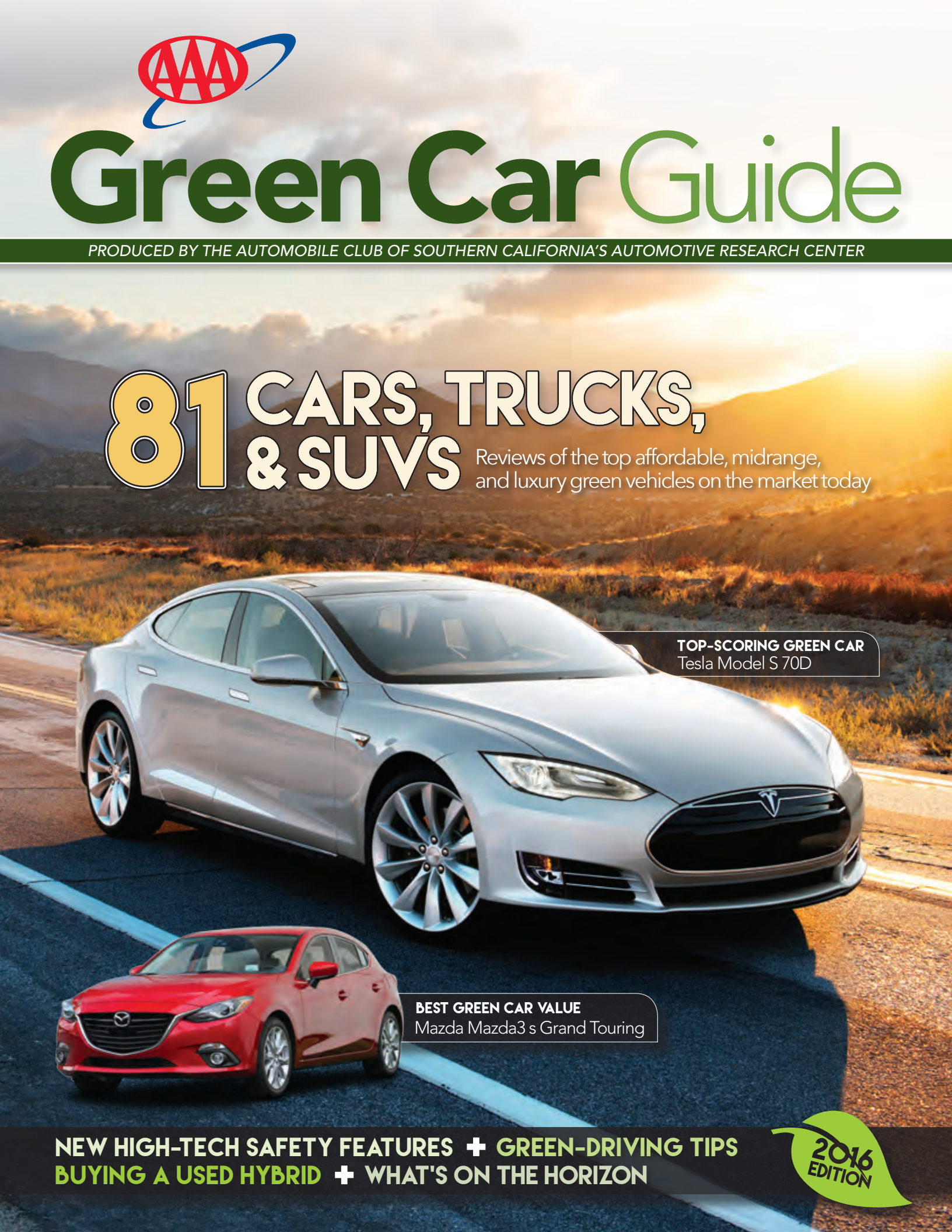
# Green Car Guide

PRODUCED BY THE AUTOMOBILE CLUB OF SOUTHERN CALIFORNIA'S AUTOMOTIVE RESEARCH CENTER

## 81 CARS, TRUCKS, & SUVS

Reviews of the top affordable, midrange, and luxury green vehicles on the market today



**TOP-SCORING GREEN CAR**
Tesla Model S 70D

**BEST GREEN CAR VALUE**
Mazda Mazda3 s Grand Touring

**NEW HIGH-TECH SAFETY FEATURES + GREEN-DRIVING TIPS**
**BUYING A USED HYBRID + WHAT'S ON THE HORIZON**

2016 EDITION

# Green Car Guide

2016 EDITION

Produced by the
Automobile Club of Southern California's
**Automotive Research Center**

AAA.com/greencar

# INTRODUCTION

The *AAA Green Car Guide* is an annual report produced by the Automobile Club of Southern California's Automotive Research Center (ARC) that reviews, tests, and ranks hybrid, electric, and alternative-fuel vehicles, as well as fuel-efficient gasoline-powered vehicles and those that emit low levels of smog-forming pollutants. Vehicles are evaluated on the basis of qualities such as fuel economy, emissions, ride comfort, braking, and handling. The *Guide* can help motorists make better choices when buying a car by providing them with the latest information about green vehicles and technologies. The ARC has produced the *AAA Green Car Guide* since 2010.

Located in Los Angeles, the ARC is a premier vehicle-emissions test laboratory. It has state-of-the-art facilities and equipment operated by experienced Auto Club engineers and technicians. Its purpose is not only to run emissions and fuel-efficiency tests but also to investigate the latest advances in vehicle technologies and provide useful automotive information to AAA's 54 million members.

As a complete guidebook to green vehicles, the ***AAA GREEN CAR GUIDE***:

- **DEFINES** what a green car is and explains why buying a green car can be good for both you and the planet.
- **EXPLAINS** the differences between various types of green cars, the advantages and disadvantages of each, and how to choose one that's best for you.
- **PREVIEWS** green cars scheduled to come on the market in the next few years.
- **EVALUATES** green cars both on the road and on a test track to determine their usefulness in daily driving.

The *AAA Green Car Guide* ranks cars from highest to lowest based on a total point score from 13 types of evaluations and specifies the best green car at different price levels. And it provides summary snapshots of the cars, including strong and weak points.

The *Guide* groups the green cars that were tested into six categories according to size or body type—subcompact, compact, midsize, large, SUV, and pickup truck—and specifies a winner and finalists in each category. This year, the *Guide* also features a chapter on the latest automotive safety technology: features that make driving safer and more convenient. Safety features for each vehicle tested are included in the car-reviews section.

When you finish reading the *AAA Green Car Guide*, you'll have the tools you need to find the green car that best suits your driving needs.

# WHAT'S INSIDE


















CHAPTER 1

# WHAT DOES IT MEAN TO BE GREEN?

This is a good time to buy a new car. Auto sales set a record in 2015, with 17,470,700 vehicles sold, topping the previous record of 17,402,500 vehicles sold in 2000. That kind of demand means consumers have lots of choices. In addition, gas prices were consistently low in 2015, averaging $2.40 a gallon nationwide for regular gas, 94 cents below the 2014 national average of $3.34 a gallon.

The price of oil dropped below $30 a barrel in January 2016, its lowest price in 12 years. The U.S. Energy Information Administration (EIA) forecasted lower crude oil prices—and lower gas prices—through 2016, and AAA estimates that gas prices nationwide in 2016 will average between $2.25 and $2.45 a gallon. That can signal many consumers to shift their interest from fuel-efficient, low-emitting cars to SUVs and light trucks—and indeed, sales of those vehicles have increased.

Still, gas prices fluctuate from year to year. Also, there are plenty of other good reasons to buy green besides the price of gas. And in response to consumer interest and to meet increasingly strict government regulations, automakers will continue to bring a wide variety of green cars to the marketplace.

Hyundai **Tucson Fuel Cell**

**HYDROGEN FUEL-CELL VEHICLES** run on electricity produced by hydrogen reacting with oxygen in an onboard fuel cell.

BMW **528d**

**CLEAN-DIESEL VEHICLES** run on low-sulfur diesel fuel.

**HYBRID VEHICLES** (including plug-in hybrids, or PHEVs) usually run on a combination of gasoline and electricity.

Ford **Fusion Hybrid**



Toyota **Corolla Eco**

**CARS WITH ADVANCED INTERNAL-COMBUSTION ENGINES** (ICEs) run on gasoline. Because of their design, they use much less fuel and produce fewer emissions than the average car and are therefore considered green.

Chevrolet **Impala Bi-Fuel**

**NATURAL-GAS VEHICLES** run on compressed natural gas (CNG).

Mitsubishi **i-MiEV**

**ELECTRIC VEHICLES** (EVs), which plug into household current or chargers, store electrical energy in large onboard batteries and are propelled by electric motors.

Ram **1500**

**FLEX-FUEL VEHICLES** (FFVs) can run on gasoline or a gasoline-ethanol blend.

# DEFINING GREEN

What does the term *green car* mean, and how are green cars different from other vehicles? Green cars have two defining criteria.

They're designed to:

- **Burn less fuel** than most vehicles powered solely by gasoline or diesel fuel. To achieve this, green cars sometimes run partially or completely on a different energy source, such as electricity, compressed natural gas, ethanol, or hydrogen.
- **Produce fewer harmful emissions** from burning the fuel they use, thereby reducing the harm they do to people and the environment.

## FUEL EFFICIENCY

Automakers attempt to improve fuel efficiency in various ways, including:

- **Installing a more fuel-efficient powertrain,** such as hybrid-electric, electric, compressed natural gas, or diesel.
- **Reducing vehicle size and weight** by using lightweight materials, such as aluminum and carbon fiber.

For cars with internal combustion engines (ICEs), automakers also continually improve engine and transmission design, using features such as:

- **Turbocharging and supercharging,** which increase an engine's efficiency and power by forcing more air into the combustion chamber.
- **Stop-start technology,** which saves gas by automatically shutting down and restarting the engine when it would otherwise be idling—for example, at a stoplight.
- **Cylinder deactivation,** which conserves gas by shutting down one or more of an engine's cylinders when they're not under load, such as when the car is cruising on a level highway.
- **Continuously variable transmissions** (CVTs), which enable engines to run more efficiently.
- **Increasing the number of speeds in automatic transmissions** (some cars now have as many as nine) to reduce engine rpm at cruising speed, thereby improving fuel economy.
- **Improved vehicle aerodynamics** (pictured) to reduce drag and increase efficiency via such elements as special underbody panels, air deflectors, and grilles that open and close.

- **Regenerative braking systems,** which convert a car's kinetic energy into electricity to power the car's accessories, a task usually left to the engine.
- **"Economy" driving modes,** which adjust a vehicle's throttle, transmission, climate system, and cruise-control settings for maximum fuel efficiency.
- **Instrument-panel gauges** that let drivers know when they're driving in the most fuel-efficient manner.
- **Low-rolling-resistance tires,** which maximize mpg.



## REDUCING EMISSIONS

Typically, carmakers use three types of technology to build vehicles with lower levels of harmful emissions:

- **Improved powertrain design,** including direct fuel injection and an engine control unit (ECU) that regulates the air/fuel ratio, ignition timing, idle speed, and valve timing to achieve more complete combustion.
- **Catalytic converters,** which use elements such as platinum, palladium, and rhodium as catalysts to convert hydrocarbons, carbon monoxide, and nitrogen oxide in a car's exhaust into less-harmful gases.
- **Evaporative-emissions systems,** which use charcoal canisters to absorb from a vehicle's fuel system harmful vapors that might otherwise escape and pollute the atmosphere.

Technological improvements to motor fuels—such as removing lead from gasoline and reducing the amount of sulfur in gasoline and diesel fuel—have also helped reduce the harmful emissions that vehicles produce.

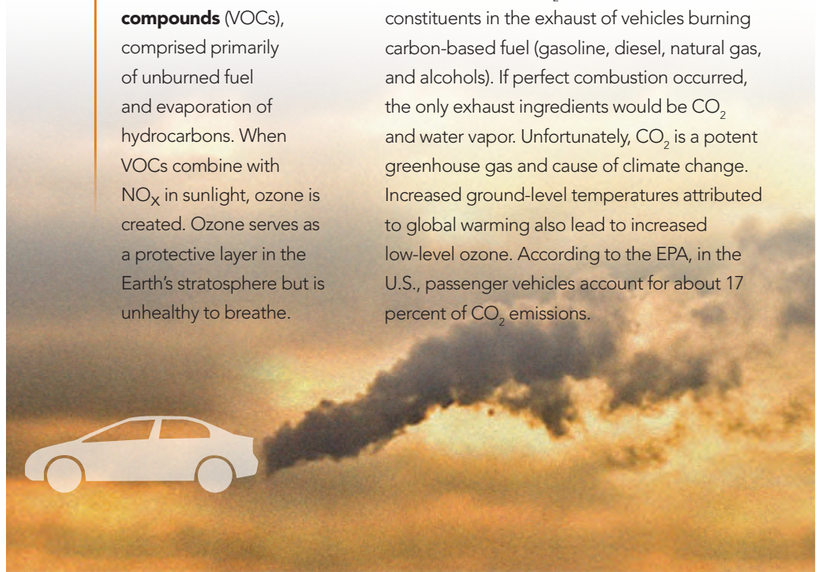
## PRINCIPAL POLLUTANTS in vehicle exhaust

**Nitrogen oxide** ($NO_X$), caused from superheating nitrogen and oxygen during fuel combustion.

**Volatile organic compounds** (VOCs), comprised primarily of unburned fuel and evaporation of hydrocarbons. When VOCs combine with $NO_X$ in sunlight, ozone is created. Ozone serves as a protective layer in the Earth's stratosphere but is unhealthy to breathe.

**Carbon monoxide** (CO), caused from the incomplete combustion of carbon-based fuel (for example, oil, natural gas, alcohol, coal, or wood).

**Carbon dioxide** ($CO_2$), one of the two main constituents in the exhaust of vehicles burning carbon-based fuel (gasoline, diesel, natural gas, and alcohols). If perfect combustion occurred, the only exhaust ingredients would be $CO_2$ and water vapor. Unfortunately, $CO_2$ is a potent greenhouse gas and cause of climate change. Increased ground-level temperatures attributed to global warming also lead to increased low-level ozone. According to the EPA, in the U.S., passenger vehicles account for about 17 percent of $CO_2$ emissions.





## EMISSIONS CATEGORIES

Below are descriptions of the current California Air Resources Board (CARB) LEV-II emissions categories. The new LEV-III categories are being phased in over the next several years and will eventually be adopted nationwide.

**LEV:** Low-emissions vehicles emit about 45 percent of the smog-forming pollutants permitted under the former LEV-I standard. Example: Buick LaCrosse eAssist (2.4-liter 4-cylinder, auto).

**ULEV:** Ultra-low-emissions vehicles emit half the carbon monoxide (CO) and hydrocarbons (HC) of a LEV vehicle. Example: Nissan 370Z (3.7-liter V6, auto).

**SULEV:** Super-ultra-low-emissions vehicles meet even stricter standards than ULEV when fueled with low-sulfur gasoline. Example: BMW 328i (2.0-liter 4-cylinder, auto).

**PZEV:** Partial-zero-emissions vehicles meet SULEV requirements and have no evaporative emissions. Example: Toyota Prius (1.8-liter 4-cylinder, CVT).

**AT PZEV:** Advanced technology partial-zero-emissions vehicles meet PZEV emissions requirements but use technology deemed "advanced" by CARB. CARB is changing the AT PZEV terminology; these vehicles will be called TZEV (transitional-zero-emissions vehicles). Example: Ford Fusion Energi (2.0-liter 4-cylinder, auto).

