

# “Why don't I get the EPA Mileage?”

An Explanation of Fuel Economy impactors and How You Can Improve Your MPG

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## **INTRODUCTION**

As you will discover reading this document and driving your Prius, there are myriad reasons why your MPG will fluctuate. Because one of the most commonly publicized features of the Prius is the mileage, one of the most common questions posed by drivers is why they are not matching the Environmental Protection Agency's (EPA's) determined averages.

By law, the EPA tests every car to determine how many miles per gallon the car is capable of driving. They began this practice in the 1980s after the oil crisis. Because the public was interested in purchasing cars with high mileage, the government feared that manufacturers would “exaggerate” the EPA's findings. For this reason, manufactures are required to report in advertisements and on the cars themselves the actual, unaltered numbers resulting from the EPA's tests.

However, as you will see in the following section, the EPA's tests are no longer accurate for current driving conditions and the newer technologies in cars. In some cases, such as with Hybrids, even though the EPA's numbers are high Toyota is required to report them as accurate. With most cars, drivers are not concerned that they do not achieve the EPA mileage on a regular basis, but with the Prius' real-time MPG reporting and lifetime MPG tracking, drivers immediately recognize discrepancies.

Toyota, rightly, advertises the Prius with the EPA determined gas mileage of 51 highway, 55 combined, and 60 city. Part of the excitement of getting the Prius is seeing these numbers 'right out of the box'. More often than not, that does not happen. This article will attempt to clarify some of the reasons why. You will also find suggestions, driving techniques and tricks to help you boost your overall mileage.

## **THE EPA NUMBERS**

When the EPA tests cars and rates their gas mileage they do not actually drive on a road. They use a device called a dynamometer, shown on the right. Their test-driving pattern has not changed in over 20 years.

- The “city” portion is nothing like what most of us consider city driving. There are many stretches of 1/2-2 miles at 21mph. Although there are many stops incorporated into the test, there is nothing like the stop and go driving of a real city. The Hybrid system of the Prius is most efficient when able to maintain a constant speed and least efficient when accelerating from dead-stops. Thus, many people in 'real' cities who stop more frequently do not see anything like the EPA's city mpg numbers.
- The “highway” test portion is equally outdated with an average speed of 48mph. Those who use the American interstate transit system know that posted speed limits seem to be, in reality, the minimum speeds. Most vehicles travel in the 75-80mph range making this portion of the EPA test equally unrealistic.



To further exacerbate the issue of inaccuracy with “real world driving”, the EPA tests all the cars in a temperature- and climate-controlled building at 68-86 degrees Fahrenheit. For the highway portion of the test, they warm the engine before initiating the test. For the city portion, they cold-start the engine. During both tests, they turn the car's air conditioning off and hills are not simulated. To determine gas usage, the Carbon-Dioxide content of the car's exhaust is measured.

See [How Vehicles Are Tested](#) in detail at this link, complete with photos.

- a) Recall that the EPA determines the consumption of gasoline by measuring the Carbon Dioxide consumed during the test. However, if the battery's State of Charge (SOC) was high during their testing, the battery might have been assisting the engine during a good portion of the test, relieving load from the engine. This provided excellent results for the test, but every Prius owner knows that the engine will engage as needed to recharge the battery. During the recharge cycle, MPG will drop slightly, affecting the overall mileage.
- b) All cars suffer their lowest MPG in the first 5-10 minutes of driving while the vehicle warms up. If you frequently make trips of 5 – 10 minutes, the engine is unlikely to achieve its most efficient operational condition.

## **OTHER FACTORS**

Especially early in the Prius ownership there are a number of other factors that come into play. Many of these items will seem to go away on their own while others will become second nature to you.

- 1) Break In: Almost universally, Prius drivers have noticed an improvement in mileage at about the 5,000-6,000 mile mark. The first generation Prius owners and a few 2nd generation Prius owners who have passed the 20,000-mile mark also note a “secondary break-in” period. It seems that the engine friction, wheel bearings, and other moving parts “loosen up” over that first 5,000 miles. In addition, the High Voltage Nickel Metal Hydride (NiMH or HV) battery becomes more efficient with time.
- 2) Technique/Style/Learning Curve: By paying attention to the real-time and lifetime mileage displays, most Prius drivers intuitively or through trial and error improve their driving technique to better take advantage of the most efficient modes of driving their car. Not all drivers do this, but it becomes almost a game. In time, you can learn to accelerate the vehicle in the most efficient manner. Most beneficial is to anticipate stops and begin coasting or gliding to those stops without wasting power getting there or putting undue stress on the friction brakes.

