

ROAD TEST TOYOTA PRIUS

Fuel economists wanted.

BY FRANK MARKUS

PHOTOGRAPHY BY AARON KILEY



The torrent of automotive enthusiasm has many eddies. Some car nuts get off on loading their rides with aircraft hydraulics capable of bouncing them six feet off the ground. Some jack up their trucks for the sole purpose of crushing stacks of fully depreciated cars. A few on the lunatic fringe fill their cars with deafening stereos or cover them in sod, mirror fragments, or plastic lizards—all in the name of art. And when you think about it, is a two-passenger car that is designed to sprint through a quarter-mile in 11 seconds, dart around corners at 1.00 g, and stop on a dime any less quirky than any of the above? No, that's just the current we splash in most enthusiastically.

The wheeled lozenge you see on these pages wafts along on yet another current (actually two currents—direct and alternating)

with the overall goal of traveling from A to B while leaving behind as little environmental evidence as possible. It's a laudable goal, and one we're developing a healthy appreciation of and, in some cases, even an enthusiasm for—the Prius made our 10Best list this year.

Toyota's new Prius is still a nerd's car. The engineers on our staff are the ones who wax the most eloquently about the NASA-grade technology found onboard this gas-electric hybrid. Can you blame us? Four 32-bit computers control practically every system by wire—throttle, brakes, even air cooling and heating. The steering is still mechanical, but its electric assist is computer controlled.

The original Prius's basic tech carries over, from the DOHC 16-valve low-compression-ratio/high-expansion-ratio Atkinson-cycle engine to the continuously variable tranny that directs traffic between power coming in from the engine and motor and going out to the generator and drive wheels. But for 2004 the output and efficiency of the engine, motor, and generator are all improved. Lighter, lower-friction pistons, a revised combustion-chamber design, and remapped variable valve timing help increase engine power by six ponies, to 76. Stepping up the operating voltage from 274 to 500 volts helped boost the electric motor's output from 44 horsepower and 258 pound-feet of torque to 67 and 295, respectively, and increased the capacity of the system to return braking energy to the batteries. Upping the generator's peak speed from 6500 to 10,000 rpm improves battery charging and adds flexibility to the entire hybrid system.

To these enhancements are added entirely new innovations

such as a "heat battery"—a three-liter stainless-steel thermos that keeps coolant hot for days and then cycles it directly to the cylinder head prior to cranking the engine to reduce the amount of fuel required on startup and thereby lower hydrocarbon emissions. The new air-conditioning system uses an electric compressor so it can operate without the gasoline engine, and its evaporator routes coolant through new vertically oriented micropore tubes that are so much more efficient that less refrigerant is needed (after all, even the newer R134a Freon replacement is considered an eco-unfriendly greenhouse gas).

The switch to brake-by-wire brings many benefits, one of which, oddly enough, is a slightly more normal pedal feel. Apparently, it's easier for a computer to decipher how much braking the driver wants, apply some regenerative electrical retardation and/or some old-fashioned hydraulic *whoa*, and then generate a plausible pedal effort. The old car's less-coordinated regeneration made the brakes difficult to modulate in smooth subpanic stops. The new brakes can also hold the car on a steep incline, provide panic assist, and custom-tailor the force at each wheel under varying loads and driving conditions.

Steering feel was never one of the previous Prius's stronger selling points, so the electric-assist system was upgraded to a constant 19.1:1 ratio (the old one was variable) and given quite reasonable heft. But perhaps more important, the helm is now commanding a decent set of tires—P185/65SR-15 Goodyear Integritys, up from the old car's P175/65SR-14 Bridgestones. The Goodyears are built to favor fuel economy over luxurious touring or sporty autocrossing, but they roll relatively quietly down the road and generate 0.76 g of sideways stick in the corners and 0.89 g in a straight line under braking (enough to halt a 70-mph Prius in 184 feet). Those numbers equal the performance of the third-place VW Passat GL 1.8T in our February 2003 sedan comparo, "Splashing in the Mainstream." In other words, the Prius has little to apologize for as far as the chassis goes, and it is now a far better device in which to hurry (even enviros occasionally run late for



an appointment, after all), but it will still never garner raves for its deft dynamics.

Inside, the Prius has much to crow about. At 44 cubic feet, the rear seat pegs the average of that 10-car sedan group, and the hybrid's hatch swallows 16 cubes, besting the sedan average by one. The price of our fairly loaded example, \$23,668, even undercuts the swankiest two competitors in that test, and the aero-slick Toyota (at 0.26 Cd) looks way cooler to our eyes than most of those three-boxers. Could it be that Toyota is trying to lure even a few buyers who could care less

COUNTERPOINT

PATRICK BEDARD

All of us here believe a car's first duty is to be fascinating. By that definition the Prius is a slam-dunk. Sometimes it remains stone silent even as it squirts forward at the nudge of your right toe. Sometimes you're driving and the engine quits, but your speed doesn't change. Often the car and the engine both stop for red lights, but the power steering and the A/C never flinch. This showstopping act adds up to a heroic 59 mpg on the EPA city test. Some people—the eat-your-spinach crowd—say we should all drive such cars because they're good for the environment. Okay, but I like spinach, and compared with the Prius, most cars are plain old iceberg lettuce.

