

# AIR QUALITY BASICS: Hybrid Vehicles

Ever since the first passenger hybrid gas-electric vehicles from Japanese-based Honda and Toyota rolled onto the U.S. market in 1999 and 2000, manufacturers have been slow to get on the hybrid bandwagon. But with the increase in gasoline prices and the popularity of the Toyota Prius, new hybrid vehicles began cruising into the market in 2004. Even U.S. manufacturers joined the parade with Ford first introducing its hybrid Escape in 2004.

Surprisingly, hybrid vehicles are not created the same. Although the concept of a gasoline engine/electric motor power source is the basis of a passenger vehicle hybrid, the way the power sources are used varies with the vehicle and the resulting fuel efficiency.

Basically, hybrids can be evaluated on the basis of five characteristics:

1. The engine shuts off when stopped at control signals and in drive-throughs.
2. The electric motor is recharged by the friction energy generated from the brakes.
3. The gasoline engine is smaller than in a comparable conventional vehicle.
4. The vehicle can be driven using only electric power.
5. Batteries can be recharged by plugging into an electrical outlet.

Not every hybrid has all five characteristics, but the more it has, the less fuel consuming and more environmentally friendly the vehicle. For example, the Toyota Prius and Highlander; Honda Insight, Civic, and Accord; and the Lexus RX 400 have four of the five characteristics and are considered full hybrids. (Until the 2006 model, the Honda Civic engine did not shut off when stopped.) In contrast, the new full-size pickups introduced by General Motors and DaimlerChrysler in 2004 and 2005 only boast idle-off capacity, yet call themselves hybrids. Hybrids with all five characteristics, including

a plug-in option, are not yet available on the market.

Whether or not a hybrid vehicle has one, four or five characteristics, the most important factors relative to health and the environment are fuel efficiency and emissions. Better fuel efficiency means less use of fossil fuels and the energy and pollution associated with refining them, while lower emissions mean less air pollution from exhaust. However, better fuel efficiency does not necessarily go hand-in-hand with lower emissions.

Some hybrids harness the electric energy for more horsepower rather than greater fuel efficiency or lower emissions. The Lexus RX 400 accelerates with 38 more horsepower than the conventional RX 330, but still manages to increase combined city/highway fuel efficiency from 22 to 29 mpg. Ford put two electric motors into the hybrid Escape; one to account for loss of power due to a more fuel efficient engine and the second for electric only operation. However, its fuel economy is not as good as you might expect from a small SUV because of its characteristic shape and knobby tires. The fuel savings on the GM and Chrysler full-size "hybrid" pickups amounts to only 1-3 mpg. They are essentially conventional vehicles with a larger typical car battery that can also be used as a generator when the vehicle is parked.

As more hybrid vehicles come onto the market – Nissan and BMW are expected to join the hybrid contest in 2006 and 2007 – buyers should look at their fuel efficiency and emissions. Hybrid technology with its electric motors and energy storage is a smart transition to fuel cell vehicles. Hybrid technology is also a smarter choice than reliance on fossil fuels that leads to exploitation of our natural areas and dependency on foreign oil. For more information on hybrid vehicle comparisons, go to [www.epa.gov/greenvehicles](http://www.epa.gov/greenvehicles).

*From Union of Concerned Scientists' A New Road. The Technology and Potential of Hybrid Vehicles, 2003.*

vehicle	city mpg	hwy mpg	emissions*	horsepower
Toyota Prius	60	51	Tier 2, Bin 3	110
Honda Insight	57	56	Tier 2, Bin 5	71
Honda Civic	49	51	Tier 2, Bin 2	110
Honda Accord (2005)	29	37	Tier 2, Bin 5	255
Ford Escape	36	31	Tier 2 Bin 4	155
Toyota Highlander	33	28	Tier 2, Bin 3	268
Lexus RX 400	33	28	Tier 2, Bin 3	268
GM Sierra	18	21	Tier 2 Bin 8	295
Chevy Silverado	18	21	Tier 2 Bin 8	295

\*In 2004, the EPA began phasing in more stringent federal emissions requirements for passenger vehicles. These Tier 2 requirements include 11 different categories, or Bins. The cleanest category is Bin 1, while the least clean is Bin 11.