DUDE, WHERE'S MY HYBRID?

Detroit is joining Toyota and Honda in the hybrid-vehicle market. It's trendy, but is it a business? by Stuart F. Brown

Now here's a social dilemma: Say Cameron Diaz calls to ask if she can come over to your house right after the post-Oscars parties. You're tickled, of course. Then you realize in a panic that you don't have an industrial extension cord to plug in her electric car. Just take a deep breath and relax. It's not one of those dumb battery cars. Hers is a gasoline-electric Toyota hybrid that *never* needs plugging in. Whew! No problem after all.

Diaz is just one of a horde of celebrity types who have helped Toyota achieve a PR coup with its Prius compact hybrid, which can get 52 miles per gallon in city driving. *Seinfeld* creator Larry David even wrote the Prius into his HBO series *Curb Your Enthusiasm*. Honda's on the high-fuel-efficiency bandwagon too, with its little two-seater Insight hybrid and a hybrid version of the trusty Civic. And you'll be hearing a lot more about hybrid vehicles soon, as the Detroit automakers begin rolling out their own entries in the nascent market. It's a field full of buzz, though nobody can say yet if there's a real business there.

Americans surprised the auto industry by buying 36,000 Toyota and Honda hybrids last year, a number that's expected to blossom to some 58,000 hybrid sales this year, according to the research firm J.D. Power & Associates. Viewed as a percentage of total U.S. vehicle sales, hybrids so far are trivial, accounting for just 0.2% of the market last year. But growth like that is hard to ignore, so General Motors, Ford, and DaimlerChrysler are hustling to get in on the action, with varying degrees of urgency. Their motivations are legion.

General Motors CEO Rick Wagoner astounded the Detroit auto show earlier this year when he announced that by 2007 the company will be tooled up to produce three types of hybrids in volumes as high as a million per year, if the market wants them. GM's first offerings, hybridized versions of the Chevy Silverado and GMC Sierra pickup trucks, will go into production this year. Next year, hybridized Ford Escape SUVs and Dodge Ram pickup trucks will go on sale.

But as the Detroit automakers labor to get their hybrid offerings

THE "IT" CAR

Toyota's fuel-sipping Prius is so hot that it even has a supporting role in the HBO comedy *Curb Your Enthusiasm*.

STARS AND THEIR CAR

Celebrities with Priuses include (clockwise from bottom): Harrison Ford and Calista Flockhart, arriving at the Oscars; Cameron Diaz, leaving the *Vanity Fair* Oscar party; and Leonardo DiCaprio.

into production, they may find themselves feeling—once again—that they are playing catch-up with the Japanese. Toyota's Prius was introduced in the U.S. in 2000, and in Japan in 1997. This month a second-generation version of the compact hybrid will be rolled out at the New York auto show. And in two years, Toyota's Lexus nameplate will introduce a high-performance hybrid version of its new RX330 luxury SUV as part of a hybrid sales push that Toyota president Fujio Cho hopes will reach 300,000 vehicles per year worldwide by mid-decade.

A lot of people aren't quite sure what's different about hybrid vehicles. Their recent adoption by Hollywood trendies might suggest that there's some new sort of magic under a hybrid's hood. Arianna Huffington has proclaimed them to be vehicles of peerless moral standing. Is there some kind of morality amplifier in there? A number of citizens polled unscientifically over dinner in recent months have revealed their fear that hybrid cars need to be plugged in for recharging every night. And so forth.

To clear the air on the hybrid topic, so to speak, here's a primer: They are fueled by gasoline, and nothing else. Hybrids' powertrains, as engineers like to call the engine-and-transmission combination, have a traditional piston engine and incorporate some extra electrical components, including an electric motor-generator, a black box full of high-energy circuitry, and a bigger battery than a regular car's. A hybrid can deliver fuel-economy improvements of 10% to 50% depending on the ambitiousness of its design and the way it's driven. The gains come from capturing normally wasted braking energy in the form of electricity and pumping it back into the battery, and from shutting off the engine briefly at stoplights. Hybrids also use their electric motors to provide some or all of the vehicle's power at speeds at which the gasoline engine is inherently inefficient. Hybrids cost more to manufacture than their traditional piston-engined counterparts, and the ones that have the best fuel efficiency tend to cost the most to build because of their increased engineering complexity and the pricey extra