DANIEL PUND

I was wrong. I thought Honda's approach to five-passenger hybrids made more sense than Toyota's: Make it drive and look as much like a regular Civic as possible. The original dorky-looking Prius didn't operate like a regular car, with its motor and engine cycling on and off. What I'd overlooked is the power of image. When selling complicated, expensive technology aimed at saving owners a little bit of really cheap fuel, you don't want to offer something that looks or operates like a normal car. You want a car that will advertise clearly its non-regular-car status. Slicker of shape and smoother of operation, the still distinctly non-car-like Prius still does this well.

AARON ROBINSON

The Prius makes good apparel. Put it on, and the message is clear: "This one is green." As a car—just another 3000 pounds of stamped steel, molded plastic, cut glass, nonrecyclable rubber, heavy metals, and paint—it's mediocre. Slow, numb steering means the nose wanders at will on the freeway. The computerized brakes are hard to modulate, and the computerized throttle has trouble keeping a speed without computerized aid from the cruise control. The fuel saving is measurable but not worth the trade-offs. If you want to be green, buy a bicycle. If merely appearing green is enough, go for the Prius. If you want the best car for the money, look elsewhere.

about fuel consumption, independence from foreign oil, drilling in the Arctic, or global warming?

Maybe, but anyone who buys a Prius as fashionable, commodious transportation will likely be annoyed by the car's efficiency-related quirks and will probably never realize the full value of its exotic technology. To them, the acceleration will just seem slow—at 11.3 seconds to 60 mph, it is 2.5 seconds more lethargic than the dawdler of our sedan pack, the Subaru Legacy L. That it is 1.7 seconds quicker than the previous Prius will provide little consolation.

They're also likely to be put off by the sometimes nonlinear acceleration that results as the various propulsion systems vie for the opportunity to provide traction. They'll find themselves using the cruise control a lot more than one might in a "normal" car, because without it, maintaining a constant speed requires a bit more throttle adjustment than they're accustomed to. And finally, the whole starting and shifting ritual will seem peculiar to anyone whose Prius doesn't share garage space with a BMW 7-series: Sit down, press the rectangular key into the slot, press the separate button marked "power," then wait a beat or two for the "ready" lamp to come on, hit the brakes, then move the dash-mounted stub of a shifter to R, D, or B.

That "B" position will flummox those too timid to crack the owner's manual. It stands for braking and provides the lower-range gearing required by our government, but in this position the car starts regenerating energy the instant you lift off the accelerator. Conventional piston-engine braking even kicks in at higher speeds. Prius enthusiasts will revel in the B-mode's efficiency when driving in stop-and-go traffic where hybrids return their best economy. In addition to saving fuel, B-mode often negates the need to use the brake pedal. The faithful will surely get 400,000 miles out of their brake linings by planning ahead, leaving room to slow down, and eking every last scintilla of momentum out of each milliliter of fuel. They'll also enjoy monitoring their efficiency on a screen that shows instantaneous economy and averages for six five-minute intervals and since the last fill-up or reset, along with little leaf icons to indicate how much energy has been recovered during braking.

Many of us tried to drive the Prius like committed Greens. Other less patient colleagues hammered down. Our combined results: 1338 miles per 31,832 gallons, or 42.03 mpg. That's well up on the 35 mpg we managed from our last Prius, and it puts this one in fifth place in the C/D-Observed Fuel-Economy Hall of Fame, behind a



THE VERDICT

Highs: Space-age styling with enough gadgetry and processing power to turn HAL 9000 green, at the down-to-earth price of a Camry.

Lows: Muddy sound quality from an unswappable stereo.

The Verdict: A killer deal for card-carrying Greenies, who may be the only drivers capable of achieving the EPA economy numbers.

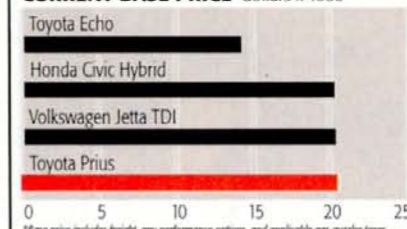


2002 Honda Insight hybrid (48), a 2000 Insight (47), a 1992 Suzuki Swift (45), and a 1998 VW Jetta TDI (43). That's still impressive, considering the Prius is bigger than all the above and that the Jetta was driven from coast to coast on the superlab.

So are hybrids the next really big thing? Well, they would be if they could all come to market like this one, priced right on top of conventional sedans of similar size but spiffed out with xenon headlamps, stability control, brake-by-wire, curtain airbags, etc. Despite Toyota's protestations to the contrary, we'll never be convinced that this car, selling at this price, earns what any Ivy League CPA would recognize as a profit. We therefore expect mass-market hybrids to be more spartan, more expensive, or probably both, at which point we wonder if diesels aren't capable of saving more fuel per dollar of vehicle production and development invested. But as long as Toyota is willing

to hang a garage-sale price on all this high-tech gear, we say catch the wave and go with the flow!