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- 3) **Warmer Temperatures:** All praise to summer. The Prius is at its most efficient in warm weather. This is particularly true in that range of temperatures where A/C use is not necessary but in a range that is 'comfortable' to the car and HV battery. Almost everyone sees a dramatic improvement in fuel economy in those summer months and reports of *exceeding* the EPA numbers begin to frequently appear on the forums!

In the same way that warmer temperatures improve overall mileage, colder temperatures will hurt it. This statement is true for all cars, not just the Prius. Even at moderately cold temperatures, such as 50°F, there is a noticeable impact. Though the influence of temperature affects all cars, it is more apparent in vehicles like the Prius.

A good example is to compare the Prius and a Toyota Camry to see the relational impact of temperature. To create a baseline for comparison, we will assume that both cars realize a 10% decline in miles per gallon as the temperature drops from 72°F to 45°F. As you can see, a 10% reduction in the Camry is a hardly noticeable 2.5MPG. The Prius driver, however, will be astounded to see that the same 10% reduction in mileage will drop their average by 5.5 mpg.

Car	Mileage at 72°F (22.2°C)	Mileage at 45°F (7.2°C)	Numerical Difference
Prius	55 mpg	49.5 mpg	5.5 mpg
Camry	25 mpg	22.5 mpg	2.5 mpg

- 4) **A/C Use:** There is a significant impact on mileage with A/C use. Unfortunately, Toyota did not make it easy or intuitive to learn how to use the 'vent' mode allowing circulation of outside air without engaging the actual heating/cooling system. Depending on your geographic location, you might not need to use the "Auto A/C" in winter months choosing instead to employ the normal vent mode to draw in heat from the ICE. In the spring and autumn, you should be able to use the vent to draw in cooler outside air rather than using the A/C. Keeping your car in a garage overnight is, of course, ideal since the engine will not be as hot or cold.
- 5) **Weight in Vehicle:** Bear in mind that Toyota worked to provide a car that is as light as realistically possible. The lightness allows the smaller engine to propel the car with less effort. Although most small articles will not make a major impact, you do not want to be carrying a bunch of unnecessary stuff in the car all the time. If you always have the car full with the spouse, three children, and all their necessities of life, it will negatively affect your mileage.
- 6) **Tire and Road Rolling Resistance:** The tire rolling resistance of the OEM Goodyear Integrity tires is very low. However, when under-inflated, the resistance increases dramatically creating a significant impact on gas mileage. Many of us have decided to use higher tire pressures than Toyota recommends to further improve fuel economy by a small amount and to improve tire wear, handling, and road hazard safety. Some argue that this causes an uncomfortably rough ride and might be a safety issue. The pressure you choose to maintain in your vehicle is your prerogative. However, be sure to keep the front tires 2psi higher than the rear tires and to stay within the tire manufacture's maximum rating (44psi for the Goodyear Integrity).
- Road rolling resistance is out of your control. Nevertheless, it is a factor. If you have rough roads, wet roads, gravel, etc., they will inevitably increase the rolling resistance and reduce your mileage. Ideally, dry smooth roads are best.
- 7) **Other Weather-Related Issues:** Wind speed and direction have an impact, as does rain (see above), humidity, elevation, and barometric pressure. There is no need to linger on those issues, but they do factor in.
- 8) **Speed, Braking, Acceleration, and Anticipatory Driving:** The MFD's Energy and Consumption screens present a degree of feedback unprecedented in any other stock vehicle. It acutely increases your awareness of how the engine is operating in three periods: moment to moment, every 5 minutes, and over an averaged amount of time. If you pay attention to these two screens, you cannot help but to alter your driving style. Many Prius owners have reporting a dramatic change in their driving habits from their previous cars to their Prius.

**Speed:** Many Prius owners report that speeds from 40 to 50 MPH provide the greatest MPG. At these speeds, the weight of the car provides momentum and allows the ICE to reduce its efforts drawing assistance from the battery. As you exceed 60 MPH, the wind resistance will require more engine power and decrease your mileage.

**Acceleration:** Many Prius owners choose to accelerate relatively briskly, depressing the pedal 1/3rd way or so. Once they achieve 25-30mph, they try to 'Dead-band' with all power coming from the Engine (ICE) to power the wheels with no arrows to or from the battery. This is the most efficient power phase since there are no losses from converting the energy to stored battery energy and back to kinetic energy powering the wheels.

