

Fuel Economy Testing and Labeling

1. Why should I trust EPA's fuel economy values?

The MPG estimates on the EPA/DOT Fuel Economy and Environment Label (or window sticker) are based on standardized laboratory test procedures to ensure they are reliable, repeatable, and fair across different car models. That means consumers can compare mpg for different vehicles on an 'apples-to-apples' basis to determine which vehicle is more fuel efficient.

EPA's fuel economy tests have been correlated with national average values for many important real-world driving conditions, including stop-and-go traffic, cold weather, air conditioning use, and high speed and aggressive driving. In addition, all EPA fuel economy test results are adjusted downward to reflect many other variables that are not incorporated into our tests such as wind, hills, and road conditions.

While individual mileage will always vary and no label value can accurately predict fuel economy for all drivers under all conditions, we believe the EPA fuel economy values are the best estimates for typical U.S. drivers and average driving conditions.

2. It seems like few drivers get the exact mpg listed on their vehicle's window sticker. Why does EPA claim they are "real world"?

We believe EPA label values are the best "real world" estimates for consumers because they are based on a methodology that reflects national-average conditions for a wide range of factors that affect fuel economy: vehicle maintenance, road conditions (e.g., icy, uphill), high speed or aggressive driving, stop-and-go traffic, cold temperatures, high AC and other accessory load use, the number of passengers and amount of cargo, and many more. We believe the EPA fuel economy test procedures are unique in this regard.

Over any given year, we expect that most drivers will achieve fuel economy at or very close to our estimates. Some drivers will get mpg that is higher than the label values while others may experience lower fuel economy, generally due to more unusual driving behavior or ambient conditions. While we do occasionally receive complaints about mileage from consumers, these tend to be concentrated on a relatively small number of new vehicle models and we investigate and address these on

a case-by-case basis. We also have the opportunity to review real-world driving data voluntarily submitted by consumers through the “My MPG” tool on the joint EPA and Department of Energy website fuelconomy.gov. The average fuel economy reported through this tool is higher than the corresponding label value.

3. Why are EPA’s fuel economy tests conducted in an indoor laboratory? Wouldn’t it be better to test cars on roads or at least on an outdoor track?

Testing vehicles in controlled laboratory conditions establishes a level playing field for all cars and ensures that the test results are consistent, accurate, repeatable, and equitable among different vehicle models and manufacturers. Vehicles are driven on a dynamometer (a device similar to a treadmill) using five standardized driving patterns or test cycles. These test cycles represent a variety of driving conditions including speed, acceleration, braking, air conditioning use, and ambient temperatures. The test results from the five driving cycles are combined to yield individual “city” and “highway” values, and a “combined” fuel economy value that assumes a 55% city/45% highway split.¹

We also account for the impact of other conditions that may occur during ordinary driving, but which are not directly reflected in our tests, in our fuel economy calculations. These include wind, low tire pressure, rough roads, hills, snow or ice, carrying cargo, and certain differences between the gasoline we use for our tests and that which is typically available at the pump (see Q5). Collectively, we estimate that these conditions reduce fuel economy by about 10%. This is reflected in the fuel economy values that you see on the label.

On average, combined label values with today’s label methodology are about 20% lower than the traditional city and highway tests used to calculate Corporate Average Fuel Economy, or CAFE. This is because Congress requires manufactures to demonstrate that they meet CAFE on a specific set of laboratory test procedures. The label, however, is meant to be more reflective of the fuel economy under the range of conditions the average driver can expect. The additional test cycles, plus the adjustments for other conditions, do just that.

Although testing a vehicle on the road may seem like it would result in a more representative mpg value, road tests can only provide a snapshot of driving conditions at one point in time. On the other hand, EPA’s laboratory tests cover a broad set of conditions drivers may experience throughout the year and are designed to represent national average, real world driving.

¹ To calculate combined fuel economy, we harmonically average the city mpg and highway mpg assuming 55% and 45% driving shares, respectively: $FE = (0.55/mpg_{city} + 0.45/mpg_{hwy})^{-1}$. Note that when averaging multiple fuel economy values, it is important to use harmonic averaging because this method correctly accounts for the fact that more fuel is consumed at lower mpg. By contrast, a simple arithmetic average is misleading because it equally weights low and high mpg values. For a detailed explanation of harmonic averaging, please see *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2013* (p.109-111), available at: epa.gov/otaq/fetrends-complete.htm.

