

19+53

ALL THE MATH YOU NEED: \$18,950 AND 53 MPG

BY JOE SAGE



Toyota Prius c delivers the highest rated city fuel economy of any vehicle without a plug

Many masterful new technologies were developed in the improbable pursuit of delivering a much smaller Prius at a much lower price

The amazing thing about the new Toyota Prius c is its formula of low cost (under \$19,000) and high fuel mileage (53 MPG city, highest-rated of any vehicle "without a plug," i.e. it is neither an electric nor a plug-in hybrid. The other amazing thing is what it took to get there.

The technologies behind the primary Prius are firmly established, but of course have represented well over a decade of intense research and development, bringing that fuel-sipping sedan to the public for a starting price of \$24,000. We may all be jaded by now about what that took, but it's been quite an achievement.

One thing it took was clever groundbreaking engineering. Another was a massive effort at manufacturing efficiency. Everybody would love to save money on fuel, but there are limits to just how much they will spend to do so. There's also the matter of the Prius being a smaller car (originally a compact, currently considered a mid-size), and there are limits to how much people will spend for one of those. Toyota conquered all that.

Over the past year or so, Toyota announced—and displayed concepts of—an expanded family of Prius. (The proper Latin derivative, Prii, won a contest for pluralization, but all options remain awkward.) Last summer, Toyota released the Prius v, a larger multi-purpose-vehicle format seating five (or seven in Europe), carrying significantly more cargo and starting at \$26,550 (see our September/October 2011 issue). The v stands for "versatility," though it's evocative of v for "wagon," as with Volvo.)

There was a fuel efficiency penalty to be paid for that larger Prius: its rating is 44/40/42 MPG (city/highway/combined), compared to 51/48/50 for the standard Prius. So you were paying more for purchase and paying more for fuel, but you were gaining capability. This was not a tough sell to the buying public. In fact, 33 percent of Prius v buyers are first-time hybrid buyers.

But now, a new challenge. Shown conceptually at the same time as the Prius v was the Prius c (standing for "city"). We saw the show car in New York a year ago and thought it was a beauty, ready to breathe new life and soul into the staid Prius image.

A NEW KIND OF ENTHUSIAST

We flew to Austin, Texas, to see and drive the Prius c. There, Rick LoFaso, Toyota USA corporate manager of marketing for passenger cars, told us that Toyota is rolling out a whopping 19 new or updated models this year, an average of one every 19 days—unprecedented in the company's history. The first is the Toyota Prius c.

The original Prius, LoFaso reminds us, was introduced at the turn of the new millennium as "an enthusiast car for a different kind of enthusiast." And well it surely is—your typical Prius hypermiler will rarely be confused with your typical Viper rally driver.

All in all, the formula has been a smashing success. Prius has the highest brand awareness, the highest sales and the highest loyalty of any midsize car—hybrid or otherwise. It's no wonder the Prius name has stuck, as the Toyota hybrid lineup has expanded.

The nomenclature for the Prius c is based on its suit-



The original concept version of the Prius c, shown at the New York International Auto Show in April, 2011.

ability for city driving, but its price and general spunk are attractive to a young and active buyer, urban or otherwise. Its 60/40 split rear seat is tailor-engineered to accommodate bicycles or snowboards. But affordability is attractive not just to the young.

Affordability may not normally be particularly difficult to achieve in a downsized car, but the Prius is not typical. Its technologies, particularly its need for a heavy battery pack, and the weight of other components to support that, were already engineered as efficiently and economically as originally possible. To do more so would require a lot of new engineering, and that would cost more money. Expenses in R&D can be recouped in a product with a premium price. But in one with a lower-than-ever price? This was Prius c's prime challenge.

The standard Prius (Two, Three, Four or Five) runs from \$24,000 up to a hair under \$30,000 for a Prius Five. The Prius c (One, Two, Three or Four) was targeted at under \$19,000 and has indeed come in at \$18,950, with its Prius c Four iteration at \$23,230—the top model Prius c still beating the base standard Prius.

Dave Lee, senior product communications specialist for Toyota, explained that "fit" was the essence of the downsizing solutions. Key elements couldn't be scaled down in a normal cost-cutting manner. Components'

locations had to be addressed anew, and though they did have to be reinvented at smaller size, both would drive significant new investments in the project.

THE HIGH COST OF EFFICIENCY, ECONOMY

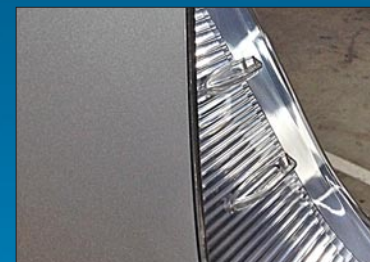
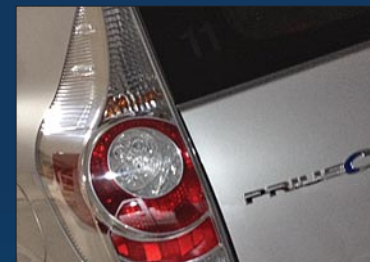
The Prius v, despite a noticeably larger bulk and greatly increased carrying capacity, is just 5.3 inches longer than the standard Prius. The new Prius c, on the other hand, is a full 19.1 inches shorter than the standard (more than two feet shorter than the v). It's easy to see that creating the Prius c would be a huge endeavor compared to creating the Prius v.

The Prius c is the same basic size as the diminutive Toyota Yaris, which nobody would mistake as anything but small, small, small. The Prius c looks like a standard Prius "that has been washed in hot water," jokes Lee.