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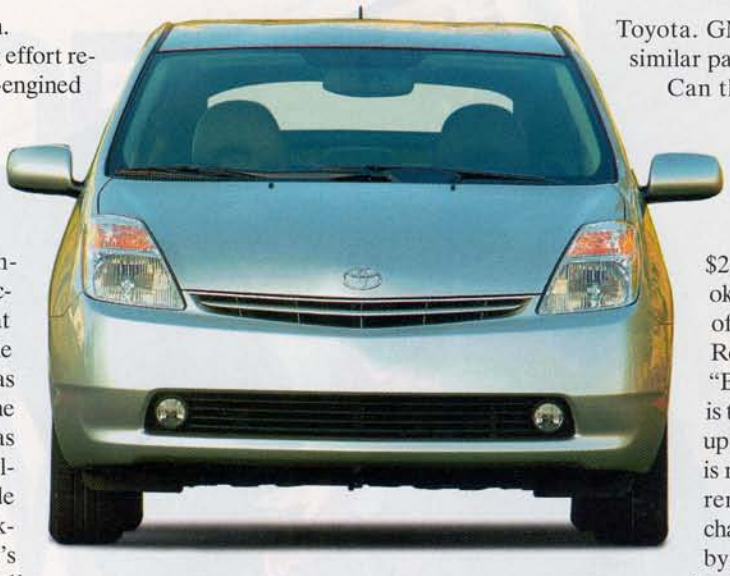
components that they contain.

The amount of engineering effort required to "hybridize" a piston-engined vehicle's powertrain ranges from moderate to gigantic, depending on how enterprising the design is. A lot of the work goes into developing the sophisticated computer controls and "power electronics" in the black box that shuttles electricity between the motor-generator and battery as driving conditions demand. The humble Prius, for example, has no fewer than six chips and zillions of lines of computer code directing its underhood workings, which rival a small town's electric grid. Developing all that stuff and making it work smoothly takes a lot of time and money. Being first out of the gate is an advantage for Toyota and Honda, which have already refined the designs and lined up the component suppliers needed to build their hybrids.



NEXT GENERATION
The new Prius rolled out this month aims to get even better mileage with low wind drag.

Some automakers will probably never offer hybrids, while others will end up purchasing the components needed to hybridize their vehicles from outside suppliers, to save on development costs. Both Toyota and GM have said their hybrid bits and pieces will be available for sale to other automakers, and Nissan has already agreed to purchase hybrid components from Toyota. GM is expected to announce similar partnerships soon.

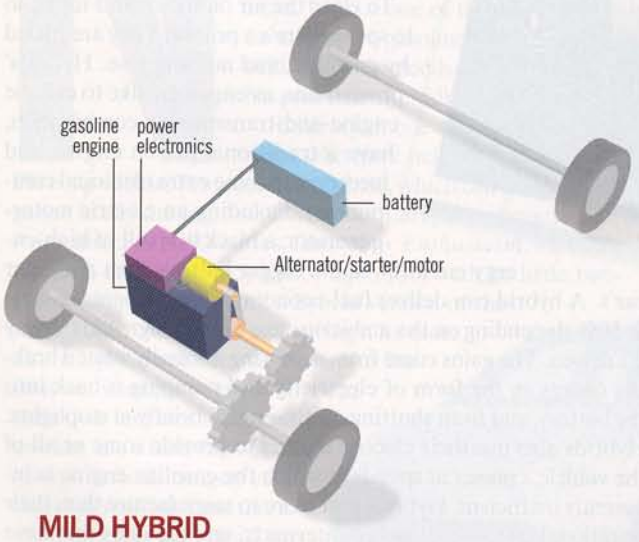
Can the automakers make a real business out of hybrids? "If a hybrid costs $3,000 more to build than a conventional powertrain, and the government is going to kick in a $2,000 tax credit, that's probably okay," says David Cole, director of the Center for Automotive Research in Ann Arbor, Mich. "But if the tax credit goes away, is the customer expected to pick up that $3,000 premium?" Cole is referring to the tax credit currently available to hybrid purchasers, which will be phased out by 2006. A bill sponsored by Utah Senator Orrin Hatch would increase the tax break for hybrid buyers to as much as $4,000, but has yet to make its way through Congress.

Like America, Japan has a fledgling hybrid market. But the interest in Europe is almost nil, and you won't be seeing a hybrid Mercedes or Volkswagen in a U.S. show room any time soon. In their quest to squeeze more driving miles from expensive fuel, the Europeans have been buying advanced diesel cars by the millions. These new-generation diesels use electronic controls and new fuel-injection systems to make good power, without clatter and black smoke. The advanced diesels would have a hard time meeting EPA pollution rules in this country, however.