4. I heard that the top speed in EPA's highway test is 60 mph. Since everyone knows that people drive much faster, why should I believe EPA's highway (and combined) mpg estimates?

Vehicles are tested at a top speed of 80 mph in order to calculate the highway mpg estimates.

EPA utilizes five test cycles to represent real-world driving conditions. While it's true that the test cycle historically labeled as the "highway" test has a top speed of 60 mph, this test is currently meant to represent driving on lower speed highways as well as rural and suburban driving. EPA's highway mpg estimates are primarily derived from a separate "high speed" test cycle, which has a top speed of 80 mph. The remaining three tests are designed to simulate stop-and-go city driving, high air conditioning use, and driving in cold temperatures. For more information on the five test cycles and how EPA calculates its mpg estimates, go to epa.gov/fueleconomy.

5. When I buy gas at the pump, it typically contains about 10% ethanol and other additives. Does EPA use a gasoline-ethanol blend for fuel economy testing?

No, EPA's test fuel does not currently contain any ethanol or other oxygenates. However, EPA does account for the impact of low-level ethanol blends in our fuel economy estimates. Ethanol has a lower energy density than gasoline—about 1/3 less energy per gallon. That means a car operating on 10% ethanol would require about 3% more fuel to travel one mile than a car operating on gasoline and thus have about 3% lower fuel economy. EPA currently reduces all fuel economy test values by about 10% to account for ethanol in gasoline and other factors such as wind, hills, and road conditions.

Later this decade, EPA is phasing in a requirement to change our federal emissions test fuel to include 10% ethanol by volume. Information about this change is available at: epa.gov/otaq/tier3.htm.

6. Driving behavior has changed significantly in the past 30+ years, but I read that EPA has only made minor adjustments to the fuel economy testing and labeling methodology in that time. Why?

Actually, EPA has made several significant updates to the methodology for determining fuel economy estimates since we started providing these values to consumers in the 1970s.

In 1984, mpg results from the two tests then in use, the "city" and "highway" tests, were adjusted downward by 10% and 22%, respectively, to better reflect real world driving and national average conditions. The methodology was updated again for model year 2008 and later vehicles. Data from three additional tests designed to capture high-speed and aggressive driving, high air conditioning and accessory loads, and operation during cold temperature are now incorporated into the fuel economy values. Rather than applying an overall correction factor, this new methodology accounts for the impact of these real-world driving conditions on each specific vehicle. A correction factor is also applied to account for factors not directly reflected on our tests (see Q3).

Last year, EPA announced plans to re-examine how auto manufacturers group certain types of car models for the purpose of fuel economy testing. This will likely have the greatest impact on some hybrid cars and other very fuel efficient vehicles (see Q7).

7. Are EPA's fuel economy tests accurate for hybrid vehicles? Why were the mpg estimates revised for the Ford C-Max hybrid?

Yes, EPA's fuel economy tests are accurate for hybrid vehicles. However, that doesn't mean every driver will get the exact mileage listed on the label.

Hybrid vehicles, as well as other very fuel efficient cars, use significantly less gasoline to travel each mile than an average vehicle. As a result, even small increases in gasoline consumption—such as that caused by aggressive driving, high AC use, cold temperatures, or driving over rugged terrain—can have a relatively larger impact on mpg. That means hybrid drivers will likely experience more variability in their mileage compared with EPA's (or any other published) fuel economy estimates.

The Ford C-Max hybrid is a special case. EPA tested the C-Max after receiving consumer complaints that the vehicle did not achieve the label values of 47 miles per gallon (mpg) for highway, city, and combined driving. Based on the results of these tests, EPA determined that the fuel economy performance of the C-Max was lower than the original label values.

Label regulations allow vehicles with the same engine, transmission and weight class to use the same fuel economy label value data, since, historically, such vehicle families achieve nearly identical fuel economy performance. Ford based the model year 2013 Ford C-Max label on testing of the related Ford Fusion hybrid, which has the same engine, transmission and test weight. For the vast majority of vehicles this approach would have yielded an appropriate label value for the car, but these new vehicles are more sensitive to small design differences than conventional vehicles because highly efficient vehicles use so little fuel.