**ZEV:** Zero-emissions vehicle. The only current technologies that meet this standard are EVs and hydrogen fuel–cell vehicles. Examples: Volkswagen e-Golf and Toyota Mirai.

# WHY GO GREEN?

The two main reasons to buy a green car are to save money and save the planet.

## SAVING MONEY

If you want to spend less money on gas, buying a car that gets great fuel economy is one of the most effective ways to do it. But if gas prices are low, as they have been for the past year, why shop for a fuel-efficient car? Because at some point, they'll go back up.

Unfortunately, where gas prices are concerned, most car buyers have short memories. When prices trend downward, many buy larger cars, trucks, and SUVs. They base a long-term decision—buying a car—on short-term information.

Gas prices are volatile. In the past eight years, the national average price of regular gas reached a high of $4 a gallon in July 2008, dropped to a low of $1.67 in December of the same year, rose again to $3.85 in May 2011, dropped to $2.05 by January 2015, and finished the year at $2.40, according to the AAA Daily Fuel Gauge Report (fuelgaugereport.com). The point? No one could have predicted these extreme price swings, so who knows where gas prices will be five or 10 years from now?

What's more, low gas prices can be a boon for green-car buyers: When lots of people are buying big cars and light trucks, dealerships are more likely to offer incentives to attract buyers to fuel-efficient models.

Some people think green cars cost more to buy, but that's not necessarily true, especially for green cars powered by fuel-efficient internal combustion engines (ICEs). Take, for example, subcompact and compact green cars such as the Chevrolet Sonic, Ford Fiesta, Honda Civic, Kia Forte, Mazda3, Nissan Versa, Subaru Impreza, and Toyota Corolla. They're fun to drive, reliable, and cost less to buy and maintain than cars that use more fuel. They also offer plenty of creature comforts and many of the latest safety features. Despite these advantages, though, there are some trade-offs: They're not as roomy, not as comfortable for long trips, and typically have less powerful engines.

That's where larger vehicles with fuel-efficient ICEs come in. For example, the Buick LaCrosse, Ford Escape, Honda Accord, Hyundai Sonata, Mazda Mazda6, Subaru Forester, and Toyota Camry offer more room and higher comfort levels. They also don't cost much more than subcompact and compact cars and exact little penalty in fuel economy.

Some kinds of green cars—hybrids, electric cars, and diesels—*do* cost more than their conventional counterparts because they use additional or specialized powertrain components, such as electric motors, battery packs, or diesel engines. For example, a 2016 Hyundai Sonata Hybrid costs about $4,200 more than the nonhybrid Sonata SE, and a 2016 Lexus ES 300h costs about $2,900 more than an ES 350, its nonhybrid equivalent. In some cases, the price discrepancy can be even higher.

Of course, a green car's fuel savings may recoup the higher purchase price—but not always, and it may take a long time. For example, if regular gas is priced at $2.24 a gallon and you drive 15,000 miles a year, it would take more than 14 years to make up the $4,200 price difference between the Sonata SE (30 mpg) and the Sonata Hybrid (42 mpg), according to the EPA's calculator.

But the time required to make up the difference can also be relatively short. For example, with the same gas price and mileage parameters, it would take just under three years to make up the $700 price difference between a 2016 Toyota RAV4 XLE AWD (25 mpg) and a 2016 Toyota RAV4 Hybrid AWD (33 mpg). Of course, as gas prices rise, the time it takes to recoup any purchase-price premium for a green car goes down.

Sometimes the price difference between hybrids and nonhybrids is minimal or nonexistent. For example, the manufacturer suggested retail price (MSRP) for a 2016 Buick LaCrosse eAssist is the same as for a 2016 nonhybrid LaCrosse. However, the eAssist version gets a combined 29 mpg versus the nonhybrid's 22 mpg, which saves $368 a year at $2.24 a gallon and 15,000 miles of driving annually. The same is true for the 2016 Lincoln MKZ: The MSRPs for the hybrid and nonhybrid versions are the same, but the hybrid saves $452 a year in fuel costs.

To calculate the payback time for other hybrids versus nonhybrids, use the EPA website tool: fueleconomy.gov/feg/hybridCompare.jsp. To compare gas mileage savings, go to fueleconomy.gov/feg/findacar.shtml.

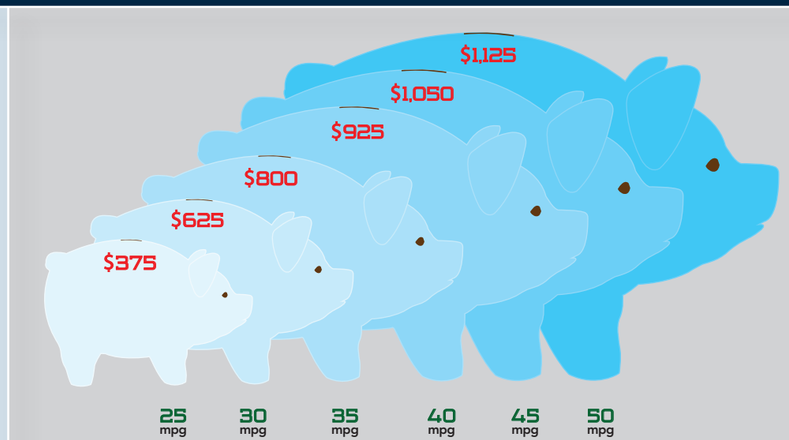
Of course, such comparisons don't matter to some car buyers. They might decide to buy a green car like a Toyota Prius on its other merits—its price, reliability, and roominess. The fact that it gets an EPA-estimated 52 mpg might just be icing on the cake.

There's another way to save money by buying green: New all-electric (EV) and plug-in electric hybrid (PHEV) cars may be eligible for a federal income tax credit of up to $7,500, depending on the battery that powers the vehicle. (Hybrids used to qualify for tax breaks and incentives, but no longer.) To find out which cars qualify and the amount of the tax credit, go to the U.S. Department of Energy website, fueleconomy.gov/feg/taxevb.shtml.

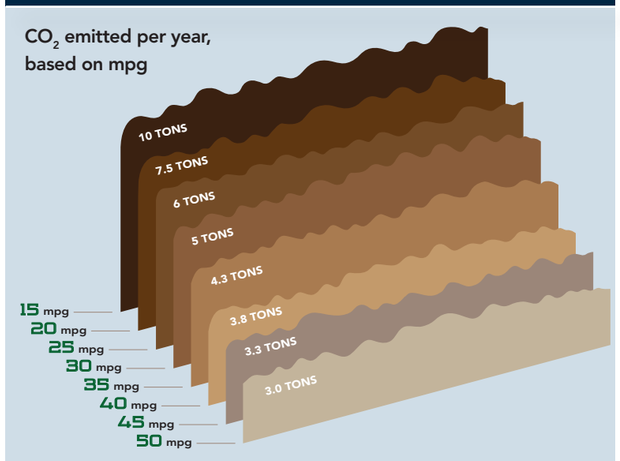
In addition, state and/or local incentives may also apply. For a list of the most recent updates to state laws and incentives for EVs and PHEVs, go to the Alternative Fuels Data Center at afdc.energy.gov/laws/state. Knowledgeable salespeople at car dealerships should be able to tell you about current incentives, as well.

### MONEY SAVINGS BASED ON MPG

Here's how much you could save in one year if you switched from a 20-mpg vehicle to a MORE FUEL-EFFICIENT ONE, based on 15,000 miles of driving annually with gas priced at $2.50 a gallon. (Savings rounded to the nearest $25.)

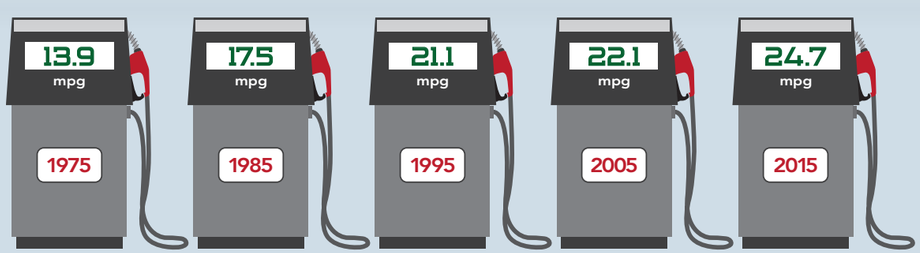



### GREENHOUSE GASES




As mpg goes down, the amount of GREENHOUSE GASES released into the atmosphere goes up. (Based on 15,000 miles of driving per year.)

### AVERAGE U.S. PASSENGER-CAR FUEL ECONOMY



## SAVING THE PLANET

Saving money on gas—a short-term benefit—is one reason to buy a green car. But it's far from the most important reason in the larger scheme of things. Getting more mpg and reducing automotive emissions also have societal benefits. Three of the most important are: environmental benefits, health benefits, and energy security.

**ENVIRONMENTAL BENEFITS.** Climate change is the most significant long-term threat to a livable world, according to the EPA and the Intergovernmental Panel on Climate Change (IPCC). And because carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$) from vehicle emissions contribute significantly to the concentration of greenhouse gases that cause climate change, burning less gasoline and diesel fuel is beneficial to the planet's (and ultimately our) well-being.

Each gallon of gas burned puts about 19 pounds of $CO_2$ into the atmosphere. (For an explanation of how this is possible—since a gallon of gas weighs just 6.3 pounds—go to the U.S. Department of Energy website, fueleconomy.gov/feg/contentincludes/co2_inc.htm). And if you take into account the energy that goes into making and distributing the fuel, the total global-warming impact equals 25 pounds of $CO_2$ emissions per gallon of gas, according to greenercars.org, a part of the American Council for an Energy-Efficient Economy.

How serious is the problem? In 2014, Americans burned about 375 million gallons of gasoline every day for personal transportation—about 45 percent of the total daily U.S. oil consumption, according to the U.S. Energy Information Administration (EIA). And passenger vehicles are responsible, on average, for 51 percent of a household's $CO_2$ emissions—an average of 7 to 10 tons per vehicle per year, according to the EPA. You don't need to do much math to realize that driving a vehicle with a higher mpg rating can significantly reduce your contribution to climate change.

Furthermore, the planet could use some help. On a global scale, progress in increasing fuel economy and lowering emissions for passenger vehicles and light trucks is moving at a rate of 2.6 percent annually in developed countries. But in developing countries, which are preparing for rapid growth in their vehicle markets, annual improvement is just 0.2 percent, according to a new study, *Fuel Economy State of the World 2016: Time for Global Action*, released by the Global Fuel Economy Initiative at the Paris COP21 Climate Summit in December 2015. Both numbers are below the target rate of 3.1 percent annual improvement needed to halve fuel consumption in passenger and light-duty vehicles by 2030. To download the report and see a short film about the importance of improving fuel economy, go to globalfueleconomy.org

Thus far, the United States and other Western nations have not done as good a job improving fuel economy as they have reducing emissions. So in future years, government agencies are likely to focus more on raising fuel-economy standards than on further reducing emissions.

Toward that end, the federal government has set ambitious corporate average fuel economy (CAFE) standards and greenhouse-gas goals for automakers in the next decade and beyond. The U.S. Congress first enacted CAFE standards in 1975 with the goal of reducing energy consumption by increasing the fuel economy of cars and light trucks. By 2025, automakers must raise the average fuel efficiency of new cars and light trucks to 54.5 mpg. CAFE regulations are complicated, but here are the basics: First, smaller vehicles must have a smaller carbon footprint—that is, they must attain a higher mpg rating—than large vehicles. Second, CAFE standards for a given automaker are based on the automaker's total expected vehicle production, broken down by sales estimates for the specific models the carmaker produces. For example, a carmaker that produces mostly SUVs and pickups has to meet a lower CAFE requirement than a carmaker that makes mostly small cars.

CAFE fuel-economy numbers (54.5 mpg, above) aren't the same as the EPA mpg estimates listed on a vehicle's fuel-economy label (see page 18). Rather, CAFE standards are issued by the National Highway Traffic Safety Administration (NHTSA, pronounced *nit*-sa), a division of the U.S. Department of Transportation.

ALEXANDR PARFENOV/ALAMY STOCK PHOTO

What's more, CAFE standards are based on EPA fuel-economy tests from decades ago, whereas EPA estimates are based on current testing procedures (see "How the EPA Calculates Fuel Economy," page 15). In general, EPA estimates are about 30 percent lower than CAFE numbers.

The new CAFE standards should significantly reduce both $CO_2$ emissions from passenger vehicles and the nation's demand for petroleum. By 2025, the average new passenger vehicle is expected to reach a real-world average of about 42 mpg.

The technology needed to achieve higher fuel standards will increase new-vehicle costs by an estimated $1,800 each, but that should be offset by fuel savings over a vehicle's 15-year lifespan, according to the EPA. (Incidentally, Americans are keeping their cars longer these days. In mid-2015, the age of the average car in the U.S. was a record 11.5 years.)

By 2025, the EPA estimates that the new CAFE standards will reduce oil consumption by about 2.2 million barrels a day. And as older vehicles are replaced by newer ones, that number will rise to more than 4 million barrels a day.

It's also good for the planet when car buyers choose a vehicle with an engine and drivetrain that produces fewer harmful emissions. The cleanest gasoline-powered cars are those with a PZEV (partial-zero-emissions vehicle) rating from the California Air Resources Board (CARB).

PZEVs (see "Emissions Categories," page 9) meet super-ultra-low-emissions vehicle (SULEV) exhaust emissions standards and also produce zero evaporative emissions. PZEVs typically achieve lower emissions through modifications to the catalytic converter and engine control module (ECM).

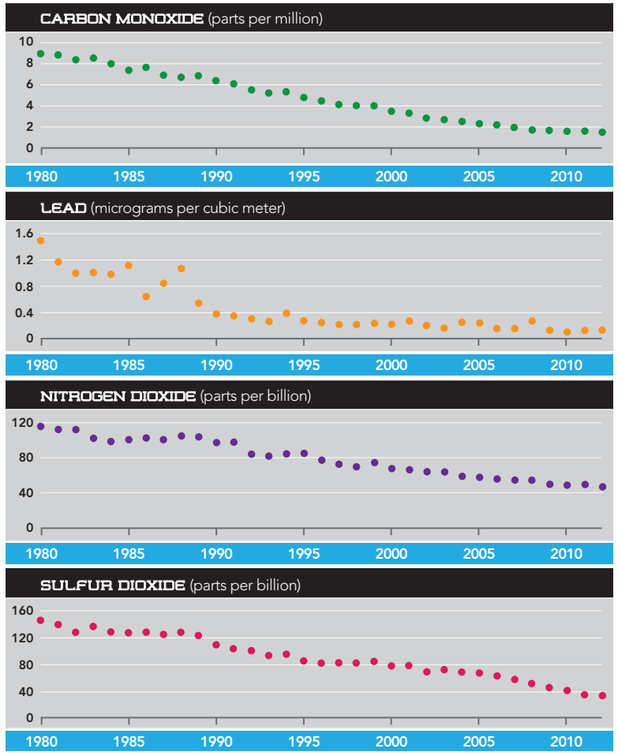
Many, if not most, carmakers offer PZEVs, although not necessarily in all states. Some—Subaru, for example—make PZEV versions of their cars available in nearly every model type and in many regions of the U.S. (To find vehicles with a PZEV rating, check out the EPA's Smartway Vehicles list at fueleconomy.gov/feg/download.shtml.)