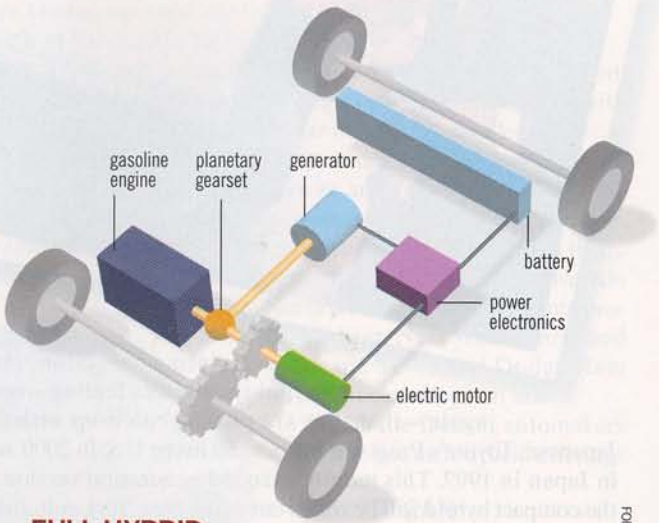
One thing that's certain about hybrids is that they are great for green PR. Toyota and Honda have used their hybrids to nur-

HOW HYBRIDS USE ELECTRICITY TO STRETCH A GALLON OF GAS

Normally wasted braking energy is captured to supplement gasoline in varying degrees.



MILD HYBRID
A slightly modified standard engine combines the alternator and starter into one component that can charge the battery as well as boost engine power.



FULL HYBRID
Complex electrics manage the "parallel" design that pairs a smaller engine with an electric motor. It offers higher fuel efficiency, but at a price.

FORTUNE GRAPHIC

ture reputations for smart engineering and environmental sensitivity. The other manufacturers may look like slightly late arrivals on the scene, but it's hard to see how adopting fuel-conserving technology in some models could hurt their images. Then there's the all-important matter of the corporate average fleet economy, or CAFE, rules. Although it is moving aggressively into full-sized pickup trucks, Toyota has always managed to stay within the CAFE limits. And Honda, which has a very fuel-efficient fleet of products, is in no imminent danger of facing CAFE worries. But at the Detroit Big Three, where fuel-thirsty SUVs and light trucks are the profitmakers, staying on the right side of the CAFE regulations is a worry that significant hybrid sales could mitigate. Makers that exceed the CAFE limits draw fines from the federal government and criticism from environmentalists. "The Big Three have been just sort of skating along, barely making their light-truck CAFE numbers every year," observes Walter McManus, executive director of global forecasting at J.D. Power & Associates. "The mild-hybrid pickups could help them meet the proposed 1.5 mpg increase in the CAFE standard for trucks."

Having pitched the compact Prius to environmentally minded efficiency buffs, Toyota will be taking a different and interesting approach to marketing the Lexus 330 hybrid SUV. "We're going to position it as a V-6 vehicle with the performance of a V-8, and by the way, it has four-cylinder fuel economy," says David Hermance, executive environmental engineer at Toyota Technical Center in Torrance, Calif. "With the upscale vehicle, you've got to sell the customers on performance, and give them the fuel economy." Hermance says it adds more than $2,500 to the production cost of a Corolla-sized compact car to make it into a Prius hybrid. So far, Toyota and Honda haven't fully passed along to customers the added costs of building their hybrids, which sell for about $20,000. But in pursuing the luxury-performance segment, Toyota is trying to make the hybrid feature pay its own way.

Expect confusing claims in the next few years about whose hybrid is the real thing. Every maker adding some electrical propulsion and regenerative braking to its piston-engined vehicles will be calling them hybrids. But some will contain more extensive engineering, and more cost, than others. Engineers talk about hybrid designs ranging from "mild" to "full" (see diagram). The most modest setup is the belt-driven starter-alternator GM will offer on its Chevrolet Equinox and Malibu in

IS THERE A HYBRID IN THE ARMY'S FUTURE?

Mobility has been a catchword in the war in Iraq, and mobility begins with fuel. Diesel fuel may be cheap, but some armored vehicles burn more than a gallon a mile, and the Army spends as much as $400 per gallon transporting diesel fuel to battlefields. So it's a no-brainer for the Army that hybrid diesel-electric engines consuming 20% less fuel would be preferable to its conventional diesels.

The gigantic fuel-hauling costs begin to make sense when you consider that the military doesn't count on finding gas stations out there; it brings all its own stuff. "One of the largest expenses we have in time, money, and resources is keeping our vehicles fueled and moving," says Brigadier General Roger Nadeau. Thus any reduction of the "logistics tail" of tanker trucks, drivers, mechanics, cooks, medics, and so forth that follows fighting forces wherever they go quickly adds up to a big deal.

