Environmental Case Study

Hybrid Automobile Engines

In 1990 the California Air Resources Board shocked the automobile industry by ordering it to start producing emission-free vehicles or face stiff penalties. It’s not surprising that California was the first state to get tough on automobile emissions. Auto exhaust counts for 90 percent of the state’s carbon monoxide, 77 percent of its nitrogen oxides, and 55 percent of its smog-producing hydrocarbons. At the time this order was issued, however, only battery-powered electric vehicles were available. Although several manufacturers built all-electric autos, the batteries were heavy and expensive, and they required more frequent recharging than customers would accept. Even though 90 percent of all daily commutes are less than 80 km (50 mi), most people want the ability to take a long road trip of several hundred kilometers without needing to stop for fuel or recharging.

An alternative that appears to have much more customer appeal is the hybrid gas-electric vehicle. The first of these hybrid cars to be marketed in the United States was the two-seat Honda Insight. Its 3-cylinder, 1.0-liter gas engine is the main power source. A 7-hp electric motor helps during acceleration and hill climbing. When the small battery pack begins to run down, it is recharged by the gas engine, so that the vehicle never needs to be plugged in. More electricity is captured during “regenerative” braking, further increasing efficiency. With a streamlined, lightweight plastic and aluminum body, the Insight gets 72 mpg (30.3 km/liter) in highway driving and has low enough emissions to satisfy California requirements. Quick acceleration and nimble handling make the Insight fun to drive.

Both Toyota and Honda have also introduced-larger hybrids, such as the Toyota Prius and the Honda Civic. During most city driving, they depend only on a quiet, emission-free, battery-powered, electric motor. The 1.5-liter gas engine kicks in to help accelerate or when the batteries need recharging. Some drivers are unnerved by the noiseless electric motor of hybrids. Sitting at a stoplight, it makes no sound at all. You might think it’s dead, but when the light changes, you glide off silently and smoothly. Because electric motors have high torque at low speeds, pure hybrids have tremendous pick-up. The batteries are like booster rockets for the tiny engine. Both the hybrid Civic and Prius sell for about $20,000 and qualify currently for up to $4,500 in Federal Clean-Fuel Vehicle tax deduction. The Sierra Club estimates that, in 160,000 km (100,000 mi), a Prius will generate 27 tons of CO₂, a Ford Taurus will generate 64 tons, and the Ford Excursion SUV will produce 134 tons. In 1999 the Sierra Club awarded both the Insight and the Prius an “excellence in engineering” award, the first time this organization has ever endorsed commercial products.

The EPA rates the Prius at 60 mpg (25 km/l) in city driving and 51 mpg (22 km/l) on the highway. For even greater fuel efficiency, some Prius owners are now equipping
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their hybrids so they can recharge batteries from household electricity at night. This allows them to drive about 32 km (20 mi) before having to use the gasoline motor at all. Since most Americans drive less than 32 km/day, they would rarely have to buy gasoline: An even greater savings can be achieved by modifying the engine to burn ethanol/gasoline blends. A plug-in hybrid burning E85 fuel (85 percent ethanol) might use only one gallon of gasoline in 600 miles in ordinary city driving (although you would have to buy 5 gallons of ethanol). If we all had such vehicles, we wouldn’t have to import any oil at all. Although Toyota also has an experimental fuel cell car, it expects hybrids to be the best automobile choice for the next 20 years at least.

With rapidly rising gasoline prices, the demand for hybrids is surging. Most automakers have plans to build hybrid models. By 2010, Ford Motors plans to offer hybrid engines in half of its models. Several sport utility vehicles, including the Toyota Hylander, the Lexus RX400, the Ford Escape and the Mercury Mariner already are available. Some of these are “mild” hybrids, however, with 42 V generators (versus 500 V in the Prius) that provide only enough power to run extra lights and electronic accessories. Their mileage can be less than many ordinary gasoline-powered sedans.

What do you think? Would you buy a vehicle with a hybrid engine system? Would you take a chance on this new technology to get a quiet, clean, efficient, environmentally friendly means of transportation? Do you think that automobile makers are wise to wait for fuel cells, or should they be producing hybrid vehicles as well?