PZEVs sometimes cost a bit more, but they require no special maintenance and, in some states, they receive longer emissions performance and defect warranties, including those for the onboard diagnostic (OBD II) vehicle system. Cars with PZEV emissions ratings have such tight pollution controls and burn fuel so completely that in smoggy urban areas, exhaust from the tailpipe of a PZEV can be cleaner than the ambient air.

To find out a specific vehicle's fuel economy and emissions ratings, go to fueleconomy.gov/feg/findacar.shtml. The site lists official EPA mpg estimates, annual fuel costs, unofficial mpg estimates from vehicle owners, and much more. The Energy and Environment section (see below), under a header near the top of the homepage, details many vehicles' energy impact scores, greenhouse gas emissions, and EPA smog ratings.

**HEALTH BENEFITS.** In the mid-1900s, emissions from passenger vehicles produced 50 percent of the gases that resulted in smog, which causes respiratory and cardiopulmonary disease, lung cancer, and higher mortality rates. That situation started to change with the


**The EPA'S ENERGY AND ENVIRONMENT LABEL gives a vehicle's energy impact, greenhouse gas emissions, and smog rating. (Go to fueleconomy.gov, and click on "Find and Compare Cars." Choose a vehicle, then click on the "Energy and Environment" tab.)**




**U.S. AIR QUALITY HAS IMPROVED SIGNIFICANTLY in the past several decades. From 1980–2014, the levels of four key pollutants dropped by more than 50 percent.**

passage of the Clean Air Act in 1973, and since the 1980s, agencies such as the EPA and CARB have led the way in requiring automakers to produce an increasing number of low- and zero-emissions vehicles.

Because of federal and state regulations, today's cars are many times cleaner than in the past. And even though many more cars are on the roads today and they drive many more miles than before, passenger vehicles now account for less than 25 percent of smog-producing emissions. For example, in 1965 a new car emitted on average 228 pounds of volatile organic compounds (VOCs) per 15,000 miles of driving; today, that number is down to less than 2 pounds—a 95 percent reduction.

The payoff for these emissions reductions is that the air we breathe is significantly cleaner than it was three decades ago. From 1980 through 2014, levels of four key air pollutants in the U.S.—carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide—dropped more than 50 percent (see figure above). Ground-level ozone numbers also dropped, but not as precipitously.

Despite such improvements, there is still cause for concern. A recent study by the American Lung Association, *State of the Air 2015*, reports that more than 40 percent of Americans live in places with unhealthy air. And although air pollution levels have dropped in the U.S., worldwide they've stayed about the same because of rising pollution levels in Asia.

**ENERGY SECURITY.** Until recently, most of the oil the U.S. consumed was imported. But after the gasoline shortages caused by the 1973 oil embargo by the Organization of Petroleum Exporting Countries (OPEC), the U.S. government worked to ensure that the country didn't become dependent on oil supplies from potentially unfriendly governments.

Today, the U.S. produces more oil than it imports. In large part due to the expansion of hydraulic fracturing ("fracking"), U.S. petroleum net imports fell from 60 percent in 2005 to 27 percent in 2014, the lowest level since 1985, according to the EIA.

The EIA's 2014 Annual Energy Outlook predicted that by 2037 the U.S. will be energy self-sufficient, so reducing fuel consumption for security reasons may not be as important as it once was. But burning less fuel still reduces our dependence on foreign sources of oil.

## FUTURE SCENARIOS

In the near term, whether people buy green cars will depend largely on factors such as fuel prices, government tax credits, and perks like HOV-lane access and EV charging stations at work—all of which are subject to change. (For example, some states have proposed special taxes for EVs because owners don't pay gasoline taxes.)

And because conventional gasoline-powered vehicles cost less to buy and continue to improve in fuel economy, they're likely to outsell cars with alternative powertrains, at least through the end of this decade—and as long as gas prices remain low.

Few motorists are willing to put public interest before perceived self-interest if buying green costs more or is inconvenient (for example, if a green vehicle has a limited driving range or if refueling/recharging locations are scarce). However, automakers will continue to introduce more cars with alternative powertrains, if for no other reason than to meet increasingly strict government mandates. As these vehicles become more mainstream, their costs will come down and people will be more inclined to buy them.



## HOW THE EPA CALCULATES FUEL ECONOMY

The EPA develops its fuel-economy ratings by performing tests on a dynamometer, a sophisticated treadmill-like device for cars that reproduces the load a vehicle experiences on the road under a variety of driving conditions. The EPA uses testing procedures that were developed by recording motorists' driving patterns and creating "drive cycles" that represent those driving patterns. These tests, known as transient driving cycles, monitor idling, acceleration, steady-state driving, braking, and coasting.

For many years, car buyers were justifiably skeptical of the EPA's mileage estimates. In practice, the common phrase "your mileage may vary" essentially meant "your mileage will be lower than the EPA estimate." But these accuracy problems have largely been remedied. What's responsible for the improvement?

For one thing, the EPA changed its test procedures. Until model year 2007, the agency used tests known as the Federal Test Procedure (FTP) for city mpg and the Highway Fuel Economy Test (HFET) for highway mpg. These tests were developed in the late 1960s and early 1970s, when the speed limit was 55 mph.

In the 1980s, the EPA decided that these tests didn't accurately predict the mileage motorists would get, so they adjusted the ratings downward 10 percent for city driving and 22 percent for highway driving. The adjusted numbers predicted on-road performance fairly accurately and were used through the 2007 vehicle model year.

Since 2007, however, cars and the way we drive them have changed markedly. Freeway driving in cities is more congested than before, and when it's not congested, people typically drive faster than they used to. They tend to accelerate more rapidly, and vehicles are generally larger. These changes made the EPA's fuel economy estimates optimistic.

**A Mazda5 on the DYNAMOMETER at the Automobile Club of Southern California's Automotive Research Center.**

Based in large part on scientific input from the Automobile Club of Southern California's Automotive Research Center (ARC) and AAA, in 2007, the EPA adopted new methods for estimating mpg. It added three newer dynamometer tests—the US06 (higher speeds and more-aggressive driving), SC03 (high temperature with air conditioner on), and Low-Temp CO (start-up at low temperature) tests—to the adjusted FTP and HFET testing to create a new methodology for estimating mpg. These tests were put into effect for 2008 and later model-year vehicles.

But do the new testing methods work? AAA and the ARC recently conducted a study of real-world fuel economy to determine if they do. The EPA encourages motorists to do real-world calculations of their vehicle's fuel economy by recording the odometer reading and the amount of fuel required to fill the tank, then posting the results on the EPA's website, fueleconomy.gov. AAA's study used data collected from the EPA website exclusively. These data were correlated to determine whether vehicles achieved the same, better, or a lower mpg than the EPA estimate.

In general, AAA found that drivers of 1996 to 2014 model-year vehicles reporting their mileage on the EPA's website achieved an average of 12 percent better fuel economy than EPA estimates. Overall, 82 percent of drivers reported getting better mileage than EPA estimates; 2 percent of motorists reported getting mileage equal to the EPA's combined mpg rating; and 16 percent of drivers reported getting less than EPA estimates.

CHAPTER 2

# GREEN ALTERNATIVES

Most automakers now produce a variety of green cars—subcompacts and compacts, midsize cars, large cars, crossover SUVs—and even pickup trucks that focus on getting better gas mileage and reducing emissions.

But it's much more than a matter of vehicle size or body style. Ten or 15 years ago, if you wanted to buy a green car, you had to settle for a gasoline-powered subcompact or an early Toyota Prius or Honda Insight hybrid. Today, it's easy to find green cars that run on gasoline, a combination of gasoline and electricity, flex fuel (a mixture of gasoline and ethanol), electricity, compressed natural gas, diesel fuel, fuel cells, and soon perhaps even diesel and electricity (plug-in diesel hybrids, which are currently available in Europe).

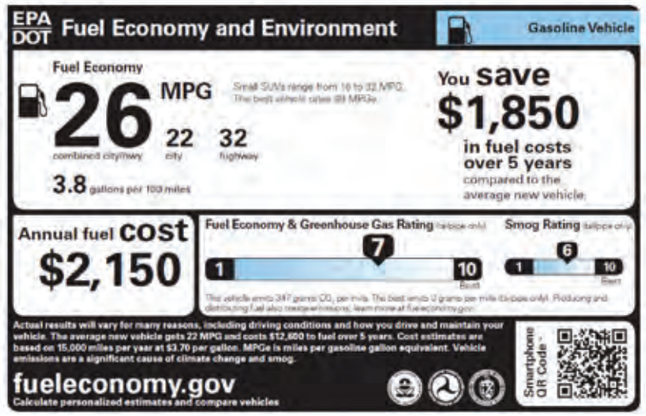
The *AAA Green Car Guide* will help you sort out what's most important and simplify the decision-making process for you. For even more information, go to AAA.com/greencar. In this chapter, we'll describe the major types of green cars and list the advantages and disadvantages of each.

Volkswagen **e-Golf**

# FINDING A GREEN VEHICLE

If you're in the market for a green car, how do you know you're buying a high-mpg, low-emissions vehicle? Start by checking out a vehicle's EPA Fuel Economy and Environment label (pictured below), which contains a lot of useful information. It's attached to the side window of all new cars and light trucks. The label varies depending on the type of vehicle (gasoline, hybrid, plug-in hybrid, natural gas, diesel, or electric).

The example below is for a gasoline-powered vehicle. Take note of four numbers on the label: fuel economy (upper left), fuel-economy and greenhouse-gas rating (center), smog rating (center right), and gallons per 100 miles (directly below mpg).




- The **fuel-economy score** lists city, highway, and combined mpg, with combined as the most prominent. In a box below fuel economy, you'll find an estimate for annual fuel costs and, in the upper right, how much you can expect to save over five years compared with fuel costs for the average new car. Alternatively, it lists how much extra you'll spend if you buy vehicle that is less fuel efficient.

  For plug-in hybrids, the combined fuel-economy number is expressed both as an mpg and an MPGe (miles per gallon equivalent) because PHEVs run on both gasoline and electricity. For EVs and fuel-cell vehicles, the combined fuel-economy number is expressed solely as an MPGe. MPGe is defined as the estimated number of miles a vehicle can go on the quantity of fuel with the same energy content as a gallon of gas, which the EPA states has 115,000 BTUs, or 33.7 kilowatt-hours, of energy. An example of an MPGe label is on page 23.

- The **fuel-economy and greenhouse-gas score** assigns a rating from 1 to 10 (worst to best) for fuel economy and greenhouse-gas emissions; that is, how much $CO_2$ the vehicle's tailpipe emits. As we mentioned earlier, higher fuel economy correlates with lower greenhouse-gas emissions.

- The **smog rating** (1 to 10, worst to best) is a rating for vehicle tailpipe emissions that cause smog and other local air pollution.

- The **gallons-per-100-miles** score is a more useful way to calculate fuel consumption, because thinking strictly in mpg terms can be misleading. Here's why:

  If you drive a car that gets 10 mpg, you'll burn 10 gallons of gas to travel 100 miles. And if you trade that car in for one that gets 20 mpg, you'll use just five gallons of gas, a five-gallon savings.

  But suppose you traded in a car that gets 33 mpg for one that gets 50 mpg. You might think you'd be saving even more fuel—but you'd be wrong. Do the math: A car that gets 33 mpg burns three gallons of gas to travel 100 miles, and one that gets 50 mpg burns two gallons. So you'd save just one gallon of gas per 100 miles, even though it's a 17 mpg improvement. And if you could buy a car that gets 100 mpg, a 100 percent improvement over the 50-mpg car, you'd still save just one gallon of gas.

  In other words, not all mpg gains are equal, and improvements in mpg aren't linear. At the high end of fuel economy, they're less significant. So in terms of fuel usage, there's more benefit to trading a gas guzzler for a midsize sedan than trading a midsize sedan for a fuel-sipping hybrid.





## ADVANCED-TECHNOLOGY INTERNAL COMBUSTION ENGINES (ICEs)

When most people think of green cars, they don't think of gasoline-powered vehicles. But numerically speaking, most green cars on the road are equipped with high-tech ICEs that burn gasoline, get high fuel economy, and produce low emissions. As we mentioned in Chapter 1, these vehicles use a variety of advanced technologies in their drivetrains to achieve such high fuel-economy standards, including turbocharging, direct fuel injection, CVTs, and so on.

They also produce fewer harmful emissions than conventional cars, as the following table illustrates. Although not all cars listed are available in all states, some examples of 2016 vehicles with advanced ICEs that can have SULEV (super-ultra-low-emissions vehicle) or PZEV (partial-zero-emissions vehicle) ratings include:

| Vehicle | Drivetrain | Combined mpg | Greenhouse-gas rating | Smog rating |
|---|---|---|---|---|
| Audi A3 Cabriolet | 1.8L, 4 cyl, auto | 28 | 7 | 9 |
| Chrysler 200 | 2.4L, 4 cyl, auto | 28 | 7 | 9 |
| Ford Focus | 2.0L, 4 cyl, auto | 31 | 7 | 9 |
| Ford Fusion | 1.5L, 4 cyl, auto | 29 | 7 | 9 |
| Honda Accord | 2.4L, 4 cyl, auto | 31 | 8 | 9 |
| Honda Civic | 2.0L, 4 cyl, auto | 35 | 8 | 9 |
| Hyundai Elantra | 2.0L, 4 cyl, auto | 28 | 7 | 9 |
| Hyundai Sonata | 2.4L, 4 cyl, auto | 30 | 7 | 9 |
| Kia Forte | 1.8L, 4 cyl, auto | 31 | 7 | 9 |
| Kia Optima | 2.4L, 4 cyl, auto | 28 | 7 | 9 |
| Mazda Mazda3 | 2.0L, 4 cyl, auto | 34 | 8 | 9 |
| Mazda Mazda6 | 2.5L, 4 cyl, auto | 32 | 8 | 9 |
| Subaru Impreza | 2.0L, 4 cyl, auto | 31 | 7 | 9 |
| Volkswagen Beetle | 1.8L, 4 cyl, auto | 28 | 7 | 9 |
| Volkswagen Golf | 1.8L, 4 cyl, auto | 29 | 7 | 9 |
| Volkswagen GTI | 2.0L, 4 cyl, auto | 28 | 7 | 9 |
| Volkswagen Passat | 1.8L, 4 cyl, auto | 29 | 7 | 9 |
| Volvo S60 | 2.0L, 4 cyl, auto | 30 | 7 | 8 |

Not long ago, many auto enthusiasts thought that the future of green technology lay strictly in alternative fuels and hybrid, electric, or hydrogen-fuel technology. But as you can see from this list, lots of vehicles qualify as green cars. (For more information about the EPA's fuel-efficient, clean Smartway vehicles, go to fueleconomy.gov/feg/SmartWay.do.)

One of the big surprises in the past few years has been how far automakers have been able to push the envelope in improvements to the internal combustion engine. For example, in mid-December 2015, the EPA named Mazda as the top carmaker for fuel efficiency for the third consecutive year. Mazda produces no hybrids or EVs. It relies on 4-cylinder engines (turbocharged and naturally aspirated) and its SkyActiv powertrains to achieve high levels of fuel efficiency.

Subaru **Crosstrek**

### WHAT'S COOL

- Proven, reliable technology
- Get better gas mileage, pollute less than conventional vehicles
- Typically less expensive than other types of green vehicles

### WHAT'S NOT

- May not be as fuel efficient or clean as other kinds of green vehicles

Toyota **Prius**

## HYBRIDS

### WHAT'S COOL

- Get better gas mileage and produce less pollution than most conventional cars
- Reliable technology

### WHAT'S NOT

- Can cost more than comparable conventional cars
- More complex than conventional cars, which could lead to higher repair costs

Hybrids (sometimes referred to as HEVs, or hybrid-electric vehicles) have been on the market since the late 1990s, and for many people, they're synonymous with the term *green car.* Hybrids aren't viewed as quirky or exotic anymore—EVs have taken on that role. In many parts of the country, hybrids like the Toyota Prius are considered mainstream and are among the most popular vehicles sold.

