

# Hybrids 101

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June 18, 2008 Torrance, CA – With the introduction of the third generation Prius, hybrid-electric vehicles have now been on the road for more than 10 years. They've received much attention for offering substantial fuel savings and fewer emissions than their traditional counterparts. But questions remain. What *is* a hybrid? How do hybrids work?

Any vehicle that combines two or more sources of power that can directly or indirectly provide propulsion power is a hybrid. A mo-ped (a motorized pedal bike) is a type of hybrid because it combines the power of a gasoline engine with the pedal power of its rider. In fact, hybrid vehicles are all around us. Most of the locomotives we see pulling trains are diesel-electric hybrids. Cities such as Seattle have diesel-electric buses that draw electric power from overhead wires or run on diesel when they are away from the wires. Giant mining trucks are often diesel-electric hybrids. Submarines are also hybrid vehicles — some are nuclear-electric and others are diesel-electric.

As we know them today, hybrid-electric vehicles (HEVs) combine the benefits of gasoline engines and electric motors. Toyota's iconic Prius is the country's most popular hybrid-electric vehicle. More than 707,000 Prius have been sold in the United States since they hit American roads in 2001 (as of April 2009).

The hybrid system found in the Toyota Prius, Highlander Hybrid and Camry Hybrid, which is called **Hybrid Synergy Drive**, combines an electric motor and a gas engine, along with technology that allows the motor to capture and reuse energy that is usually lost during traditional vehicle braking (regenerative braking).

## The Electric Motor

Unlike some other hybrid vehicles on the market, the Toyota Hybrid Synergy Drive motor provides power to start the vehicle and for low-speed driving conditions where internal combustion engines are least efficient. The electric motor provides additional power to assist the engine in accelerating, passing or hill climbing. This allows a smaller, more efficient engine to be used.

One of the biggest misconceptions about hybrid vehicles is that the driver must turn the electric motor on and off. Not true; the Hybrid Synergy Drive system automatically shuts off the engine when the vehicle comes to a stop and gradually restarts the engine as the vehicle begins to move forward again. This prevents wasted energy from idling and starting from a dead stop — two times when a vehicle's engine is the most inefficient.

These features make Toyota's Hybrid Synergy Drive system unique in that it is a "full" hybrid, meaning that it can run on electric power alone under certain conditions. Other hybrids on the market are known as "mild" hybrids, which means they rely on the gasoline engine to power the vehicle at all times while the electric motor assists the engine as needed. The electric motors and batteries in mild hybrids are less powerful than in full hybrids.

Because hybrids can be used by combining any two power sources, it will continue to be applicable even when gasoline is no longer a prime source of vehicle power. In fact, the Toyota Fuel Cell Hybrid Vehicle (FCHV) uses hybrid technology to marry the electric engine with hydrogen fuel cell technology. Like the FCHV exemplifies, hybrids have the ability to assist any power source from gasoline to hydrogen fuel cells to biodiesel. For more information on Toyota hybrids, please visit [www.toyota.com](http://www.toyota.com)

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