Just the Facts About ...

Hybrid Electric Vehicles

From the Alternative Vehicle Fact Sheet Series

What is a Hybrid Electric Vehicle (HEV)?

A hybrid is any vehcile that uses two or more sources of power. In today's HEVs, the two sources are electricity (from batteries) and mechanical power (from a small internal combustion engine). HEVs can offer the very low emissions of electric vehicles with the power and range of gasoline vehicles. They also offer up to 30 more miles per gallon, perform as well or better than, and are just as safe as any comparable gasoline powered car. And, they never have to be plugged in for recharging!

Widespread use of HEVs would reduce our nation's growing dependence on foreign oil, and reduce ozone precursor emissions by 90% and cut greenhouse gas emissions by up to one-half over conventional gasoline vehicles.

How Do HEVs Work?

Hybrids offer tremendous fuel economy and emissions benefits because they operate differently than conventional gasoline-fueled vehicles.

Gasoline Vehicle: The heat energy obtained by burning gasoline powers the engine, which drives the transmission that turns the wheels.

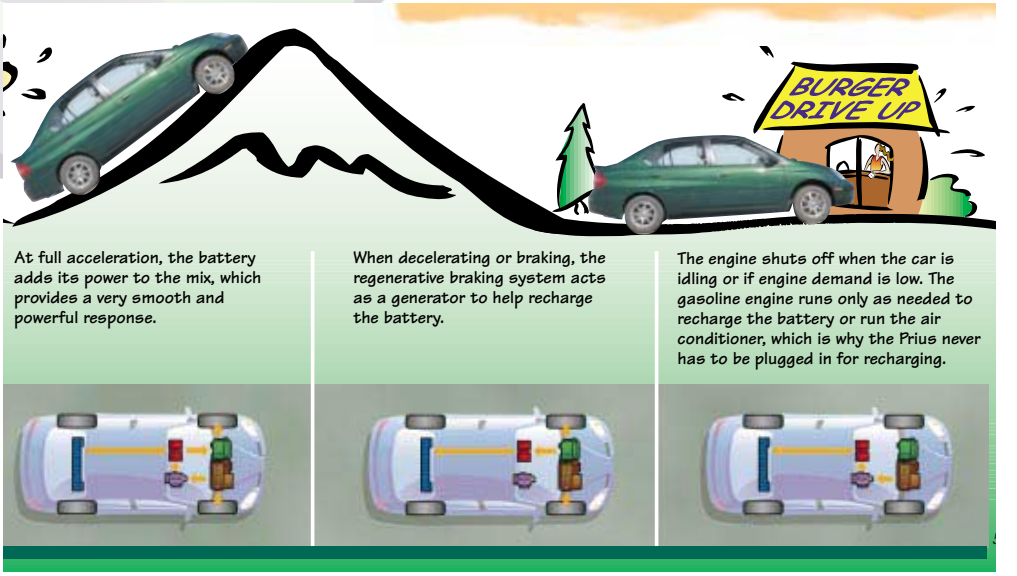
Electric Vehicle: A set of batteries provides electricity to a motor which drives the wheels.

Hybrid Electric Vehicle: Many configurations are possible for HEVs. There are many ways to combine the engine, motor/generator, and battery. Three basic hybrid configurations are the series, parallel, and split designs.

Series. The engine never directly powers the car. Instead, the engine drives the generator, and the generator, can either charge the batteries or power an electric motor that drives the wheels.

Parallel. The engine connects to the transmission, as do the batteries and the electric motor. So both the engine and the generator/motor can supply power to the wheels, switching back and forth as driving conditions vary.

Split. The engine drives one axle and the electric motor drives the other. There is no connection between the engine and the electric components except "through the road".



Why Don't HEVs Ever Need to be Plugged-In for Charging?

An HEV recharges its batteries primarily by using its own gasoline engine, in addition to regenerative braking. Some of the power from the engine is "split off" and stored in the car's battery pack. This "self-charging" system greatly enhances driving range--to more than 600 miles on a tank of gas in the city.

What is Regenerative Braking?

When a driver slows down or steps on the brake, the regenerative braking system converts kinetic energy from the motion of the wheels--normally dissipated as heat in the brakes--into electric current to help recharge the battery. About 20 percent of the total energy consumed by the HEV comes from regenrative braking, which contributes to the car's excellent fuel economy.

In fact, the engine even shuts off when it isn't needed for acceleration or to recharge the battery. For example, when engine demand is low, such as when starting, idling, or stopping, many HEVs are driven only by its electric motor, using battery power.