Hybrids currently on the road in the U.S. are all of the gasoline/electric variety; they combine a conventional gasoline engine with one or more electric motor/generators, a battery pack, and a controller.

Hybrids take advantage of the efficiencies of different powertrains to increase a vehicle's overall fuel efficiency. Electric motors are more efficient in stop-and-go city driving, and gasoline engines are more efficient when driving on highways at higher speeds. Hybrids' stop-start technology (see page 8) increases fuel economy and reduces emissions.

European cars with gasoline-powered ICEs and diesel engines have used stop-start technology for decades, and some nonhybrid domestic cars with ICEs also use it. Stop-start technology became standard on the 2015 Chevrolet Impala, for example. In the near future, an increasing number of cars will use it to help meet fuel-economy mandates.

Hybrids also are equipped with regenerative braking. That means when the car coasts or brakes, the electric motor helps slow it down and functions as a generator, converting the vehicle's kinetic energy into electricity to charge the battery pack.

In 2015, hybrid sales in the U.S. totaled 384,000 cars and light trucks, a 15 percent drop from the 452,000 sold in 2015. Of 2015 hybrid sales, 30 percent (about 114,000) were the Toyota Prius liftback.

Some sources think the decline in hybrid sales has been due to consistently low gas prices, but others state that hybrid sales figures started to slip shortly *before* gas prices dropped. Still others believe that loyal Prius customers were waiting for the redesigned 2016 version, which came out in January. Also, because cars with advanced ICEs keep getting more efficient, they could be winning over potential buyers from the hybrid ranks.

In the past decade, the hybrid scene has changed significantly, mainly in the range of hybrids that are now available. Initially, the only modern hybrids were subcompacts like the Honda Insight and the Toyota Prius. Now, dozens of hybrid models are available—Toyota offers eight models for 2016—ranging from sports cars to SUVs to compact, midsize, and luxury sedans.

As we mentioned in Chapter 1, hybrids usually cost more than their nonhybrid counterparts—but not always, and sometimes not much more. The difference in purchase price depends mostly on the model. And if a hybrid does cost more, how long it takes to recoup the difference in initial cost depends on the difference in purchase price, the price of gasoline, and how much you drive.

But there's another reason it makes sense to drive a hybrid—the ecological benefits, which go beyond purely financial considerations. For folks with these priorities, burning significantly less gas and polluting less offsets the supposed penalty of paying more to buy the car.

Hybrid technology has proven very reliable. Battery packs rarely fail, have long warranties (up to 10 years/150,000 miles), and usually work flawlessly well beyond the warranty.

## PLUG-IN HYBRIDS

### WHAT'S COOL

- Higher fuel economy than standard hybrids
- Fewer greenhouse-gas emissions
- Lower fuel costs (electricity costs much less than gasoline)
- No range anxiety

### WHAT'S NOT

- Higher purchase price than standard hybrids
- Difficult for some people (apartment dwellers, those without a garage) to recharge
- Difficult to measure fuel economy accurately, since PHEVs operate on electricity, gasoline, or a combination of both

In late 2010, Chevrolet began selling the Volt, a plug-in hybrid electric vehicle (PHEV), and in early 2012, Toyota introduced the Prius Plug-in Hybrid. A plug-in hybrid has a larger battery pack than a standard hybrid; it can be recharged by connecting it to an external power source. The larger battery pack allows PHEVs to operate on electricity alone (typically for 15 to 50 miles, depending on the vehicle and driving conditions) before they burn gasoline.

Once the battery is depleted, the gasoline engine seamlessly kicks in, and drivers can travel until they need to stop for gas and/or recharge their battery pack. (In the case of the Volt, the gasoline engine doesn't power the drive wheels; instead, it runs a generator that produces electricity to power the car.)

Because PHEVs run solely on electricity longer than conventional hybrids do, their overall fuel economy is better. And they save more money, because the cost of electricity to recharge a PHEV or EV typically is significantly lower than the cost of gasoline or diesel fuel, especially for utilities that provide discounts for off-peak or nighttime charging. Typically, PHEV batteries can be recharged overnight on a 120-volt outlet and even more quickly—usually in four or five hours—on a 240-volt charger.

PHEV owners often buy their vehicles because they have short commutes and find the idea of driving without having to use gasoline appealing (as well as less expensive). Of course, they're also not plagued by the "range anxiety" that sometimes afflicts EV owners—who worry that they'll be stranded if their car runs out of electricity—because of the safety net their PHEV's gasoline engine provides.

In addition, PHEVs are eligible for federal and (sometimes) state tax incentives (the U.S. Department of Energy has information at fueleconomy.gov/feg/taxevb.shtml, and the Alternative Fuels Data Center writes about incentives at afdc.energy.gov/laws/state). Plus, in many states, PHEVs can use carpool lanes with only the driver aboard.

Plug-in hybrids are becoming more popular because of their convenience, range, and fuel efficiency. (The Volt, which has developed an extremely loyal following, was redesigned for 2016 and is reviewed on page 106.) And Chevrolet and Toyota aren't the only automakers offering PHEVs. Audi, BMW, Cadillac, Ford, Hyundai, Mercedes-Benz, Mitsubishi, and Porsche currently make PHEVs—and more are on the way (see Chapter 4).


Audi **A3 e-tron**

### WHAT'S COOL

- Cheaper to run because electricity costs less than gasoline
- EVs don't produce $CO_2$
- Clean running—zero tailpipe emissions
- Strong initial acceleration, smooth and quiet to operate
- Less maintenance

### WHAT'S NOT

- Higher vehicle cost (even with tax breaks, rebates, and other incentives)
- Limited range on most EVs (typically 75–100 miles) before a recharge is needed
- Long recharging times, especially on a 110-volt outlet
- Not so clean to drive if your electricity source is a coal-fired power plant
- Limited places to recharge
- Cold and hot weather reduce an EV's range

# ELECTRIC VEHICLES

Electric vehicles (EVs) are powered by an electric motor (or motors) that draws current from a rechargeable battery pack. Green car buyers like EVs for a variety of reasons. Electric motors are efficient, quiet, and powerful; provide instant, smooth, and strong acceleration; and produce zero emissions at the tailpipe. And because EVs have simpler drivetrains and fewer components, they typically require less maintenance than other types of vehicles (no oil or air-filter changes, no tune-ups, no radiators to repair or refill, no timing belts or water pumps to replace). In many states, EVs can use HOV lanes with only the driver as an occupant (surveys indicate this perk is a big draw for prospective EV buyers).

Like plug-in hybrids, EVs are eligible for federal and (sometimes) state tax incentives (get more information at fueleconomy.gov/feg/taxevb.shtml and at afdc.energy.gov/laws/state). A 2016 Nissan Leaf has a base price of $29,010. Deduct the federal tax credit, and that's $21,510—pretty reasonable.

Used EVs are an even better deal—largely as a result of cheap gas, which put a crimp in the used EV (and hybrid) markets. In early January 2016, for example, a popular online site listed nearly 600 2013–2015 Nissan Leafs for sale nationwide. All vehicles had been driven fewer than 30,000 miles, and prices ranged from $8,800 to $22,000, with an average price of $12,800.

EVs typically are cheaper to run, too. For example, the U.S. Department of Energy (fueleconomy.gov) estimates that it would cost $1,050 a year in gasoline to drive a VW Golf 15,000 miles, but just $550 in electricity to drive the same mileage in a VW e-Golf.

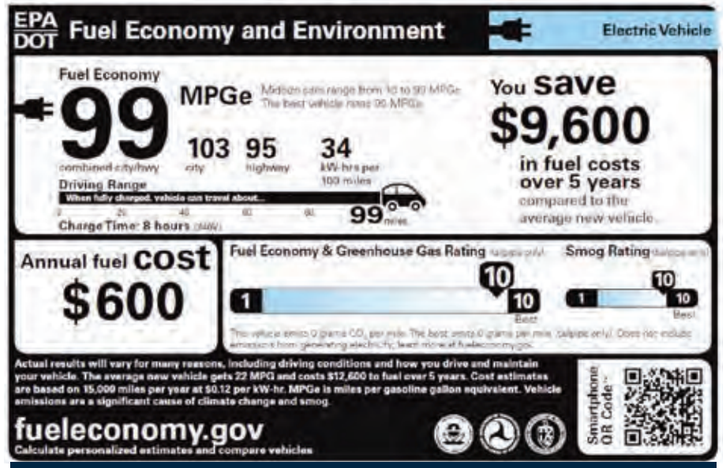
That being said, there are some downsides. Most EVs suffer from a single significant drawback: the lack of a small, light, inexpensive battery with a large storage capacity, plus the related challenge of high recharge time. Although battery charge times are coming down, most EV batteries require four to eight hours to recharge fully, sometimes longer. Even a "quick charge" to 80 percent capacity can take a half hour.

Nearly 80 percent of Americans have a round-trip commute of fewer than 50 miles, much less than the range of most EV batteries (typically about 75–100 miles). Nevertheless, EV batteries' limited storage capacity minimizes the cars' appeal, and for many drivers, reduces their practical utility to that of a second car.

The Tesla Model S and Model X have big, expensive batteries that largely avoid the range-anxiety issue; the carmaker offers batteries with EPA-estimated ranges between 208 and 265 miles. But their MSRPs also are out of reach of most prospective EV owners.

However, more public and workplace charging stations—including quick-charging stations—are springing up, and battery technology is improving so that in the future, EVs will likely have greater ranges. (The new Chevy Bolt, due out in late 2016, claims a range of around 200 miles on a charge.)

Volkswagen **e-Golf**




**FUEL ECONOMY is estimated differently for EVs, for PHEVs when they're running on electricity, and for hydrogen fuel–cell vehicles. Instead of mpg, the labels on these vehicles display MPGe (miles per gallon equivalent). The number represents the estimated miles a vehicle can travel on the quantity of fuel with the same energy content as a gallon of gasoline.**

Would-be EV owners should be aware that many factors affect an EV's range, including ambient temperature and the use of power-consuming accessories (air-conditioning, entertainment systems).

AAA and the Automobile Club of Southern California's Automotive Research Center conducted tests of EV battery-pack performance in cold, moderate, and hot conditions to see how EV battery range fluctuates with temperature.

The driving range of all of the vehicles decreased in both extreme hot and cold conditions. The average EV battery range was 105 miles at 75° F, but dropped to an average of 69 miles at 95° F. Cold weather had a more dramatic impact, dropping the range to an average of only 43 miles when the temperature was held steady at 20° F.

In other words, EVs aren't for everyone. That said, in addition to Nissan and Tesla, BMW, Chevrolet, Fiat, Ford, Honda, Kia, Mercedes-Benz, Mitsubishi, Smart, Toyota, and Volkswagen have produced EVs or will bring them to market soon.

EV sales (including plug-in hybrids like the Chevy Volt and Toyota Prius PHEV) have been strong in the U.S. over the past few years. Sales in 2014 (123,300) topped those in 2013 (97,500) and in 2012 (52,600), and EV sales worldwide during the past two years have increased. However, EV sales in the U.S. dropped slightly in 2015, to 115,300 vehicles.

The number of public charging stations nationwide is rising, so it's easier than ever to "fill up" an EV. There are about 11,400 stations with 28,400 charging outlets, up from about 9,000 and 22,000, respectively, in early 2015. (Find charging station locations at afdc.energy.gov or on the AAA App.)

Tesla is continuing to expand its network of Supercharger stations, which provide free quick charges for Tesla owners. At press time, there were about 600 stations in the U.S., equipped with almost 3,500 chargers. (Get locations at teslamotors.com.)

## GREENER FROM START TO FINISH?

EVs are, of course, zero-emissions vehicles (ZEVs). And it's been noted that the greener a car owner's sources of electricity (e.g., not getting it from a coal-fired power plant), the greener the EV driving experience. To extend that line of inquiry, one might ask: Are EVs cleaner compared with gasoline-powered cars if we look at their entire life cycle?

The Union of Concerned Scientists (UCS) calculated the total global-warming emissions of both kinds of vehicles through their manufacturing, driving, and disposal cycles. It found that the assembly stage of a small gasoline-powered car produces about 7 metric tons of emissions; in comparison, the assembly of an EV with a range of 84 miles (think Nissan Leaf) produces about 8 tons of emissions.

By the end of its driving life, the gasoline-powered car will produce 57 metric tons of global-warming emissions (including the refining and transporting of the gasoline it burned) compared with 28 metric tons of emissions for the EV. (Also, the UCS estimates that two-thirds of Americans live in regions where charging an electric car produces fewer emissions than driving even a 50-mpg gasoline car.) Disposing and recycling each type of car adds less than 1 metric ton of emissions, and electric batteries can be recycled or reused.

The UCS concluded that, within a year of driving, an EV cuts global-warming emissions by more than 50 percent compared with a similar-size gas-powered vehicle, making up for the extra emissions that are produced when the EV battery is created. And as sources of electricity become greener, so will driving EVs. (A UCS video on this topic is at insideevs.com/union-of-concerned-scientists-release-video-on-electric-car-global-warming-emissions.)

## TIPS FOR MAXIMIZING EV BATTERY RANGE IN HOT OR COLD WEATHER

**Store your vehicle** in a garage, which in winter is usually at least a few degrees warmer than the outside temperature, especially if it's attached to a house. In hot climates, garages offer shade to keep internal vehicle temperatures lower.

**Monitor recharge times** in colder weather. If your car's charging system is using electric current from the grid to keep the battery warm, it could take longer than usual to fully charge the car.

Before driving, **preheat or precool the car** while it's plugged in to reduce the drain on the battery.

**Use electric seat heaters and steering wheel heaters** to keep warm; they use less energy from the battery than heating the air in the cabin.

**Check the tire pressure** frequently. Tire pressure falls slightly as the weather turns colder, which creates more rolling resistance.

# EV CHARGING 101

Because electrical chargers are an evolving technology, obtaining quick, convenient, and reliable charging remains a significant concern for EV owners. The AAA App and the U.S. Department of Energy's Alternative Fuels Data Center (afdc.energy.gov/fuels/electricity_locations.html) provide information about public charging-station locations. The following are three categories of EV chargers:

## LEVEL 1

This is a 120-volt charger, which provides the slowest charging. Almost all currently produced electric cars come with a power cord that can plug in to a standard 120-volt outlet. Many current EVs require about 20 hours to achieve a full charge on 120 volts, but some—Teslas, in particular—can take considerably longer. Recharging for plug-in hybrids typically takes from a few hours to overnight.


## LEVEL 2

A 240-volt charger can be used by all EVs now being produced; it's usually at least twice as fast as Level 1 charging. Most public charging stations are Level 2 (including stations at some AAA branches). When a motorist purchases an EV, most manufacturers offer to sell them a Level 2 charger for installation in their garage. Recharging time is generally from 8 to 10 hours for a fully depleted battery.

Some cars (Nissan Leaf, Smart Electric Drive, BMW i3, and Ford Focus Electric, for example) have higher-capacity onboard chargers that can speed up Level 2 charging to between 4 and 6 hours. If you choose a Level 2 charger, your garage (or other charging location) will need 30-amp, 240-volt electrical service. The cars listed above with higher-speed Level 2 capabilities will likely need a 50-amp-capacity circuit.