Ford has voluntarily re-labeled the Ford C-Max to match EPA's fuel economy estimates. Going forward, EPA is planning to work with consumer advocates, environmental organizations, and auto manufacturers to propose revised fuel economy labeling regulations that address the issue of how vehicles are grouped for fuel economy testing purposes.

8. What happened with Hyundai and Kia?

Each year, EPA tests a subset of the new vehicle models at our National Vehicle and Fuel Emissions Laboratory (NVFEL) in Ann Arbor, Michigan to verify that the fuel economy estimates provided by auto manufacturers are accurate.

In 2011 and 2012, EPA began performing an audit program of manufacturers' coastdown tests. Coastdown testing is used to develop the dynamometer inputs for each vehicle model, so that the laboratory tests accurately replicate its tire rolling resistance, friction due to bearings and

brakes, and aerodynamics. EPA audit tested multiple vehicle models, including the model year 2012 Hyundai Elantra. Discrepancies between EPA coastdown test results and information provided to EPA by Hyundai resulted in an ongoing investigation into the data for other Hyundai and Kia vehicles.

Hyundai Motor America and Kia Motors America lowered their fuel economy (mpg) estimates for the majority of their model year 2012 and 2013 models to be consistent with EPA test results. The mileage for most vehicles was reduced by one to two mpg. The largest adjustment was six mpg highway for the Kia Soul.

9. How many vehicles does EPA test each year?

Auto manufacturers are responsible for testing vehicles in their laboratories according to EPA test specifications and reporting fuel economy values to EPA.

EPA re-tests a subset of these vehicles each year at its National Vehicle and Fuel Emissions Laboratory in Ann Arbor, Michigan. Some vehicle models are selected for testing because of consumer complaints; others are selected at random. Historically, we have audited between 10% and 15% of new vehicle models (or about 150-200 vehicles), but this has grown to 15%-20% in recent years.

10. Why are CAFE values different than the mpg estimates given on a car's window sticker? Will consumers achieve 54.5 mpg with new cars in 2025?

The Corporate Average Fuel Economy (CAFE) program has a different purpose than the EPA/DOT Fuel Economy and Environment Label (or window sticker) and the mpg estimates used for each program differ accordingly. CAFE is the required average fuel economy that individual manufacturers must meet for their fleets of passenger cars and light trucks manufactured for sale in the United States for each model year. The National Highway Traffic Safety Administration (NHTSA), within the Department of Transportation, establishes and enforces the CAFE standards, while EPA performs vehicle testing and CAFE calculations.

CAFE values are calculated from the EPA vehicle fuel economy database (based on testing at both EPA and automakers, including the test data used to determine the fuel economy estimates for the labels.) However, the law requires that the methodology used to calculate fuel economy for CAFE compliance be consistent with the 1975 test methods so, unlike the label values, CAFE mpg estimates are not adjusted to reflect real-world driving conditions. As a general rule of thumb, the combined mpg estimate on a vehicle's window sticker is about 20% lower than its combined mpg estimate for CAFE, though the actual difference depends on the particular vehicle. For consumers, the label value provides the best estimate of the fuel economy they are likely to experience in real world driving.

In the National Program, a joint rulemaking with DOT, EPA has established increasingly stringent greenhouse gas (GHG) emissions standards that will require automakers to average about 54.5 mpg over EPA tests in model year (MY) 2025, assuming that all GHG improvements are achieved with fuel economy technologies. EPA projects that compliance with these standards will lead to an average label, or real world, value of about 40 mpg in 2025. This is compared to an average real world value of 23.6 mpg in MY 2012.

11. Why does EPA measure fuel economy?

Congress directed EPA to establish test methods and procedures to measure the fuel economy of passenger car and trucks, and to provide this information to the public. We designed our test procedures to reflect national-average, “real world” driving conditions. The tests are standardized for all vehicles and conducted in a controlled laboratory setting, ensuring they are repeatable, reliable, and fair.

If auto manufacturers each designed their own procedure for measuring and reporting mpg, consumers would not be able to make ‘apples-to-apples’ comparisons of mileage among different car models. By contrast, EPA’s standardized test procedures create a level playing field for all vehicles. Consumers can rely on these values when trying to determine which vehicles are more fuel efficient.