**Stopping:** You should work to anticipate stops well ahead of time. If you drive a regular route, learn the stoplight timing patterns and watch for them while they are far ahead. In time, you should know if you can catch the upcoming green by maintaining your current speed or you will need to adjust your speed. Watch other cars as well to anticipate the traffic's patterns. This type of anticipatory driving not only increases your mileage but also makes for a safer driver. For example, if you know of an upcoming stop but traffic is pressing behind you, you try to initiate a 'glide' rather than a deceleration. Do this by working the gas pedal until there are no arrows displayed on the Energy Screen. Because you are relieving the drag of regenerative braking, it might feel as though you are accelerating; in reality, you are truly coasting. If you need to maintain a little more speed, press the gas pedal just enough to power the wheels using only the battery. If you see that a full stop is inevitable, press the brake pedal firmly but not hard to quickly drop speed. Now you can use the drag of the regenerative brakes to slow you down and recharge the battery. When possible, you should try to avoid coming to a complete stop. Accelerating from a dead stop is much more difficult than accelerating from a roll of even 10 MPH.

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***As always, however, PLEASE make safety your first priority.  
When you can safely take advantage of this type of anticipatory driving it is just a bonus.***

- 9) Fuel Type: Due to pollution control issues in most parts of the US, summer gas has a higher BTU rating than winter gas. For this reason, you get more energy per unit of gasoline when burning summer gas. Thus, in addition to the cold weather hit alone, now you get less 'bang-for-the-buck' from your gasoline. Make it another 5% and you are down into the mid-40s MPG area from the 55 MPG you may have gotten in the summer! If that's not bad enough, it's completely out of your control.

In addition, many parts of the country are beginning to use E10 gas (10% ethanol). While E10 has an even lower BTU rating than winter gas resulting in lower gas mileage, its lower sulfur content provides positive environmental benefits. Many people are not even aware that they are using E10 fuel. The pump should have a small sticker notifying you of the fact though some do not.

- 10) Synthetic Oil: Some Prius owners have stated they have noticed a measurable improvement in MPG just by switching to synthetic motor oil. Others remain skeptical, though synthetics do tend to have a slightly lower viscosity than mineral oils. So it is possible synthetics provide a benefit. Any affect would be particularly noticeable in COLD weather in which synthetic is clearly a superior performer.

Some chose to use synthetic after extensive research based primarily on the slightly lower environmental impact of synthetic oil. Also factored in is the potential for slightly higher gas mileage and longer engine life. You must weigh these benefits against the significantly higher cost for synthetic oil, which certainly outweighs any cost savings realized by fuel efficiency improvements alone.

- 11) Short Trips: You will almost immediately notice that your first 5-minute bar on the consumption screen will be in the range of 25-35 MPG most of the time. To warm the engine and catalytic converter, the car will use extra fuel. Therefore, short trips are a mileage killer. If you must make short trips, try to combine them minimizing the time for the ICE and CAT to cool down. The 'coolant' stored in the 'thermos' will also be hotter to aid that process. Longer drives at moderate speeds will show some of your best gas mileage – often in the 60 MPG range.
- 12) Terrain: Those of you lucky enough to live in flat areas like New Orleans or Florida have a distinct advantage. The ECU is able to maintain a steady speed over the entire distance traveled. Here, the Cruise control is truly your friend. Those who live in hilly or mountainous terrain take a pretty good hit on the steeper hills. Although one can sometimes recoup a little of the inefficiency on the down-hill portion, it is never as much as was expended getting up the hill in the first place.
- 13) Alignment: For persistent issues with mileage not meeting your expectations after factoring in ALL the items above, consider having the alignment of your tires checked and fixed. This is critical to long term mileage and not always something that can be appreciated by 'feel' alone.

### **Summary**

Multiple factors conspire to affect MPG. The relative impact seems greater in a higher mileage vehicle like the Prius though, percentage wise, it is probably not any worse than a conventional vehicle. Consider. . .

- Minimizing your use of the A/C
- Maximizing anticipatory driving
- Maintaining tire pressures higher than Toyota recommended (many use 42f/40r, 40/38, or 38/36)

Finally: Be patient...it will get better, there is nothing wrong with your car. We have just all been set up with some relatively unrealistic expectations and it's natural to be a little disappointed when those expectations are not immediately met.

### **LINKS AND REFERENCES**

Another Great Resource is [FuelEconomy.gov](http://FuelEconomy.gov)

A thread at the Yahoo site: <http://autos.groups.yahoo.com/group/Prius-2G/message/2742>

See also the [Official Toyota PDF](#) on Fuel Economy

[Direct Link to PDF on PriusChat](#)

In addition, this is a very thorough article from [Chevron on Fuel Economy](#) that is well worth downloading and reading.