## DC FAST CHARGING

A 480-volt charger converts 480-volt AC power to DC current. DC fast-chargers are generally expensive, fixed-site high-speed units. They can recharge a battery pack to 80 percent in about 30 minutes; the final 20 percent of recharge must be trickled in to prevent battery overheating and takes a couple of hours, no matter which level charger is used. Not all EVs are equipped with fast-charging capabilities.

Most DC fast-chargers use a CHAdeMO adapter, which fits the Nissan Leaf and Kia Soul EV. U.S. and European EVs fitted for fast-charging—including BMW, Chevrolet, Mercedes-Benz, Volkswagen, and Volvo—use the combined charging standard (CCS) adapter. Tesla EV owners use free, dedicated Tesla Supercharging stations to recharge their cars' batteries.



## CLEAN-DIESEL VEHICLES

Historically, diesel-fueled passenger cars have been extremely popular in Europe—where gas prices are much higher than in the U.S.—because of their high fuel efficiency, reduced $CO_2$ emissions compared with gasoline-powered cars, and durability. Diesel vehicles haven't sold well in this country, though, with the exception of heavy-duty pickup trucks and SUVs, mainly because they're reputed to be noisy, smelly, rough-running, and dirty.

These qualities don't apply to modern diesel passenger vehicles, which are smooth, quiet, and emit virtually no odor. Most people who drive them can't tell the difference from driving a gasoline-powered vehicle.

Diesel engines offer snappy acceleration and are well-suited for towing. But even with low-sulfur diesel fuel and exhaust after-treatment, diesel vehicles are still among the highest-emitting vehicles currently sold, meeting only California's LEV or ULEV emissions standards.

Diesels often cost more than their gasoline-powered counterparts, and diesel fuel typically costs more than gasoline. According to the U.S. Energy Information Administration (EIA), "Diesel fuel prices have been higher than regular gasoline prices almost continuously since September 2004." In 2015, diesel prices also dropped but on average were higher than gas prices. The average price of diesel in 2015 was $2.71 per gallon, the lowest for the fuel since 2009. In 2014, by comparison, diesel averaged $3.81 per gallon.

Mercedes-Benz **E250 BlueTEC**

### WHAT'S COOL

- High fuel economy
- Durable, powerful engines
- Less maintenance required, relative to gasoline-powered vehicles
- Ready availability of diesel fuel

### WHAT'S NOT

- Diesel fuel is typically more expensive
- Still "dirtier" than most vehicles

## DIESELGATE

Diesel passenger vehicles are currently in a state of limbo—or perhaps purgatory is a better term. Although we featured a dozen diesel vehicles in the 2015 *AAA Green Car Guide*, many of them highly ranked, diesels are conspicuous by their relative absence this year.

In recent years, diesels' traditional lack of popularity had been changing with the emergence of so-called "clean diesel" technology. Among the most popular models were the Volkswagen Golf TDI and Jetta TDI. It seemed almost too good to be true.

It was. In September 2015, VW admitted that, beginning with model year 2009, it violated U.S. diesel emissions regulations by installing emissions-cheating software that allowed 10–40 times the permissible level of nitrogen oxides to be emitted from its diesel passenger cars. The software, referred to as a "defeat device," turned on its cars' emissions controls for EPA testing and then turned them off during real-world driving. This wavto 2015 and that were equipped with 2.0-liter, 4-cylinder diesel engines. Later, it was discovered that VW's V6 diesel engine also used a cheat device, and that Audi and Porsche vehicles (part of the VW Group) were implicated in the scandal, too. The automaker faces up to $18 billion in fines from the EPA.

VW dealers, customers, government officials, and auto industry executives expressed shock, anger, disbelief, and dismay at the deception. In early 2016, Volkswagen was working on a plan to compensate owners of affected diesel vehicles by fixing existing vehicles or providing cash payments, buybacks, or replacement vehicles.

Does the VW scandal spell the death of diesel cars in the U.S.? Probably not, but it's unquestionably a major setback. VW sales fell off in the last months of 2015, and industry executives fear that the scandal will affect the entire industry. As business analysts are fond of saying, it's easy to destroy trust and hard to rebuild it, and Volkswagen has put itself in that situation, in spades.

## FLEX-FUEL VEHICLES

### WHAT'S COOL

- Domestically produced alternative fuel reduces the need to import oil
- Burns cleaner than gasoline and pollutes less

### WHAT'S NOT

- Limited availability of E85
- Lower mpg than gasoline
- Diversion of corn to fuel production may increase food prices

Flex-fuel vehicles have engines that can run on both gasoline and gasoline/alcohol blends in ratios up to 85 percent alcohol. Initially, the alcohol used was methanol, but now it's ethanol. E85 (85 percent ethanol and 15 percent unleaded gasoline) is available in about 2,700 public service stations—about 2 percent of the total number—the vast majority of them in the Midwest. In other regions of the country, E85 is relatively scarce. In 2011, the EIA estimated that there were nearly 10 million flex-fuel vehicles on the road, about 1 million of which actually used E85 fuel. (Find a service station that sells E85 fuel on the Alternative Fuels Data Center website, afdc.energy.gov/fuels/ethanol_locations.html).

Why flex-fuel? For one thing, ethanol is domestically produced, so using it reduces the need to import oil. Acknowledging the importance of energy independence as a national mandate, Congress passed the Energy Independence and Security Act in 2007, which contains a Renewable Fuels Standard that requires blending increasing amounts of biofuels with gasoline over time. By late 2015, however, controversy had arisen over how much ethanol blending is really necessary, based on current and probable future use, and the EPA proposed reducing its original target amounts.

Ethanol also burns cleanly and reduces greenhouse-gas emissions. Unfortunately, recent studies have shown that producing ethanol at current levels creates roughly as much extra greenhouse-gas emissions as it saves at the tailpipe. This phenomenon is known as carbon shifting, which means decreasing carbon emissions in one area of manufacture or use but increasing it in another area as a result. Carbon shifting can undermine many voluntary attempts at reducing $CO_2$ emissions. Additionally, ethanol has a lower energy content than gasoline, resulting in about 25 to 30 percent lower mpg figures.

Most ethanol used in American gasoline today comes from corn, and over time ethanol production has consumed a growing portion of the nation's corn crop. In 2014, it was estimated that 40 percent of U.S.-grown corn was used to make ethanol.

In Brazil, Sweden, and South Africa, fuel ethanol is made from sugarcane and wood chips. It was expected that future U.S. ethanol production would come from cellulosic sources such as corn stover (leaves, stalks, and other leftovers), napier grass, wood chips or pulp, rye straw, or switchgrass, but as of late 2015, alternative sources of ethanol in the U.S. simply didn't exist and weren't being developed.

For more information on flex-fuel vehicles and E85 fueling locations, go to fueleconomy.gov/feg/flextech.shtml and e85vehicles.com.

Chevrolet **Silverado**

## CNG-POWERED VEHICLES

### WHAT'S COOL

- CNG is cheaper and cleaner than other motor fuels
- CNG is abundant and domestically produced

### WHAT'S NOT

- Only one CNG vehicle is produced for the U.S. market
- CNG vehicles are more expensive than comparable gas-powered vehicles
- Fueling stations are scarce, especially outside of urban areas

Compressed natural gas (CNG) has some great advantages as a vehicle fuel. First, the U.S. has vast reserves of it, so we're not dependent on other countries for supply. Second, CNG is relatively clean. When burned, it yields 60 to 90 percent fewer smog-producing emissions and 30 to 40 percent fewer global-warming gases than gasoline.

CNG typically is also less expensive than gasoline. Since April 2011, the price of CNG has fluctuated very little—between $2.06 and $2.17—unlike the price of gasoline. At press time, the prices of the two fuels were similar.

Only about 500 CNG fueling stations in the U.S. are open to the public, and they're concentrated mostly in urban areas. This limited availability is a major reason CNG technology hasn't been more widely adopted. A list of CNG fueling stations can be found at cnglocator.net.

Public transportation across the country has used CNG for decades. About 12 to 15 percent of U.S. public transit buses currently run on natural gas. Despite CNG's compelling advantages, very few private passenger cars available in this country run on CNG—less than one tenth of 1 percent—and many of those are taxi and governmental vehicle fleets. In the U.S., CNG passenger cars have been called the "neglected stepchildren" of green cars.

The situation took an unexpected turn for the worse in the past year. In mid-2015, Honda announced that, after nearly two decades, it was discontinuing production of its Civic Natural Gas model. The reasons? The Natural Gas model costs about $6,000 more than a conventional Civic, and lower gasoline prices have eliminated the appeal of potential fuel savings. As a result, customer demand for the vehicle, which had never been strong, would likely have dropped off even more. In recent years, Honda has sold only about 700 Natural Gas models annually.

That leaves the Chevrolet Impala Bi-Fuel (reviewed on page 141) as the only passenger car in production running on CNG. In 2013, Chevy announced it would produce an Impala "hybrid" that would run on both CNG and gasoline. The Bi-Fuel, which lists for about $40,000, has two fuel tanks. The CNG tank takes up considerable trunk space and holds the energy equivalent of 7.8 gallons of gasoline, good for about 150 city miles of range.

When the CNG supply is exhausted, the engine seamlessly switches over to burning gasoline. However, a dashboard-mounted switch allows drivers to choose their fuel at any time. Fuel-economy numbers for the Impala Bi-Fuel are 20 mpg combined (17 city/25 highway) on gasoline and 19 mpg combined (16 city/24 highway) using CNG.

Quality-control delays held up the initial release of the Impala Bi-Fuel, but by late 2015 the car was in production, and about 200 vehicles were delivered to customers by the end of the year. It's expected that most will be used for fleet or commercial purposes. Chevrolet, Ford, GMC, and Ram have introduced CNG-powered pickup trucks or vans into their lineups—medium and heavy-duty vehicles that can also run on gasoline. For more information about CNG-powered vehicles, go to cngnow.com.

Chevrolet **Impala Bi-Fuel**

## HYDROGEN FUEL-CELL VEHICLES

**WHAT'S COOL**

- The ultimate clean vehicle—zero tailpipe emissions, and no plugging in required

**WHAT'S NOT**

- High vehicle cost
- Lack of supportive infrastructure—extremely limited number of fueling stations

Hydrogen fuel–cell vehicles, considered by many as "the cars of the future," are propelled by electric motors; they create their own electricity through a chemical process in which hydrogen fuel reacts with oxygen from the air. They emit only water and heat.

Currently, most hydrogen is made through a process known as reforming, which converts natural gas into hydrogen gas and carbon dioxide. Hydrogen can also be produced from cleaner sources of energy—for example, by splitting water into hydrogen and oxygen through electrolysis. In addition, methane gas from landfills and sewage-treatment facilities (biomass) can be used to produce hydrogen, although precautions must be taken to minimize methane leakage from landfills.

In 2008, Honda introduced the FCX Clarity, a fuel-cell sedan, in limited numbers and made it available as a lease vehicle, mainly in Southern California. At the Tokyo Motor Show and the Los Angeles Auto Show in late 2015, the automaker unveiled its new five-passenger fuel-cell sedan, the Clarity Fuel Cell, which it planned to begin leasing in Japan in March 2016 as a 2017 model. A U.S. launch is planned for late 2016 to customers in California.

In the spring of 2014, Hyundai released a Tucson-based fuel-cell electric vehicle (reviewed on page 155) to a limited number of customers in Southern California. Production continues at the rate of about 60 vehicles annually.

Toyota made headlines in late 2014 with its Mirai FCEV, which became available for sale or lease in the U.S. in the fall of 2015. Other automakers, including Mercedes-Benz, are also pursuing fuel-cell technology.

Many hurdles must be overcome before fuel-cell vehicles fill new-car showrooms. The technology is expensive and relatively unproven, and the infrastructure for hydrogen refueling is practically nonexistent. For example, Toyota delivered 57 Mirai sedans in October and November 2015, but at the time only four California hydrogen stations were open, so as a stopgap measure, the automaker provided portable hydrogen fueling units to six of the eight California dealers selling the Mirai so that customers could more easily refill their vehicles.

Toyota **Mirai**

# OWNERSHIP COSTS, VALUE RETENTION

Do green cars cost more to own, and do they hold their value? It depends on the type of green car, the specific brand and model, how the car is maintained, the price of the fuel it uses, and your driving habits, among other factors.

Of course, some kinds of green cars—high mpg/low-emissions models with advanced internal-combustion engines (ICEs)—have similar ownership costs to conventional vehicles because they don't differ from conventional gasoline-powered vehicles in ways that would create higher costs, such as increased maintenance.

Other kinds of green cars—diesels, for example—might have lower ownership costs in some ways but higher ones in others. For example, they're more durable and less prone to break down (assuming the specific diesel car in question has a reputation for reliability), but their purchase price will probably be higher, and the cost of diesel fuel has typically been higher than that of gasoline.

Hybrids generally cost more to buy than conventional cars, and they use complicated, potentially expensive technology such as battery packs. In addition, they have multiple power sources: an ICE and one or more electric motors. However, surveys show that some popular hybrids—the Toyota Prius, for example—are among the most reliable of all cars. And most hybrid components have proven themselves to be durable, too.

As an example, for 2016, the industry trade journal *Ward's Auto* picked three hybrid powertrains to be on its list of 10 Best Engines for 2016: those for the 2016 Chevrolet Volt, the 2016 Hyundai Sonata Plug-in Hybrid, and the 2016 Toyota Prius. This is a departure from the journal's usual practice of choosing stand-alone ICEs for its 10 Best list.

Routine maintenance and repairs for some green cars might be higher than for conventional vehicles. It depends mostly on brand (e.g., regardless of the powertrain, a luxury car generally costs more to maintain than a compact) and how well the car is maintained. But hybrids don't require extra maintenance, and some hybrid components (such as brake pads) last longer because hybrids have regenerative braking—energy-recovery mechanisms that slow down the vehicle and convert its kinetic energy into electrical energy, thus reducing wear on brake pads. Furthermore, EVs are less complicated, require less overall maintenance, and are likely to be more durable than other types of cars.

Insurance costs make up 7 to 18 percent of total car ownership costs. Regarding green cars, those with advanced ICEs don't cost any more to insure than conventional cars. However, there are no definitive answers about the relative costs to insure hybrids and EVs. Some studies indicate that hybrids cost slightly more to insure because many are small and don't fare as well in crashes, and because their parts can be expensive. However, the difference in the premium might be small enough to be recouped by hybrids' lower fuel costs.

| VEHICLE | POWERTRAIN | 5-YEAR COST OF OWNERSHIP |
|---|---|---|
| 2015 Ford Focus Fusion S | ICE | $37,517 |
| 2015 Ford Fusion Hybrid S | Hybrid | $39,814 |
| 2015 Ford Focus SE | ICE | $34,008 |
| 2015 Ford Focus EV | EV | $35,012 |
| 2015 Hyundai Sonata SE | ICE | $36,155 |
| 2016 Hyundai Sonata Hybrid | Hybrid | $38,500 |
| 2015 Infiniti Q50 | ICE | $48,364 |
| 2015 Infiniti Q50 Hybrid Premium | Hybrid | $53,237 |
| 2016 Toyota Camry LE | ICE | $36,330 |
| 2016 Toyota Camry Hybrid LE | Hybrid | $37,292 |

**FIVE-YEAR OWNERSHIP COSTS** for five green cars and their conventional counterparts, based on an analysis of depreciation, financing, insurance, state fees, fuel, maintenance, and repairs. (Source: kbb.com)

Hybrids cost less to insure than they did a decade ago, when insurers were unfamiliar with them and their potential risks. Also, reports indicate that Nissan Leafs have been less expensive to insure because of their limited range (which means they're generally driven less).