General Motors built this prototype military hybrid from a beefed-up Chevy Silverado pickup equipped with hybrid components, which were developed by its Allison Transmission division for use in city buses. In addition to saving fuel, a hybrid powertrain enables the truck to drive silently for short distances on battery power, which can provide a tactical benefit. Silence isn't the only advantage: A hybrid truck running on its electric motor is hard to spot through an infrared scope, once its diesel engine has cooled off.

TEST BED
GM developed this diesel-electric hybrid truck to help the Army reduce its huge fuel costs.

The Army's Tank-automotive and Armaments Command (a.k.a. TACOM) will be testing the prototype under its commercially based tactical truck (that's Combatt) program, as it considers investing in a fleet of as many as 30,000 hybrids by the end of the decade.

In a box on the back is a mast-mounted infrared night-vision device and a prototype fuel-cell stationary generator that can silently produce a household's worth of electricity for up to five hours. That could come in handy down the pike, when the Army may field exotica like electromagnetic railgun weapons.

PAUL SANCYA—AP

2006 and 2007. It consists of an electrical gadget that replaces the truck's normal alternator and starter motor. Electronic controls switch it from being a generator to being a motor, as needed. The system gathers energy and stores it in a battery when slowing down, and adds some electric power to the truck's piston-engine power when accelerating. It also starts up the piston engine when you turn the key.

The next level up in complexity puts a slim, large-diameter starter-generator where the engine's flywheel normally would be. It is the system used by Honda in its Insight and Civic, by Dodge in the Ram Contractor Special pickup it will sell next year, and by GM in the Chevy Silverado and GMC Sierra pickups it will start building later this year. The Dodge and GM systems will also function as stationary generators when idling in park, letting the truck owner plug in power tools such as saws and drills at remote worksites.

The most complex systems are "parallel" designs that enable a vehicle to move on its own at low speed solely under electric power. These systems trade the cost of additional hardware for the benefit of even greater fuel efficiency. Toyota's Prius, the Ford Escape hybrid that's coming next year, and GM's hybrid Saturn VUE, a small SUV that will go on sale in 2005, use parallel designs.

"With the upscale vehicle, you've got to sell the customers on the performance, and give them the fuel economy."

The technology is here, but will people care enough about fuel economy to make hybrids a real market segment? If geopolitical anxieties once again push fuel efficiency into the calculations of vehicle shoppers, the automakers will have three choices: (1) Start shrinking the size and weight of their products; (2) Solve the emissions hurdles facing advanced diesels; (3) Hybridize, to whatever extent people are willing to pay for.

We're now in a period of high crude-oil prices induced by the war in Iraq, the supply disruption in Venezuela, and a cold winter that drove up demand for heating oil. But once those conditions have passed, America's gasoline prices are likely to return to bargain-basement levels. Ample worldwide oil and gas reserves mean that fuel prices are likely to remain reasonable for at least another decade or two, depending on how heavily governments choose to tax them. Facing $5 per gallon prices at the pump would doubtless transform people's vehicle choices, but it's hard to imagine Congress pushing for heavy gasoline taxation anytime soon.

A wild card that could change the national thinking about hydrocarbon fuels overnight is the weather. If global warming were to produce a giant storm of the sort scientists have warned about—erasing mankind's presence from Florida, say—or if those threatened sea-level increases began noticeably gnawing away at low-lying coastal areas, the policy picture would change quickly.

A MILLION A YEAR?
That's how many hybrids CEO Rick Wagoner said GM could be building by 2007—if the market wants them.

Over the next few years the manufacturers will learn just how much fuel economy is worth as customers in the show rooms make their own return-on-investment calculations on the added cost of hybrid technology. It's possible that hybrids will turn out to be a case like VW's New Beetle, where most of the people who really wanted updated Beetles bought them in the first few years, and then sales drove off a cliff. If hybrids end up being show room duds, the manufacturers will put the technology on the shelf, to be tried again someday when fuel prices are higher. Remember the caveat GM's Wagoner attached to his newsmaking million-hybrids announcement: if the market wants them.

Looking further down the road, carmakers like Toyota point out that the electric-drive, power-control, and battery systems that hybrids need will also be key building blocks of the fuel-cell cars that could begin getting into volume production in a decade or so. Extract the piston engine and gas tank from a hybrid, and drop in a fuel cell and some sort of hydrogen storage, and you're off into the clean green future, the argument goes. They are right about that. Experience gained from the uncertain hybrid business will be critical to getting into the even more uncertain business of fuel-cell cars. It's just too early to say more. F

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