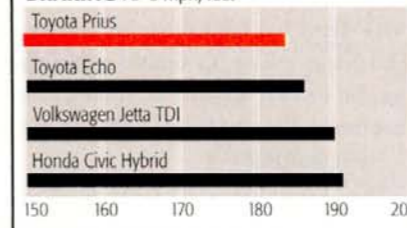
CURRENT BASE PRICE* dollars x 1000



ACCELERATION seconds ■ 0-60 mph ■ 1/4-mile



BRAKING 70-0 mph, feet



ROADHOLDING 300-foot skidpad, g



EPA CITY FUEL ECONOMY mpg



C/D TEST RESULTS

ACCELERATION	Seconds
Zero to 30 mph	3.4
40 mph	5.6
50 mph	8.2
60 mph	11.3
70 mph	15.3
80 mph	20.5
90 mph	27.6
100 mph	39.6
Street start, 5-60 mph	11.3
Top-gear acceleration, 30-50 mph	5.5
50-70 mph	7.9
Standing 1/4-mile	18.3 sec @ 76 mph
Top speed (governor limited)	104 mph

BRAKING	70-0 mph @ impending lockup
	184 ft

HANDLING	300-ft-dia skidpad
Roadholding	0.76 g
Understeer	minimal moderate excessive

FUEL ECONOMY	mpg
EPA city driving	59
EPA highway driving	51
C/D-observed	42

INTERIOR SOUND LEVEL	dBA
Idle, internal-combustion engine off	31
Idle, internal-combustion engine on	45
Full-throttle acceleration	70
70-mph cruising	69

TOYOTA PRIUS

Vehicle type: front-engine, front-wheel-drive, 5-passenger, 5-door sedan

Price as tested: \$23,668

Price and option breakdown: base Toyota Prius (includes \$515 freight), \$20,510; Option Package 7 (includes stability control, side and curtain airbags, keyless entry, fog lamps, and intermittent rear wiper), \$2255; 6-CD changer, \$589; auto-dimming rearview mirror, \$265; cargo net, \$49

Major standard accessories: power windows and locks, remote locking, A/C, cruise control, tilting steering wheel, rear defroster

Sound system: Toyota/JBL 56838 AM/FM radio/cassette/CD changer, 9 speakers

ENGINE

Type	inline-4, aluminum block and head
Bore x stroke	2.95 x 3.33, 75.0 x 84.7mm
Displacement	91 cu in, 1497cc
Expansion ratio	13.0:1
Effective Atkinson-cycle compression ratio	9.5:1
Fuel-delivery system	port injection
Valve gear	chain-driven double overhead cams, 4 valves per cylinder, hydraulic lifters, variable intake-valve timing
Power (SAE net)	76 bhp @ 5000 rpm
Torque (SAE net)	82 lb-ft @ 4200 rpm

ELECTRIC MOTOR

Type	3-phase AC permanent-magnet synchronous electric motor powered by 168 1.2-volt nickel-metal hydride batteries
Power (SAE net)	67 bhp @ 1200-1540 rpm
Torque (SAE net)	295 lb-ft @ 0-1200 rpm

DRIVETRAIN

Transmission	continuously variable automatic
Final-drive ratio	4.11:1
Transmission ratio range	infinite

DIMENSIONS

Wheelbase	106.3 in
Track, front/rear	59.3/58.3 in
Length/width/height	175.0/67.9/58.1 in
Ground clearance	5.9 in
Drag area, Cd (0.26) x frontal area (24.0 sq ft)	6.24 sq ft
Curb weight	2987 lb
Weight distribution, F/R	59.2/40.8%
Curb weight per horsepower	20.9 lb
Fuel capacity	11.9 gal

CHASSIS/BODY

Type	unit construction
Body material	welded-steel and aluminum stampings

INTERIOR

SAE volume, front seat	52 cu ft
rear seat	44 cu ft
luggage	16 cu ft
Front-seat adjustments	fore-and-aft, seatback angle
Restraint systems, front	manual 3-point belts; driver and passenger front, side, and curtain airbags
rear	manual 3-point belts, curtain airbags

SUSPENSION

Front	ind, strut located by a control arm, coil springs, anti-roll bar
Rear	trailing arms integral with a transverse member, coil springs, anti-roll bar

STEERING

Type	rack-and-pinion with electric power assist
Steering ratio	19.1:1
Turns lock-to-lock	3.7
Turning circle curb-to-curb	34.1 ft

BRAKES

Type	regenerative electric and electrohydraulic by wire
Front	10.0 x 0.9-in vented disc
Rear	7.9 x 1.4-in cast-iron drum

WHEELS AND TIRES

Wheel size/type	6.0 x 15 in/cast aluminum
Tires	Goodyear Integrity, P185/65SR-15
Test inflation pressures, F/R	35/33 psi
Spare	high-pressure compact on steel wheel