Do green cars hold their value? The answer depends on a number of factors that can change with the times. For example, in times of high gas prices, hybrids sell at a premium. Popular, prestigious, and reliable green cars tend to hold their value better. On the other hand, the value of green cars with more-conventional technology—gasoline-powered cars with advanced ICEs—varies little if at all from their less-efficient counterparts.

So, does a green car cost more to own? There's no black-and-white answer. The bottom line is, if you're interested in a green car, do the necessary research, and if the numbers are right for you, buy one that's reliable and maintain it properly. AAA's car research tools can help; go to AAA.com/auto.

# BUYING A USED HYBRID OR EV

Hybrids and EVs have been around long enough to create a healthy used-car market. Here are some things to keep in mind if you're thinking about buying a used one.

## USED HYBRIDS

Hybrids have been available in reasonably large numbers for just over a decade—more than 2 million (mostly Toyotas and Hondas) have been sold since the year 2000—so they have a pretty good track record. Hybrid technology, though complex, is well established, and many hybrids have good to excellent reliability records.

The first step in buying a used hybrid is to research the model you're interested in. Pay close attention to reliability reports, owner comments, recalls, and price/depreciation information. Once you find a car you like, use the vehicle identification number (VIN) to track a vehicle's service history, and obtain a vehicle history report through a company like Autocheck or Carfax. If you can afford it, look for a car with low mileage and at least a year left on the bumper-to-bumper factory warranty.

The single biggest potential expense for a used hybrid is replacing the battery pack. That's not likely to be a major concern, though, because the battery pack and certain other hybrid components are guaranteed for longer than other vehicle parts—up to 10 years/150,000 miles, depending on the state you buy the car in. And perhaps as an indicator of confidence in the technology, Hyundai provides a lifetime guarantee on its hybrid batteries; it will replace the battery and cover recycling costs for the old battery free of charge to the original owner.

Hybrid battery replacement costs vary widely depending on the make of car and where you have it serviced. Again, this is not an especially realistic concern. Most hybrid battery packs last the life of the vehicle.

Even though hybrids are more commonplace nowadays, it's still likely you'll have to go to a dealer for service. So if you prefer taking your car to an independent repair shop, check to make sure it will be able to work on the hybrid you're considering.

When you've found the vehicle you're interested in, tell the dealer or private party you want to have it independently inspected. AAA Approved Auto Repair shops can perform a detailed inspection of a vehicle for under $100.

## USED EVs

Electric vehicles have only been on the market since 2010, so the used EV market is much smaller and in a much greater state of flux. However, in the fall of 2015, a surplus of used EVs was reported, likely due to the return of EVs from two- and three-year manufacturer-subsidized leases. Some of the vehicles (three-year-old Leafs, for example) were reported to hold their value at less than one-third their original price—which means that you may be able to get a very good deal on a used EV.

Now, if used EVs are worth buying, why would their value have dropped so much? In part because when they were new, they came with a $7,500 federal tax credit and perhaps some state incentives, so their current pricing reflects that. Also, EVs are considered less desirable by many buyers simply because gas prices were consistently low throughout 2015. Therefore, demand for them is lower. Another factor: People are less familiar with EV technology and aren't sure how reliable they'll be.

Here are some things to keep in mind when shopping for a used EV:

First, have the EV inspected—in particular, have a battery-capacity test done to gauge its condition. Make sure all of the accessories work. Try to determine whether the car has been driven a lot in extreme heat or cold, which can affect battery life. (EV batteries are warranted against total failure for up to 10 years/150,000 miles, depending on the state you live in.)

EVs are simpler vehicles, so many of the items that might wear out or fail on a gas-powered vehicle—clutch, transmission, fuel system—aren't a concern. Therefore, total mileage driven isn't as important a consideration as it might be with other kinds of vehicles. Similarly, EVs require less maintenance, an additional perk.

Some early EV models lack a capacity for fast-charging. Determine how important this feature is to you before you buy. And some EVs (such as the Honda Fit EV and Toyota RAV4 EV) were produced only as compliance cars—that is, to satisfy government requirements for a specific number of zero-emissions vehicles—and have become EV orphans. You're probably better off buying a used EV that's still in production and that you know can be serviced where you live.





## BEST GREEN CARS FOR TEENS

If you're buying a car for your teen, a green car is an excellent choice. However, be aware that your teen might not agree with what you think is the best car. He or she might want something more sporty or performance-oriented. Get ready to put the brakes on that idea. AAA recommends a midsize sedan or crossover with a 4-cylinder engine, automatic transmission, and high crash-test scores. Here's why:

- A midsize car is big enough to protect occupants in a crash but small enough for a new driver to handle easily.
- A 4-cylinder engine limits a car's acceleration (and a teen's desire to show off) and generally provides better fuel economy and a lower carbon footprint.
- Cars with automatic transmissions are easier to drive, allowing teens to focus on steering, proper speed, and braking.
- Traffic crashes are the leading cause of teen deaths, so a car with a high crash-test score could save your teen's life or reduce the chance that they'll be seriously injured in a crash.

**Based on these criteria and the scores from this year's reviews, the Top 10 green cars for teens in the 2016 *AAA Green Car Guide* are:**

1. Subaru **Outback**
2. Volkswagen **Passat**
3. Subaru **Legacy**
4. Subaru **Forester**
5. Honda **Accord**
6. Lexus **NX 300h**
7. Toyota **Camry Hybrid**
8. Lexus **ES 300H**
9. Mazda **Mazda6 i Grand Touring**
10. Hyundai **Sonata Eco**

GETTYIMAGES/ANDRESRIMAGING

CHAPTER 3

# HOW AAA CHOOSES, TESTS, AND SCORES VEHICLES

The Automobile Club of Southern California's Automotive Research Center (ARC) has tested and reviewed green vehicles and published the results in the *AAA Green Car Guide* since 2010. During that time, there has been a tremendous increase in the number of green makes and models, as automakers attempt to meet federal Corporate Average Fuel Economy (CAFE) standards and increasingly stringent smog-forming-emissions standards (see Chapter 1).

The ARC staff actively monitors the car-buying market and green technology to stay current with the latest fuel-efficient and alternative-powered vehicles. ARC engineers and technicians evaluate available vehicles that meet the testing criteria using independent, objective testing procedures. Evaluations are performed at the ARC facility, on Southern California roads, and at the Auto Club Speedway in Fontana, California.

For a vehicle to be included in the *Guide*, it must have at least one of the following characteristics. It must be a:

- zero-emissions (ZEV) or partial-zero-emissions (PZEV) vehicle
- hybrid or plug-in hybrid vehicle
- battery-electric vehicle
- diesel vehicle that meets California emissions standards
- vehicle that runs on compressed natural gas (CNG)
- vehicle that runs on hydrogen
- vehicle with EPA category-leading fuel economy

For the category-leading fuel-economy group, the ARC staff chooses the leading internal-combustion, gasoline-powered vehicles from the categories established by the EPA and published on its website, fueleconomy.gov.

The ARC tracks changes to a vehicle's powertrain to decide whether it should evaluate the latest model year of that vehicle. For example, ARC staff tested a 2014 Mazda Mazda3 sedan two years ago. No significant changes were made to its powertrain for 2015 or 2016, so the 2014 model's review remains in the 2016 *Guide*. However, the vehicle's ranking was recalibrated based on the scores of other cars evaluated for 2016.

Based on its research, the ARC compiles a list of potential vehicles to be tested in the current year. ARC staff then ask automakers to lend test vehicles. Manufacturers don't always have the vehicles needed for testing, either because they're not yet in press fleets or they're otherwise not available. If the ARC is unable to acquire a vehicle from a manufacturer, it attempts to acquire vehicles from rental companies and other sources.

The ARC makes every attempt to acquire a vehicle or powertrain that fits within the *Guide* guidelines. If a vehicle isn't included in the review section, it's because the ARC wasn't able to acquire it by the publishing deadline.

## SCORING

After the ARC completes vehicle testing, it ranks the scores for each test area on a zero- to 10-point basis. The best-scoring vehicle receives 10 points, and the lowest receives zero points. Then the scores from all of the tests for a particular vehicle are totaled to determine its overall score. The max possible score is 130.

Next, we divide the point difference between the highest- and lowest-scoring vehicles into nine equal units. We then assign each vehicle a Leaf score (1 to 5 leaves, in half-leaf increments, with 5 being the best) based on where it falls in the unit ranking.

A 2016 Toyota Prius negotiates the SLALOM COURSE at the Auto Club Speedway in Fontana, California.

(Clockwise from top left) An **OPTICAL FIFTH WHEEL** is used in braking and acceleration tests at the Auto Club Speedway in Fontana, California; measuring a vehicle's **TURNING CIRCLE**; using a **DECIBEL METER** to measure interior sound levels.

The following are the 13 criteria that ARC staff use to evaluate and score vehicles:

**EMISSIONS SCORE.** A vehicle's emissions score is taken directly from the EPA's ratings, which gives every vehicle a score of 1 through 10 (with 10 being the best), determined by the vehicle's emissions levels. The emissions score is the equivalent of the EPA's smog rating, which is found on all vehicle window stickers. All vehicles have a federal rating. All vehicles sold in California also must pass California exhaust-emissions standards. So, most vehicles will have both a California and a federal rating, although the EPA window sticker shows only the federal rating.

In some cases, automakers send dealers in California (and the other states that share the same emissions standards) vehicles that produce lower exhaust emissions than vehicles sold in other states. For example, Subaru's vehicles meet California Air Resources Board PZEV standards. The *AAA Green Car Guide* uses the federal rating in its calculations, unless the vehicle is one with a drivetrain configuration sold only in California.

**CRASHWORTHINESS.** A vehicle's crashworthiness score is calculated based on the weight of the vehicle and the number of air bags. Typically, each vehicle is weighed on a public scale with a full tank of gas and no occupants. In some cases, the weight is obtained from the manufacturer. The maximum score based on weight is five points.

A vehicle is also awarded points based on its number of air bags, with a maximum of five points. The number of air bags in our scoring often differs from what's reported by the manufacturer. For example, a manufacturer typically counts a full side-curtain air bag as one air bag, but because it protects both the front and rear passengers, the ARC counts it as two.

**BRAKING.** The braking score is based on recorded stopping distances measured by an optical fifth wheel (a device used to measure time, distance, and speed) attached to vehicles when testing them at the Auto Club Speedway. The braking-distance score is the average of three sudden-stopping distances from 50 to zero mph.

**ACCELERATION.** A vehicle is given an acceleration score based on the zero-to-60 mph and 40-to-60 mph elapsed times, which are measured using the optical fifth wheel. A total of 12 acceleration tests per vehicle at each speed are performed on the drag strip at the Auto Club Speedway, six heading west and six heading east. ARC staff then average the best two times in each direction. The vehicles with the best and worst elapsed times are rated with a five or a zero, respectively.

All vehicles are then rated on the basis of both components on a scale from zero to five, relative to the other vehicles included in the *Guide*. The maximum number of points a vehicle can earn is 10; that means it has both the best zero-to-60 mph and 40-to-60 mph times.

**HANDLING.** The handling score consists of three parts, each based on a slalom-course evaluation. A minimum of two ARC evaluators drive a vehicle through the slalom course at least six times each. The average of the top three slalom times overall is used to obtain the slalom time for that vehicle. The two other subscores (worth 1 point each) that make up the overall handling score are derived from subjective ratings of control and ease of operation.

**CARGO CAPACITY.** This refers to the trunk area, or for vehicles such as hatchbacks, the area behind the second seat. In most cases, this number is taken from the current *EPA Fuel Economy Guide*. The vehicle with the smallest cargo capacity is given a zero, and the vehicle with the largest capacity is given a 10. All other vehicle scores are then rated relative to these minimum and maximum cubic-feet values.

**RIDE QUALITY.** This measurement is derived from subjective scores of eight ride qualities: bump-impact noise, bump-impact feel, dip response, body shake (smooth road), body shake (rough road), ride firmness, sway (pitch), and sway (cornering). Each ARC evaluator rates the vehicles using scores from zero to 10 for each attribute. The overall average is the ride-quality score.

**EASE OF ENTRY AND EXIT.** The driver's seat of the vehicle is set to the comfort level of each evaluator, who then rates 11 attributes associated with the difficulty level of exiting and entering the vehicle's front and rear seats. The vehicle is also given a score based on the door swing or door angle. The average of the two overall ratings (front and rear) given by each evaluator becomes the overall score, on a scale from zero to 10.

**TURNING CIRCLE.** A vehicle's turning circle is measured at the Auto Club Speedway. The right and left turning radiuses are measured, and the average becomes the turning circle. The vehicle with the largest circle receives a score of zero, and the one with the smallest circle receives a 10. All other vehicles are then scored relative to the minimum and maximum radiuses.

**INTERIOR NOISE.** ARC evaluators measure interior noise with a decibel meter inside the vehicle at idle, at steady-state 30 mph, at steady-state 55 mph, and during an acceleration run from zero to 60 mph.

**ROOMINESS.** This score is based on measurements for leg, head, and shoulder room in the front and rear seat—a total of 10 possible points. After all vehicles have been tested, the minimum and maximum values for each attribute are calculated. The vehicles are then scored relative to the other vehicles in the *Guide*. Legroom and headroom can receive a maximum of two points, and shoulder room can receive up to one point.

**VISIBILITY.** There are three subjective visibility categories that each evaluator rates: forward, rear, and side visibility. Each attribute (for example, forward distance visibility) is rated on a scale from zero to 10. A vehicle gets additional points in each category if it has a rear-window defroster, rear-window wiper, heated windshield, heated side mirrors, or if the right-side mirror tilts down when the vehicle is in reverse. Some attributes, including headlight illumination, are weighted more heavily. The ARC calculates an average based on all evaluator ratings, and then uses the overall average of all of the scores to obtain the raw score.

**FUEL ECONOMY.** The ARC uses EPA estimates of mpg, which account for eight of the 10 possible points. If a vehicle uses regular fuel, it receives two additional points (one for midgrade). The high, low, and average on-the-road fuel economy obtained during the test vehicle's evaluation is also noted, but not included in the fuel-economy score. Generally, at least three evaluators drive each test vehicle for several days.

CHAPTER 4

# WHAT'S ON THE HORIZON?

In the coming years, carmakers will offer an increasing number of green vehicles in a variety of body styles and powertrains. The following pages describe green cars that will become available later in 2016 or at some point in the next several years.

Chevrolet **Bolt**

Over the course of the next decade and beyond, green cars will continue to evolve. In the next few years, trends will include:

- Further improvements to **TRADITIONAL GASOLINE-FUELED ENGINES,** including greater use of direct fuel injection, engine stop-start systems, and turbocharging.

- More **HYBRID VEHICLES,** especially more plug-in hybrids—including some that use alternative fuels such as diesel, hydrogen, or natural gas. European automakers known more for luxury and performance cars, including Audi, Porsche, and Mercedes-Benz, are developing hybrids and plug-in hybrids and plan to release significant numbers of them by 2020.

- More **EVs,** from both relatively new car companies, such as Atieva and Faraday Future, and from established carmakers. European automakers are also taking an interest in EVs. Lower battery prices and improvements in battery-pack capacity will continue to spur the trend.

