its fuel consumption is even lower. After all, you can roll ("sail") freely without a combustion engine at relatively high speeds. Furthermore, acceleration and flexibility are considerably improved because the electric motor and the combustion engine can also be used in concert (boosting).

Since its first presentation, Porsche has "further developed the design in very fruitful cooperation with VW," notes Dr. Michael H. Leiters, who heads the overall Cayenne Hybrid project. Its combustion engine is a supercharged 3.0-liter V6 with direct fuel injection (DFI) that generates 333 hp (245 kW). The engine is teamed to an eight-speed automatic transmission. And it takes only 6.8 seconds for the Cayenne to sprint from a standstill to 100 km/h (62 mph). "These are figures otherwise achieved only by a V8 model," says Dr. Leiters. And that's the reason for the "S" in the Cayenne S Hybrid name. The production Cayenne S Hybrid will be considerably more fuel-efficient than the standard V8 model. As Dr. Leiters says, "The most important thing about this vehicle is its lower fuel consumption. But we've succeeded very well in keeping the typical Porsche characteristics."

With all due modesty, the vehicle does more than just that. Highway cruising—"sailing"—is possible at up to 138 km/h (86 mph). This means that if you take your foot from the accelerator at this speed, the combustion engine simply turns off but the Cayenne keeps rolling on electric power. If you step on the gas again, the combustion engine immediately restarts. The fact that this masterful technical performance is taking place can only be detected via the tachometer. The needle that had been calmly pointing to zero now leaps to well above the 2,000-rpm mark. It is fascinating to see what energy can do with a body in motion.

Complete overview:
The main display constantly shows the flow of energy