During normal travel, the gasoline engine engages as needed to (1) drive the wheels and/or (2) recharge the battery. At full acceleration, the battery adds its power to the mix, which provides a very smooth and powerful response. This is why the HEVs

get better City mileage than Highway mileage--which also eliminates those nasty idling emissions!

Air Emissions and HEVs

HEVs already meet the California Super Ultra Low Emission Vehicle (SULEV) standards that take effect in 2004 without sacrificing performance. The HEV reduces hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxides (NOx) emissions by up to 90% and carbon dioxide (CO2) and other greenhouse gas emissions by up to 50% relative to those of a comparable gasoline-fueled vehicle!

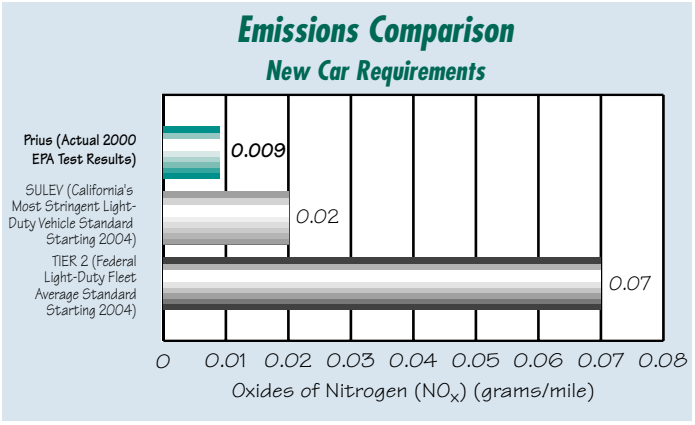
Ground-Level Ozone

Ground-Level Ozone is a serious issue in Montgomery County, which is part of the Washington Metropolitan "serious" non-attainment area for the EPA's one-hour ozone standard. Ozone is an odorless, colorless gas. Here at ground-level, ozone is a noxious pollutant created by a chemical reaction between oxides of nitrogen (NOx) and volatile organic compounds (VOCs) in the presence of sunlight.

High concentrations of ground-level ozone occur during hot, sunny days, when the flow of air is limited or stagnant and a mixture of VOCs and NOx is present. The main ozone-causing pollutants, VOCs and NOx, come from many sources such as the fumes from vehicles, lawnmowers, and boats, or emissions from power plants and industrial facilities. However, our cars account for 30 to 40 percent of pollutants that cause ozone in our area.--making the HEV a great solutionto our ozone pollution!

Greenhouse Gas Emissions

Growing scientific evidence suggests that greenhouse gas emissions could contribute to a change in the earth's climate --and transportation, specifically the combustion of fossil fuels in our vehicles, accounts for a large portion of greenhouse gases. Despite the substantial reductions in individual vehicle emissions over the last decades, the millions of vehicles on our roads--which burn thousands of gallons of petroleum every second--account for a third of the country's air emissions.



The Outlook on Oil

Most people dislike having to pay $20 or $30 or more for a tank of gas. Yet, the United States depends on petroleum for nearly 95% of its transportation energy--about 8 million barrels per day of petroleum products are used to fuel light trucks and cars. More than half of our petroleum is imported, and this percentage is growing, which is why oil imports represent one of the largest components of the U.S. trade deficit. And the demand for oil used for transportation will grow as the number of people and the number of miles they drive increase.

Montgomery County Purchases Two HEVs

In searching for ways to reduce the emissions of its fleet, the Montgomery County Department of Environmental Protection (DEP) chose to replace two of its vehicles with the Toyota Prius HEV. The Toyota Prius combines both a "series" and "parallel" hybrid electric vehicle and it is one of the world's first mass produced HEV. Like other HEVs, the Prius has many innovative features discussed in this fact sheet such as regenerative braking; a lighter smaller engine; and lower emissions. With the purchase of these two Prius vehicles, DEP has cut its fleets ozone precursor emissions by 14 percent!

Purchasing an HEV

The HEVs available for sale are very cost effective with similar conventional vehicles. Any cost premium that may be associated with HEVs can be off-set by overall fuel savings. In addition, Maryland has passed the Maryland Clean Energy Incentive Act that provides tax credits when you buy an HEV. These tax credits can be as high as $1500 depending on what type of rechargeable energy storage system and braking system the vehicle has. HEVs are also comparable to conventional sedans, there are no hard to find fuels or plug ins necessary--you fill up an HEV just like you would a conventional gas vehicle.

Other Agencies Purchasing HEVs

The City of Denver purchased 39 Toyota Prius sedans for use by the Public Works and Fire Departments. New York City has purchased 231 Toyota Prius hybrid vehicles for use by municpal agencies during their rounds. New York's MTA has already started using hybrid buses and has switched to low-sulfur diesel fuel.

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