- More **DIESEL VEHICLES**—despite the VW diesel scandal (see "Dieselgate," page 25)—especially from European automakers, including BMW, Mercedes-Benz, and Volvo.

- More **HYDROGEN-POWERED VEHICLES.**

The mid- to long-term picture isn't as certain. Only about 5 percent of the cars currently on U.S. roads have alternative powertrains (i.e., hybrids, PHEVs, EVs). The vast majority of the U.S. vehicle fleet for the foreseeable future will be traditional gasoline- or diesel-powered vehicles, mainly because petroleum-based fuels are relatively cheap and the infrastructure to deliver them is so well established. In addition, because the average age of U.S. vehicles is more than 11 years, it will take a long time for green vehicles to replace traditional ones.

Nevertheless, because of government mandates to increase fuel economy and further reduce emissions, green automotive technologies—including those using advanced ICEs—will continue to develop and gain ground.



# HYBRIDS

## **Acura** NSX

The NSX features a longitudinally mounted mid-engine twin-turbocharged V6, AWD, and three electric motors: one integrated with the gas engine and its 9-speed dual-clutch transmission, driving the rear wheels; and the other two driving the front wheels. Total horsepower: 573; curb weight: 3,800 pounds; 0–60 mph: 3.0 seconds; top speed: 191 mph; cost: $157,800 (base). Aluminum and composites are used extensively in the body structure; the floor is carbon fiber. The NSX is scheduled to start production in spring 2016 and will be considered a 2017 model; the automaker began taking orders this past February. Acura plans to sell about 800 NSXs per year in the U.S.

## **Chevrolet** Malibu Hybrid

Chevy redesigned its iconic midsize car, the Malibu, for 2016, and has added a hybrid version into the mix as well. The new Malibu Hybrid will be available only in the LT trim level, with a base price of $28,645; that's $2,750 higher than the gas-only version. The Hybrid's new drivetrain, similar to that of the new 2016 Chevy Volt (but not a PHEV), combines a naturally aspirated direct-injected, 1.8-liter, 4-cylinder engine with two electric motors for a total of 182 hp. It can propel the car under light throttle up to 55 mph on electric power alone. An 80-cell, 1.5-kWh lithium-ion battery pack is mounted in the trunk. Expected mpg is 48 city/45 highway, a huge improvement over the 2014 version's 25 city/37 highway. The Malibu Hybrid should be in dealer showrooms by the second quarter of 2016.

## **Hyundai** Ioniq

The Korean automaker is planning to introduce the Ioniq, a five-door dedicated hybrid hatchback, in late 2016 or early 2017. The so-called "Prius-fighter" will have a 1.6-liter, 4-cylinder, 105-hp engine; a 43-hp electric motor; and a 6-speed automatic transmission. Extensive use of aluminum will reduce the car's weight. Hyundai predicts fuel-economy numbers of about 53 mpg, along with a base MSRP of $25,000. An Ioniq PHEV and EV are likely to follow soon after.

## HYBRIDS (CONT.)

### **Nissan** Rogue Hybrid

A hybrid version of Nissan's popular Rogue compact crossover is slated to go into production in spring 2016 and may be available for sale as early as the summer. It will incorporate a 2.0-liter, 4-cylinder, 145-hp engine; a 30-kW electric motor; a CVT; and a lithium-ion battery pack—a variant on the system used in the discontinued Nissan Pathfinder Hybrid. The Rogue Hybrid will be offered only in the two higher trim levels, SV and SL, with a base price of just over $28,000, nearly $3,000 higher than a comparable gasoline-powered Rogue. Both FWD and AWD will be offered. Fuel-economy numbers are expected to be about 48 mpg combined.

# PLUG-IN HYBRIDS

### **BMW** 330e

BMW's 3 Series plug-in, the 330e, features a twin-turbo, 2.0-liter, 4-cylinder, 180-hp engine; an 87-hp electric motor; a 7.6-kWh lithium-ion battery pack; and an 8-speed automatic transmission with paddle shifters. Total horsepower is 248. The automaker claims a 0–60 time of 5.9 seconds, an all-electric range of 22 miles, and a total range of around 370 miles. The 330e will be in dealer showrooms in spring 2016.

### **BMW** 740e xDrive

BMW's flagship 7 Series PHEV shares a powertrain with the automaker's X5 plug-in hybrid: a twin-turbo, 2.0-liter, 4-cylinder, 245-hp engine; a 95-hp electric motor; a 9.9-kWh lithium-ion battery (housed beneath the backseat); xDrive; and an 8-speed shiftable automatic transmission. Combined system output is 326 hp. The all-electric range is 23 miles at speeds up to 75 mph. The 740e xDrive will be available in summer 2016.



## PLUG-IN HYBRIDS (CONT.)

### **Cadillac** CT6

Cadillac's flagship, the all-new CT6, has a plug-in hybrid variant that combines a turbocharged, 2.0-liter, 4-cylinder engine; two 100-hp electric motors; an eCVT; and an 18.4-kWh battery pack—larger than that of most PHEVs. Total output is 335 hp and 432 lb-ft of torque. The CT6 PHEV will have rear-wheel drive and can travel about 30 miles at up to 75 mph in all-electric mode. Its 0–60 time is estimated at 5.3 seconds and, according to Cadillac, fuel economy will exceed 65 MPGe. Recharge time is approximately five hours at 240 volts. The CT6 should arrive at dealers late in the third quarter of 2016.

### **Chrysler** Pacifica

Chrysler has dropped the Town & Country name and resurrected the Pacifica moniker for its 2017 model year minivan, one iteration of which will be the first hybrid minivan—plug-in or otherwise—for sale in the U.S. The Pacifica drivetrain uses a 3.6-liter V6, a twin electric-motor configuration, and a 16-kWh battery pack to produce 260 hp total. Chrysler claims a city MPGe of 80, a two-hour recharge time on 240 volts, and an electric-only range of 30 miles. The gasoline-powered Pacifica will go on sale in spring 2016, the PHEV in the latter half of the year.

### **Kia** Optima Plug-in Hybrid

Kia's first Optima Plug-in Hybrid, based on the redesigned 2016 Optima sedan, will arrive in the U.S. in the latter half of 2016. It will have a 2.0-liter, 4-cylinder, 154-hp engine; a 67-hp electric motor; a 6-speed automatic transmission; a 9.8-kWh lithium-polymer battery pack; and a 202-hp total power output. All-electric range is expected to be about 27 miles, with fuel-economy ratings of about 40 mpg combined and 99 MPGe. The Optima PHEV will fully charge in less than three hours with a 240-volt charger or in nearly nine hours on a 120-volt power outlet.

## PLUG-IN HYBRIDS (CONT.)

### **Mercedes-Benz** C350e

The Mercedes-Benz C350e plug-in hybrid will pair the C300's turbocharged, 4-cylinder, 208-hp engine with an 80-hp electric motor for a total power output of 275 hp. Other drivetrain components include a 7-speed automatic transmission and a water-cooled 6.2-kWh lithium-ion battery. A choice of five transmission modes (Individual, Sport, Sport Plus, Comfort, and Economy) and four engine modes (Hybrid, E-Mode, E-Save, and Charge) are available. Up to 19 miles of electric-only driving is possible; the 0–60 mph time is 5.9 seconds. Top speed in electric mode is 80 mph, and overall top speed is 130 mph. The C350e initially will be produced with RWD only.

### **Mercedes-Benz** GLC350e

The GLC replaces the GLK Class in Mercedes's lineup with a new selection of compact SUVs, one of which is the GLC350e PHEV. It's powered by a turbocharged, 4-cylinder engine and a 112-hp electric motor that produce 320 total hp and 413 lb-ft of torque; 0–60 mph will take just under 6 seconds. Other driveline components include a 7-speed transmission and 8.7-kWh lithium-ion battery pack. AWD is standard. Electric-only range is estimated at 20 miles; charging time should be about four hours at 240 volts. The GLC350e will likely be in dealer showrooms in late 2016 or early 2017.

### **Mercedes-Benz** GLE550e

The GLE Class replaces the venerable M Class, and a new plug-in hybrid SUV, the GLE550e, debuts in spring 2016 only in ZEV states (California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont). It's powered by a twin-turbo, 3.0-liter, V6 good for 329 hp; a 114-hp electric motor; a 7-speed automatic transmission; and an 8.8-kWh lithium-ion battery pack. Total output is 463 hp, with 479 lb-ft of torque. AWD is standard. Driving range on electricity alone is estimated at about 20 miles, and recharge time is expected to be two hours on 240 volts or four to five hours on 120 volts.



## PLUG-IN HYBRIDS (CONT.)

### **Mitsubishi** Outlander

The Outlander PHEV crossover is equipped with a 2.0-liter, 4-cylinder gasoline engine and two 80-hp electric motors (one at the front of the vehicle and another at the rear). Its electric motors provide the Outlander with fulltime 4WD and are powered by a 12-kWh lithium-ion battery. In its EV mode, it has a range of about 25 miles and a top speed of 75 mph. The Outlander PHEV went on sale in Japan and Europe in 2013, where it has sold well. But its entry into the U.S. has been delayed repeatedly. At press time, it was scheduled to arrive in late summer 2016, as a 2017 model, with the same styling as the redesigned 2016 nonhybrid Outlander.

### **Volvo** S90 T8 Twin Engine

Volvo unveiled its new luxury flagship sedan, the S90, at the 2016 Detroit auto show in January, highlighting a hybrid powertrain option—essentially the same drivetrain found on the redesigned XC90 T8, which went on sale in the U.S. in fall 2015: a 2.0-liter, 4-cylinder gasoline engine; a turbocharger and a supercharger; a 45-hp starter motor that acts as an engine booster; a rear-mounted 82-hp electric motor that drives the rear wheels in electric and power-boost modes; an 8-speed automatic transmission; and a 9.2-kWh lithium-ion battery pack. Total power output is 400 hp; the claimed all-electric range is up to 25 miles. The S90 will be offered only in AWD.

## EVs

### **Chevrolet** Bolt

Chevy introduced the preproduction version of its much-anticipated Bolt EV at the Consumer Electronics Show in Las Vegas in January, where GM Chairman and CEO Mary Barry said it would deliver on the promise of long range (200-plus miles) at an affordable price ($37,500 before incentives). The Bolt's in-floor battery, likely rated at 50–60 kWh, can be charged to 80 percent capacity within 60 minutes using a DC fast charger. Built in Michigan, the Bolt is scheduled to begin production in October; first deliveries may happen by the end of the year.

## EVs (CONT.)

### **Tesla** Model 3

On March 31, Tesla unveiled its "mass-market" EV, the Model 3. According to the automaker, the Model 3 will list for $35,000 before incentives, have a range of 215 miles, seat 5 adults, go from 0–60 in under 6 seconds, incorporate Autopilot hardware, and be Supercharger-capable. Deliveries are slated to begin in late 2017. Within a week, 325,000 enthusiasts had plunked down a $1,000 deposit to reserve one.

## DIESEL VEHICLES

### **Mercedes-Benz** GLC300d

In fall 2016 or early 2017, look for a diesel version of the new Mercedes GLC Class. It will have the same 2.1-liter turbo BlueTEC engine found in the C Class and E Class, which puts out 195 hp and 369 lb-ft of torque. Available in either RWD or AWD, it will be equipped with a 9-speed automatic transmission instead of a 7-speed.

## HYDROGEN FUEL-CELL VEHICLES

### **Honda** Clarity Fuel Cell

The new Honda Clarity Fuel Cell is equipped with a fuel-cell stack 33 percent more compact than the one in its predecessor, the Honda FCX Clarity, but with a 60 percent increase in power density. The fuel-cell powertrain fits entirely under the car's hood, allowing for five-passenger seating. Its driving range is expected to be more than 300 miles, with a refueling time of about three minutes. Honda will deliver the Clarity Fuel Cell in late 2016 to select California dealers, starting in Los Angeles and Orange counties, the San Francisco Bay Area, and Sacramento. The price will be about $60,000. Eventually, as hydrogen-refueling networks expand, the Clarity will be available in other areas of California as well as in other states.



# BUT WAIT, THERE'S MORE ...

The 2016 *AAA Green Car Guide* provides detailed data and reviews of 81 fuel-efficient or low-emission cars and light trucks, but we weren't able to test every vehicle. The following are snapshots of more green cars currently on the market.

## NONHYBRID HIGH MPG

### **Chevrolet** Cruze

Worldwide, the compact Cruze is Chevy's best-selling vehicle, and the automaker has completely revamped it for 2016. It features a turbocharged, 1.4-liter, 4-cylinder engine with direct injection that puts out 153 hp. Stop-start engine technology and a 6-speed manual transmission are standard; a 6-speed automatic is optional. EPA-estimated fuel economy is 30 city/42 highway/35 combined. A new Cruze hatchback is scheduled to go on sale in fall 2016, and the Cruze Diesel returns in 2017.

### **Chevrolet** Malibu

Chevy's venerable midsize sedan has been completely redesigned for 2016. The Malibu's most fuel-efficient powertrain can be found on the L, LS, and 1LT trim levels: a turbocharged, 1.5-liter, 4-cylinder Ecotec engine producing 160 hp and 184 lb-ft of torque; it's mated to a 6-speed automatic transmission. An engine start-stop system is also standard and contributes to commendable EPA fuel-economy numbers: 27 city/37 highway/31 combined.

### **Ford** Escape

Ford's remodeled Escape—its best-selling vehicle next to the F-150 Series—goes on sale in summer 2016. It features two new engines, the most fuel efficient of which is the 1.5-liter, 4-cylinder Ecoboost. The aluminum-block, twin-cam engine is projected to deliver 180 hp and 185 lb-ft of torque, comparable to the 1.6-liter engine it replaces. Automatic engine stop-start technology is standard on all Escape models.

## NONHYBRID HIGH MPG (CONT.)

### **Hyundai** Elantra Eco

Hyundai released the 2017 edition of its best-selling car, the Elantra, in January 2016. However, the greenest Elantra, the new Eco sedan, will hit dealer showrooms in spring. It features a new direct-injected, turbocharged, 1.4-liter, 4-cylinder engine that produces 128-hp and 156 lb-ft of torque. It will be paired with a new 7-speed automatic transmission. Hyundai estimates the Elantra Eco will return 35 mpg in combined city/highway driving.

### **Hyundai** Tucson

The third generation of Hyundai's popular compact crossover, the Tucson, went on sale in summer 2015. The Tucson Eco FWD is equipped with a new turbocharged, 1.6-liter, direct-injected, 4-cylinder engine that produces 175 hp and 175 lb-ft of torque paired with a 7-speed automatic transmission. EPA fuel-economy numbers are 26 city/33 highway/29 combined, an improvement of 5 mpg over the previous 2.4-liter engine.

## HYBRIDS

### **Audi** Q5 Hybrid

Audi's Q5 Hybrid receives power from a turbocharged, 2.0-liter, 4-cylinder engine and a 54-hp electric motor that combine to generate 245 hp and 354 lb-ft of torque. An 8-speed Tiptronic automatic transmission and battery pack round out the powertrain. Audi estimates the Q5 Hybrid's 0–60 mph time at 6.8 seconds. EPA-estimated fuel economy is 26 mpg combined.



## HYBRIDS (CONT.)

### **BMW** ActiveHybrid 5 Series

BMW's 5 Series hybrid features a turbocharged, 3.0-liter, inline 6-cylinder engine rated at 300 hp; an 8-speed Steptronic automatic transmission; and a 55-hp rear-drive electric motor powered by a 120-volt lithium-ion battery. Together, the gasoline engine and electric motor produce 335 hp and 332 lb-ft of torque. Combined fuel economy is 26 mpg. The BMW ActiveHybrid 3 and 7 Series have been discontinued.

