CarSmart: Celebrate Earth Day with Hybrid Cars

by Doralisa Palomares

An Environmentally Healthy Alternative

Over the past several years, auto manufacturers have provided environmentally safe solutions for automobiles. Fuel efficiency and reducing emissions are primary reasons for inventing these new alternatives. One of the first developments was an electric vehicle. While a smart solution, battery technology limited the effectiveness of the electric vehicle. Now, a better solution combining the best aspects of the electric car with conventional cars has emerged.

Hybrid electric vehicles, also known as HEVs, combine two or more power sources typically a gasoline engine and an electric motor. This combination allows for reduction of emissions and fuel consumption, while still providing the conveniences of the traditional automobile.

Why HEVs Over Conventional Cars?

HEVs can recharge as you drive.

- Regenerative braking recovers the energy used to slow down or stop a vehicle and minimizes energy loss.

Fuel efficiency is increased.

- HEVs get double the miles per gallon of gas than most cars on the road now.
- A sleek, aerodynamic design reduces drag and allows the HEV to move more efficiently.
- Lightweight materials are used to produce an HEV, which reduces the overall weight of the vehicle.
- Engines can be sized to accommodate an average load, rather than a peak load, reducing the engine's weight.

Emissions are greatly decreased.

- The smaller, gasoline engine operates at a steady pace, producing fewer pollutants than a conventional engine.
- HEVs can run on alternative fuels, reducing dependency on fossil fuels.
- An alternate power source, such as an electric motor and batteries, allows the engine to shut off.

How Do HEVs Work?

There are three categories of power sources used in HEVs: series hybrids (range-extending HEVs), parallel hybrids (power assisted HEVs), and dual-mode hybrids.

In a **series hybrid**, only the electric motor is connected to the wheels, so all the power is transmitted electrically. Generally, the engine keeps the battery charged between 60-80%. When the battery falls below this range, the engine starts. If the

The Honda Insight

battery charge is above this range, the engine shuts off. The optimization for a series hybrid comes from separating the engine speed from the vehicle speed. The engine never directly powers the vehicle, so the engine does not idle, thus reducing the overall emissions.

A **parallel hybrid** has both the engine and electrical motor connected to the wheels, allowing the HEV to accelerate faster than a series hybrid. Parallel hybrids do not require a dedicated generator and are connected to the electric grid for recharging the batteries. The electric motor assists the engine during start-up and acceleration, while the engine idles. One example of a parallel hybrid is the Honda Insight.

A **dual-mode hybrid** is similar to a parallel hybrid, except it has a separate generator to recharge the batteries. The engine moves both the wheels and the generator, which in turn supplies power to the electric motor and the batteries. If the HEV requires full-throttle acceleration or has a heavy load, the battery assists the motor in providing power. When the vehicle starts moving, the engine shuts down and only the electric motor drives the wheels, drawing its power from the batteries. A popular example of a dual-mode hybrid is the Toyota Prius.

Other options for energy storage, besides batteries, are fuel cells and flywheels. Fuel cells generate electricity by combining oxygen and hydrogen, therefore producing zero emissions. Flywheels store energy mechanically and operate on a principle similar to regenerative braking. However, the flywheel uses the speed of the rotor rather than the vehicle's momentum to generate energy.

Why Do HEVs Have an Engine?

Current electric vehicles can cover 80-100 miles using advanced battery technology such as NiMH (nickel-metal-hydride batteries). Consumer surveys indicate that this range of battery power life is not sufficient. Gasoline engines help supply the additional power, as well as providing back-up power.

Another advantage of putting an engine in an HEV is the fact that the engine can be tweaked or computer controlled to operate at its maximum efficiency. The battery power provides extra energy for carrying peak loads rather than having the engine speed up or slow down as the load varies.

What HEVs are Available?

The Honda Insight, introduced in 1999 and touting the best EPA mileage ratings, and the Toyota Prius, the first mass-produced HEV, are the most popular and widely known HEVs available today in the United States

Other HEVs that have appeared on the radar are: the ESX3 from DaimlerChrysler; the Dodge Durango sport-utility vehicle; the Ford Escape HEV, scheduled to be introduced in 2003; the Triax, which was built in conjunction with Suzuki Motor Corporation, and the Precept from General Motors; the HM-01 from Subaru, introduced at the Frankfurt Auto Show in late 2001; the Honda Civic, due to be released in April 2002; and the Dodge RAM pickup, scheduled for 2005. Additionally, General Motors sells electric buses and plans to produce a hybrid full-size truck by 2004.

The Toyota Prius

It is unknown how many of these models will be widely available, although Ford estimates it will build tens of thousands of its hybrid Escapes and Toyota, who currently has 100,000 hybrid vehicles on the roads worldwide, wants to triple the number within five years.

Think you're ready to own an HEV? In our next edition of CarSmart, we will do a comparison of the two most popular HEVs, the Honda Insight and the Toyota Prius.