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### Environmental horsepower

July 12, 2004

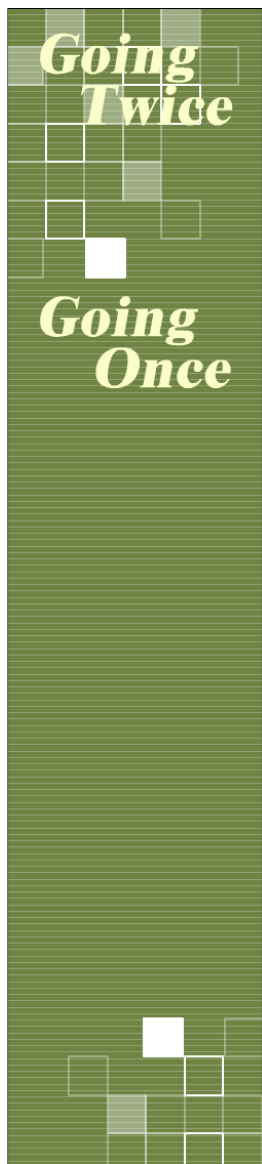


DOUGLAS  
HULLANDER

The Knoxville metropolitan area has the ninth-worst urban ozone air pollution in the country, according to the American Lung Association - the fifth consecutive year that Knoxville has been recognized for its bad air. Knox County was listed as the 15th worst county for annual particle pollution.

Local monitoring agencies warn that high ozone levels are threatening trees in the Great Smoky Mountains National Park, and posing health risks to people with respiratory problems.

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Federal officials caution that levels of carbon dioxide in the atmosphere continue rising at alarming rates, exacerbating global warming.

News reports like these appear almost daily.

Are hybrid vehicles part of the solution?

The source of air pollution, most experts agree, is fossil-fuel combustion, the burning of coal and petroleum.

While coal-fired power plants certainly release their share of harmful emissions to the air, the internal combustion engine rightfully gets most of the blame for fouling the air - at least that's true in most metro areas. Car and truck engines spew carbon dioxide, carbon monoxide and various nitrogen oxides into the air by the megaton.

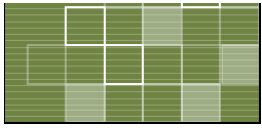
But despite admonitions from environmentalists, despite the implementation of environmentally friendly laws, gasoline consumption climbs steadily and, with that rise, an inexorable decline in air quality.

Even \$2-a-gallon gas prices haven't forced a change in our driving habits - though the high price of filling up may be forcing us to take a hard look at ways to reduce consumption.

Enter the hybrid. First appearing on the market in 1999, these cars combine the power output of an internal combustion engine with that of an electric motor for maximum fuel efficiency.

Sometimes it just makes sense for the gasoline engine to do the work, and at other times, it's better for the electric motor to provide the power. Only the on-board computer knows for sure.

Here's how that system works in Toyota's hybrid, Prius. At speeds below 15 mph, the computer tells the electric motor to provide all the propulsion.



But when you step on the pedal to accelerate, the amount of pressure against the pedal indicates to the computer just how fast you want to go. The computer then calculates whether to engage the gas engine, the electric motor, or both - and how much power each should produce.

When the vehicle stops even for brief periods, at intersections for instance, the computer may shut the gasoline engine off. Idling wastes gas.

The internal combustion engine gets its energy from burning gasoline. But what, you might ask, is the energy source for the electric motor?

The electric motor gets its get-up-and-go from rechargeable nickel metal hydride batteries. But you don't have to plug these batteries into the wall to re-charge them. Just let the car wheels do it. How?

Normally, when you apply the brakes to stop a car, the vehicle's kinetic (moving) energy is simply converted into useless heat. The brakes get hot.

In many hybrids, though, stepping on the brake pedal transfers the energy of the turning tires directly to the car's electric motor. But the electric motors are now functioning like generators - not motors. As such, they produce electricity. So as the car comes to a stop, its kinetic energy is converted to electrical energy, which is used to charge up the batteries.

This ingenious arrangement is called re-generative braking.

Once again, the car's brain, the computer, decides when the braking system needs to charge up the batteries and to what extent.

The computer also figures out when to reverse this process, that is, when to send power from the batteries back out to the electric motors and on to the wheels to move the car along.

The computer never allows the batteries to become charged over 70 percent of max and never under 30 percent of its capacity. Experts say careful monitoring of these parameters will prolong the life of the batteries to perhaps couple of hundred thousand miles. (They cost \$1,000 to \$2,000 a set.)

Toyota claims these innovations will allow the Prius to travel around 55 miles on a gallon of gas.

"It does everything on earth better, and is far better for our Earth," says Toyota President Fujio Cho.

Toyota is not the only hybrid game in town, however. The Honda Civic is available as a hybrid, as is the Ford Escape. Ford officials say batteries can power the Escape up to 40 percent of the time. GMC and Chevy introduced hybrid pickups this year, too.

Lexus, Saturn, Honda and Chevrolet are planning sports utility vehicles with hybrid engines in the next year or so. And the Chevy Malibu will go hybrid in 2007.

Hybrids generally are more expensive than their non-hybrid counterparts. So, on average, it would take the owner three or four years in gas savings to make back the higher initial cost of the vehicle.

It's been said that Americans are environmentally conscious - as long as it doesn't cost them anything. So as an

added incentive, Uncle Sam is offering tax breaks to buyers of hybrid cars through 2006.

Some see the hybrid as the technology that will help to transition us from combustion-engine vehicles to hydrogen-powered fuel-cell vehicles. But hydrogen-powered cars are not expected to be available until at least 2010.

In the meantime, consumers may find that (with apologies to Jim Henson) it is indeed "easy being green." You can go easy on your pocketbook and as well on the environment by driving a hybrid.

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