

Mean Green Driving Machine

THE year 2000 automobiles are now on sale. If you plan to celebrate the start of the millennium this January 1, the cars that are now in America's showrooms are the first new automobiles of the 21st century. If you agree that the century starts in 2001, then today's new vehicles will usher in the

new millennium 12 months from today. The new century will bring significant inventions and innovations to future automobiles.

This month's column will look at one innovation that has recently proven itself in Japan. It is expected that this new automotive powerplant will enter all world markets by the turn of the century. It is interesting to note that this new technology has some very old 1900s ideas on board. Very few people realize that electric cars were very much in vogue some 80-odd years ago when they were 38 percent of the vehicles on the road. The electric car died an early death because it couldn't compete with the internal combustion engine of its day. Can a new twist on the electric car, the hybrid, dethrone the present internal combustion vehicle during the 21st century? Let's look at the technology behind hybrids.

The first production hybrid powered vehicle, the Toyota Prius, has been on sale in Japan for over a year. In U.S. dollars the car costs about \$18,000. Car tests performed in Japan showed that this automobile could deliver 68 miles per gallon while spewing out 89 percent fewer emissions from its tailpipe.

The Japanese



Photo 1—GM's EV1.
Photo courtesy of General Motors.

public reaction to this vehicle that can go from 0 to 60 in 14 seconds has been very favorable, causing Toyota to raise production from 1,000 to 3,000 vehicles per month. It is an electric vehicle, with a gasoline engine on board. The gas engine and electric motor together deliver the performance of a regular automobile without any of the inconveniences of outside battery charging or limited driving range.

The Toyota Prius (Fig. 1) is a front-wheel drive vehicle that is powered by both an AC electric motor and a 1.5-liter gasoline engine. This makes the vehicle a Parallel Gas Electric Hybrid. A sophisticated computer system orchestrates the fusion of the two systems.

Just as a mule is a hybrid of a donkey and a horse, hybrid automobiles take the best characteristics of both power plants. When a lot of power is needed, both the battery-powered electric motor and the gas-powered engine work together to drive the wheels. The gas engine also recharges the batteries that power the electric motor, and a regenerative braking system allows the electric drive to recycle energy when the brakes are applied. Since the term "hybrid" specifically means putting two different things together, different automobile manufacturers are currently testing different combinations, including fuel cell hybrids that would run on electricity created through an oxygen-hydrogen chemical reaction. The fuel cell hybrid is considered the holy grail in automobile research since the by-product of combustion would only be water. This engine, however, is at least five years from mass production.

Hybrid engines ready for production can also be series in design. In the

parallel design, both the electric and gas engine deliver power to the wheels. Most manufacturers use a parallel design that is similar to the Toyota Prius. GM, however, has developed a four-wheel drive design that has the gas engine powering the rear wheels and the electric motor powering the front (Fig. 2) for a whopping fuel efficiency of 80 mpg and an acceleration of 0-60 in seven seconds. The GM Series Hybrid is quite different than its Parallel Hybrid siblings. This design allows the driver to throw a switch to drive this EV1 (Photo 1) as a pure electric vehicle with an average range of 80 miles (see my September 1996 column). With the switch in the hybrid position, the vehicle's gas turbine engine (Photo 2) produces enough electricity to power the vehicle's electric drive (60 mpg). A specific characteristic of the series design is that the gas turbine never drives the wheels.

The competition to be the first hybrid production vehicle in America includes a new and improved Toyota Prius Gas Parallel Electric Hybrid (68

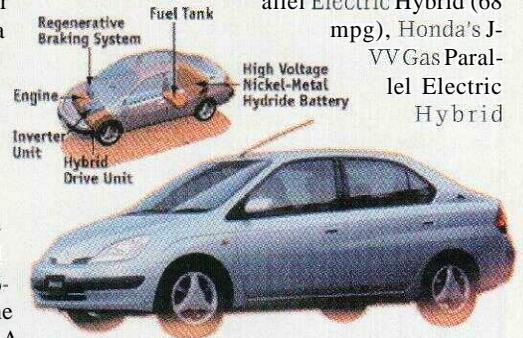


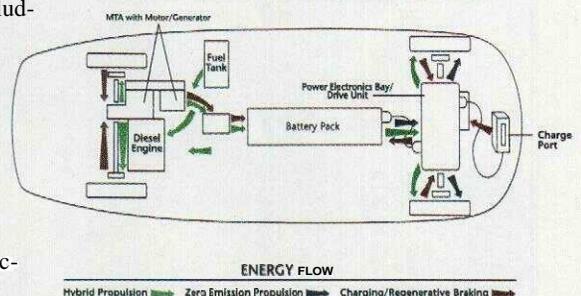
Fig. 2—GM's four-wheel drive design that produces fuel efficiency of 80 mpg and an acceleration of 0-60 in seven seconds. Illustration courtesy of General Motors.

(70 mpg), Chrysler's Intrepid ESX2 Direct Injection Diesel Hybrid (75 mpg), Ford's P2000 Direct Injection Diesel Parallel Hybrid (70 mpg), and the two GM EV1s described above. On July 6, 1999, Honda announced that their new hybrid vehicle, code named the J-VV, will go on sale this December under the new name Honda Insight. As soon as automobile manufac-



Photo 2—EV1's gas turbine engine.
Photo courtesy of General Motors.

PARALLEL HYBRID ELECTRIC



ENERGY FLOW
Hybrid Propulsion → Zero Emission Propulsion → Charging/Regenerative Braking →

Fig. 1—The Toyota Prius.
Illustration courtesy of Toyota Motor Corp.

turers mass produce hybrid vehicles that can deliver 80 miles per gallon, go 0 to 60 in seven seconds, and produce almost zero pollution, we will have us one mean, green driving machine, for the 21st century.

For more information on hybrids, you can start your search on the internet at the following addresses:

<http://spiderman.inel.gov/>

<http://www.toyota.co.jp/e/green/>

Recalling the Facts

1. When does the new millennium begin?
2. When were the first electric cars introduced in America?
3. How does a hybrid car differ from an electric or regular gas powered vehicle?
4. What's the difference between a Parallel and a Series hybrid vehicle?



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Malow Junior High School, Shelby Township, MI

Submitted by Harry Istok, Drafting Instructor

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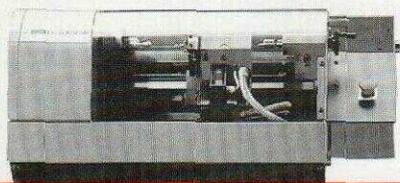
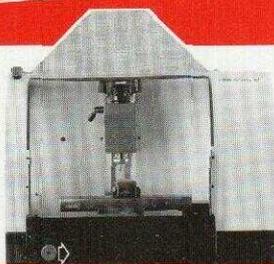
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