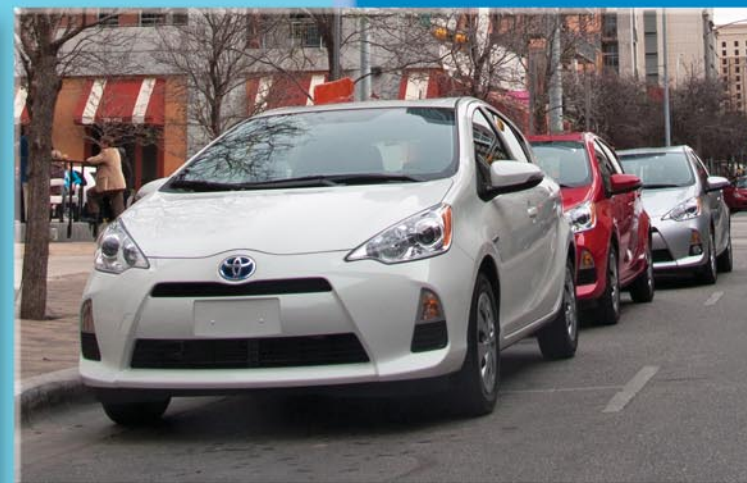
First was the engine: there was no room for the 1.8-liter engine of the larger Prii, so they built a modified Hybrid Synergy Drive system based on their longstanding 1.5-liter DOHC 16-valve four. There are no belts on the engine—everything is electrically driven. Therefore, there is no horsepower or efficiency loss, plus there will be lower maintenance cost. This electric motor system,



PRIUS C AERODYNAMICS



Little things mean a lot. Extreme attention to detail brings small aerodynamic vanes into play on the lights, mirrors and other key spots front and rear. The smoother airflow thus created contributes to the magic formula of high MPG for low cost.



AUSTIN TEXAS SCRAPBOOK



says Lee, is “basically service-free.”

The battery is a challenge in any electric or hybrid vehicle, and Toyota had already conquered it with years of development in the Prius. (Toyota notes that their battery experience has a solid history of success: now over 11 years, with a replacement rate of just one percent.) But of course that battery wouldn't fit here. But time marches on in such fields, so the engineers looked for new opportunities—and found them. The battery in a standard Prius is a 168-cell unit weighing 98 pounds and generating 1.2 kWh (kilowatt-hours) of energy. A new battery for the Prius c has 120 cells, weighs 68 pounds and generates 0.87 kWh. A big tradeoff? Lee says that since the Prius c itself is smaller and lighter, the difference in output is negligible. The difference in size and weight, however, is huge. The battery is also installed lower, at floor level, which helps balance and handling.

Everything that was done to create a small Prius could fill a book, but the bottom line is that Toyota has delivered the fruits of enormous R&D—at a new, lower price. It truly is a remarkable opportunity for the buyer.

OPERATION AND FEATURES

As with the familiar Prius, there are three drive modes: normal, ECO and EV. Under 25 mph, the EV (electric vehicle) mode operates in non-combustion silence—or near-silence, as this year's hybrids incorporate a light whirring sound till about 25 mph, to alert children and pedestrians to their presence. Above 25 mph, ECO smooths out the input of your itchy foot, so a heavy pedal or “light switch” (on/off-on/off) driver will particularly benefit. Toyota recommends a “pulse and glide” technique: nail it for strong electric torque to about 30-35 mph, then ease off the accelerator and watch the gauge as its arrow indicates charge feeding the battery. Ease your foot back onto the accelerator until the arrow goes away, i.e. engine and regeneration are in stasis. You can cruise like this for some distance. As your speed drops toward 30 mph, repeat the sequence.

Just remember to have some respect for traffic around you that's trying to maintain a normal flow.

Aerodynamics are notoriously hard on smaller cars, but Toyota has left no stone unturned nor feather unflapped in this pursuit. Against the standard Prius's 0.25 drag coefficient (cD), the Prius c was engineered to

a cD of 0.28. Beyond the usual overall shaping and undercarriage treatments, this was tweaked, as shown on the prior page, by a multitude of tiny fins on lamps, mirrors (and undercarriage) to control vortex effects.

The car's brakes are very strong, due to the effects of the regenerative system. Before our drive, we were cautioned to be careful about just how good they are.

Steering is electric—no belt—as with the rest of the engine's components. The turning circle is a nice, tight 31.4 feet (but 37.4 feet on the Prius c Four with optional 16-inch wheels). The a/c compressor is also electric, so you can operate the Prius c in the heat of an Arizona summer—except in ECO mode.

The shift lever was created in a more conventional form, not a joystick adaptation—part of winning over new customers, who will welcome a traditional layout.

Features beyond traditional include the new Toyota Entune system, a comprehensive entertainment and data system comprising music, navigation and much more, all accessed via a downloadable app. Navigation uses Bing, so it always has the latest information available, not dependent upon hard disk or DVD upgrades.

The ECO display is new and almost hands-free—hovering your hand above its wheel-mounted controls gives you eye-level information readouts.

The instrument panel is designed to give both the driver and the front passenger the feeling of “60 percent reach” within the space. With this in mind, we were disappointed to note that multi-information display operation is only accessible to the driver. Since this is fun and informative but distracting for the driver, but could be fun, informative and a great road trip time-killer for a passenger, we would change this. We also didn't get the 60 percent feeling on the passenger side in general, so this would help that.

Overall, we had a great drive in our Prius c, through the city streets of Austin, out into the more built-up hills close to town, and back along some busy frontage roads—good c-as-in-city driving. If you've been contemplating hybrids, you are already thinking about Prius. If you're interested in saving some six thousand dollars, and getting some even newer technology into your garage, you will definitely want to try the Prius c on for size. It's a technological tour de force. Remember: under \$19,000, and 53 miles to the gallon. Try to beat that. ■

Shown here are the familiar standard Prius, the new-last-year Toyota Prius v, and the new-this-year Prius c.