### **Infiniti** Q50 Hybrid, Q70 Hybrid

Both the midsize Infiniti Q50 Hybrid and full-size Q70 Hybrid (pictured) are equipped with a 3.5-liter, V6 engine; a 50-kW electric motor; a lithium-ion battery; and a 7-speed automatic transmission. The powertrain produces 360 hp. Both earn a combined fuel-economy rating of 31 mpg.

### **Lincoln** MKZ Hybrid

Introduced in 2012, the midsize Lincoln MKZ Hybrid receives a complete facelift for the 2017 edition, which will go on sale in summer 2016. However, the hybrid powertrain from the 2016 version will carry over: a 2.0-liter, 4-cylinder engine rated at 141 hp and 129 lb-ft of torque linked to a 118-hp electric motor, CVT, and 1.4-kWh lithium-ion battery. Total system power is 188 hp and 200 lb-ft of torque. The vehicle has an EPA-estimated mpg rating of 41 city/39 highway/40 combined.

## HYBRIDS (CONT.)

### **Kia** Optima Hybrid

The Kia Optima sedan was completely redesigned for 2016, but the 2016 Optima Hybrid carries over unchanged from 2015. It features a 2.4-liter, 4-cylinder, 159-hp gasoline engine paired with a 47-hp electric motor, a 6-speed automatic transmission, and a lithium-polymer battery pack. Combined power output is 199 hp and 235 lb-ft of torque. EPA fuel economy is 38 mpg combined for the base model and 37 mpg combined for the heavier EX trim level. The next-generation Optima Hybrid will likely go on sale later in 2016.

# PLUG-IN HYBRIDS

### **BMW** X5 xDrive40e

BMW's plug-in hybrid has a powertrain with a twin-turbo, 2.0-liter, 4-cylinder, 245-hp engine; a 95-hp electric motor; a 9.9-kWh lithium-ion battery (housed underneath the luggage compartment); xDrive; and an 8-speed automatic transmission. Top speed under electric power is 75 mph; the electric-only range is up to 20 miles. The 0–60 mph time is 6.5 seconds. The X5 eDrive has three selectable driving modes: intelligent hybrid drive (Auto eDrive), pure electric (Max eDrive), and Save Battery to maintain the current charge level.

### **Hyundai** Sonata Plug-in Hybrid

The all-new Hyundai Sonata Plug-in Hybrid, which went on sale in fall 2015, is powered by a direct-injected, 2.0-liter, 4-cylinder gasoline engine rated at 154 hp; an updated 6-speed automatic transmission; a 51-hp electric motor; and a 9.8-kWh lithium-polymer battery pack. Total power output is 193 hp. The Sonata PHEV has an all-electric range of up to 24 miles. The combined EPA fuel-economy rating in electric mode is 99 MPGe and 40 mpg combined when running as a hybrid. On a 240-volt charging station, recharging time is 2.5 hours; on a 120-volt outlet, about nine hours.



## PLUG-IN HYBRIDS (CONT.)

### **Mercedes-Benz** S550e

The Mercedes-Benz S550e plug-in hybrid's drivetrain consists of a twin-turbo, 3.0-liter, V6, 329-hp engine; a 114-hp electric motor; a 7-speed automatic transmission; and a water-cooled 8.7-kWh battery pack capable of powering the car for up to 12 miles on electricity alone. Total output is 442 hp. Charging on 240 volts takes about three hours; on 120 volts, about seven. The S550e's top speed is 155 mph. Mercedes claims the S550e can accelerate from 0–60 in 5.2 seconds. Fuel-economy numbers are 26 mpg combined and 58 MPGe combined.

### **Porsche** Panamera S E-Hybrid, Cayenne S E-Hybrid

The Panamera S E-Hybrid (pictured) combines a supercharged, 333-hp V6 and a 95-hp electric motor to produce a vehicle with 416 hp; the engine and motor are mated to an 8-speed automatic transmission. In all-electric mode, the Panamera S E-Hybrid has a range of 15–20 miles. The battery can be fully recharged in 2.5 hours on 120 volts. EPA-estimated combined fuel-economy numbers are 51 MPGe and 25 mpg. The same basic drivetrain is used in the Cayenne S E-Hybrid SUV, with similar performance figures. AWD is standard.

### **Volvo** XC90 T8 Twin Engine

Volvo redesigned its venerable XC90 7-passenger SUV, which includes a new plug-in hybrid variant, the XC90 T8 Twin Engine. It's equipped with a 2.0-liter, 4-cylinder gasoline engine; a turbocharger and supercharger; a 45-hp starter motor; a rear-mounted 82-hp electric motor; an 8-speed automatic transmission; and a 9.2-kWh lithium-ion battery pack. Total power output is 400 hp. The claimed all-electric range is up to 25 miles. The XC90 went on sale in fall 2015. EPA fuel-economy numbers are 25 mpg combined and 53 MPGe combined.

# EVs

## **Mercedes-Benz** B250e Electric Drive

Mercedes-Benz's B250e EV is a compact upscale FWD four- or five-passenger hatchback with a powertrain supplied by Tesla that combines a 177-hp electric motor with a 28-kWh lithium-ion battery housed under the vehicle's floor. Range is estimated at 87 miles, and a two-hour recharge is good for another 60 miles. It's now available only in California, Connecticut, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Oregon, Rhode Island, and Vermont.

## **Tesla** Model X

The Model X is a three-row, seven-passenger crossover. Based on the Model S platform, the Model X is available with a 90-KWh battery pack, has a maximum estimated range of 250 miles, and can accelerate from 0–60 mph in 3.2 seconds in Ludicrous mode. Among the car's noteworthy features are rear "falcon wings" (a kind of hinged gullwing door), dual-motor AWD, and front and rear trunks. The Model X has a 5,000-pound towing capacity. Tesla began delivering the Model X to customers in late 2015.

# DIESEL VEHICLES

## **BMW** 535d

BMW's 5 Series added a diesel-powered variant, the 535d, to its lineup in 2014. It features a turbocharged, 3.0-liter, 6-cylinder engine that produces 255 hp and 413 lb-ft of torque paired with an 8-speed automatic transmission. Engine stop-start is standard. EPA-estimated fuel economy is 30 mpg combined for both the RWD and AWD sedans.



# DIESEL VEHICLES (CONT.)

## **BMW** 740Ld xDrive

New to BMW's extensive diesel lineup for 2015 was the 740Ld xDrive, equipped with a turbocharged, 3.0-liter, 6-cylinder, 255-hp diesel engine that puts out 413 lb-ft of torque; an 8-speed automatic transmission; and AWD. EPA-estimated fuel economy is 26 mpg combined.

## **BMW** X3 xDrive28d, X5 xDrive35d

The X3 xDrive28d (pictured) has a twin-turbo, 2.0-liter, 4-cylinder diesel engine that produces 180 hp and 280 lb-ft of torque, and an 8-speed automatic transmission. Fuel economy is 30 mpg combined. The X5 xDrive35d's 3.0-liter inline-6 is good for 255 hp and 413 lb-ft of torque; it's equipped with an 8-speed automatic transmission. Combined fuel economy is 27 mpg.

## **Mercedes-Benz** C300d 4MATIC

The C300d, new for 2016, has a turbocharged, 2.1-liter, 4-cylinder diesel engine (the same one as in the E Class) that puts out 195 hp and 369 lb-ft of torque. The C300d comes with a 7-speed automatic transmission and AWD only. The mpg figures will likely be somewhat better than the E250's EPA-rated 27 city/38 highway/31 combined mileage.

## DIESEL VEHICLES (CONT.)

### **Mercedes-Benz** GLE300d

The GLE is the former Mercedes M Class of midsize SUVs, newly named and updated. A multitude of powertrains are available. The GLE300d has a turbocharged, 2.1-liter, 4-cylinder diesel engine that puts out 201 hp and 369 lb-ft of torque coupled with a 7-speed automatic transmission. EPA-estimated mpg numbers are 22 city/29 highway/24 combined.

### **Mercedes-Benz** GLS350d

Last redesigned in 2013, the largest of Mercedes's SUVs, the seven-seat GL Class, has been renamed and updated mechanically and cosmetically as the GLS Class. The 2017 diesel version, the GLS350d, is outfitted with a turbocharged, 3.0-liter V6 that makes 255 hp—15 more than previously—and 455 lb-ft of torque. A 9-speed automatic transmission and AWD are standard. The 2017 GLS Class went on sale in March 2016.

## HYDROGEN FUEL-CELL VEHICLES

### **Toyota** Mirai

Toyota began selling and leasing its midsize four-passenger fuel-cell sedan, the Mirai, in California in late 2015 as a 2016 model. The powertrain consists of a 114-kW fuel-cell stack, a 153-hp electric motor generating 247 lb-ft of torque, and a 1.6-kWh nickel-metal-hydride battery pack. The Mirai has a range of 300 miles and has a 50 MPGe rating from the EPA. Toyota provides free hydrogen fuel for three years and warranties the powertrain for eight years/100,000 miles. Initially, the Mirai will be available only in California.

CHAPTER 5

# GREEN CAR SAFETY

Green technology is still relatively new, and green vehicles (besides gasoline-powered models with advanced ICEs) are moving from niche to mainstream markets. Many people still have unanswered questions about green vehicles, including concerns about safety.

A 2016 Honda Civic undergoes a **FRONTAL-CRASH TEST** at the IIHS facility.

## ARE GREEN CARS SAFE?

People concerned with green car safety generally want to know whether a particular alternative powertrain poses a safety hazard. They want to know things like: Will I be electrocuted if I crash in a hybrid or an EV? Will a vehicle powered by natural gas explode if it's in a collision? Will hydrogen fuel–cell cars catch fire?

Not to worry. All vehicles sold in the U.S., regardless of their fuel source, must meet crash-test standards developed by the National Highway Traffic Safety Administration (NHTSA). The Insurance Institute for Highway Safety (IIHS), an independent safety-research group funded by auto insurers, performs similar crash testing on new cars.

Both organizations conduct tests under controlled conditions that simulate real-world car crashes, including front, rear, and side-impact collisions, a vehicle's propensity to roll over, and roof-strength tests. Using these tests, they determine a vehicle's structural integrity and how well it protects its occupants. New cars are not legally obligated to meet IIHS standards, but automakers take IIHS results very seriously and typically fix cars that do poorly on IIHS tests.

Go to nhtsa.gov and iihs.org to learn more about crash-testing and to watch videos about how the tests are carried out. Crash-test ratings from one or both organizations are included in individual car reviews in this *Guide*.

Green vehicles have fared well in NHTSA's and IIHS's testing. None has proved deficient in terms of safety when compared with its conventional counterpart; in fact, safety ratings of some green cars have even surpassed them. For example, in 2013, the Tesla Model S received a five-star safety rating and was ranked as one of the safest cars ever tested by NHTSA. The machine that was used to test roof strength actually broke after applying more than four times the force of gravity to the Model S's roof.

OPPOSITE PAGE: RICK FISCHER/MASTERFILE

For safety's sake, high-voltage cables are COLOR-CODED ORANGE.

Let's consider the safety of the various alternative powertrains:

## HYBRIDS, PLUG-IN HYBRIDS, AND ELECTRIC VEHICLES

We can group these three classes of green cars together because they all have large electric batteries that provide them with power. Concerns about the safety of hybrids or EVs has focused mostly on whether the electric batteries would catch fire or explode through overheating in daily use or after a crash, whether the car's occupants could be electrocuted in a car crash, or whether safety personnel could be electrocuted when responding to a crash.

Manufacturers have designed hybrids and EVs to minimize the possibility that such events will occur. For example, they typically encase the batteries in a protective covering and locate them under the floor in the middle of the car, which reduces the chance that they'll be affected by a collision. They also cool the batteries with air or liquid to prevent them from overheating. The front section of EVs have relatively big crumple zones because there's no large engine under the hood, which also reduces the chance of damage to the battery.

Manufacturers also include safeguards in hybrids and EVs to prevent electrocution, fires, or injuries from high-voltage electricity, such as fuses and circuit breakers that disconnect batteries in a collision and specially marked electrical cables with orange warning sleeves. Additionally, automakers have created special guidelines and training programs for first responders to alert them to and prepare them for dealing with crashes involving hybrids or EVs.

The National Fire Protection Association (nfpa.org) has developed an EV-safety training project and an EV-emergency field guide, and has emergency-response guides from Honda, Hyundai, Kia, Mercedes-Benz, Mitsubishi, and Toyota available for download. (For more information, go to evsafetytraining.org.)

## DIESEL VEHICLES

Diesel vehicles pose no special safety hazards. In fact, diesel fuel is far less flammable than gasoline, and would be much less likely to catch fire in a car crash.

## NATURAL GAS VEHICLES

Vehicles powered by natural gas have been used in the U.S. since the 1970s. Compressed natural gas (CNG) poses no special safety risks, and natural gas vehicles (NGVs) have excellent safety records for two reasons: the properties of natural gas and the special components of NGVs. First, natural gas is less flammable than gasoline, reducing the chances of a vehicle fire, and, unlike gasoline, it dissipates into the air if released from a tank. Second, the pressurized tanks used to contain natural gas in vehicles are much thicker and stronger than standard gas tanks. Because they must meet stringent industry and governmental safety standards, they're built to withstand severe impacts and high temperatures far beyond what a CNG vehicle would encounter in everyday use.

## HYDROGEN FUEL-CELL VEHICLES

Cars powered by hydrogen fuel cells are the latest emerging green technology. Only a few hundred such cars are currently on the road.

Concerns about hydrogen fuel–cell cars catching fire or blowing up are unfounded. "Fuel-cell electric vehicles [FCEVs] have essential safety systems designed to protect passengers and first responders in case of an accident," states the California Air Resources Board (CARB). The fuel-cell stack and high-voltage battery pack are sealed separately in metal cases that are insulated from the vehicles' metal body. Other safety systems include color-coded high-voltage circuits, fuel tanks that are double the required strength, and sensors to alert occupants to any problems with the fuel system.

In addition, FCEVs have been involved in real-world collisions without major incident. For example, Hyundai states that its Tucson FCEV "has been subjected to extensive safety testing, including destructive and nondestructive evaluations at the component, system, and vehicle level. … The Tucson Fuel Cell has undergone crash tests for offset frontal, side, and rear-impact, as well as fire tests. … Also, in the event of a crash, [impact] sensors stop the release of hydrogen from the tanks."

In sum, green cars are safe for several reasons:

- In some cases, alternative fuels are themselves safer than gasoline.
- Where an alternative power source might pose a special risk, carmakers have taken precautions to protect drivers and passengers both in daily driving and in the event the vehicle becomes involved in a crash.
- Testing by organizations such as NHTSA and IIHS has uncovered no specific risks where green cars are concerned.
- Green cars have proven themselves as safe as conventional vehicles in millions of miles of real-world driving.

# ADVANCED DRIVER-ASSIST SYSTEMS

The way a vehicle is constructed is essential to the safety of its occupants in a collision, but genuine safety involves much more. Of critical importance are any number of features that have been developed and adopted, such as—to go back a few decades—seatbelts and air bags, which are considered important enough in saving lives and preventing injuries that they're mandatory in all U.S. passenger vehicles.

In recent years, however, technology has taken a more active role, not just in protecting a vehicle's occupants during or after a collision, but in helping prevent collisions from occurring in the first place, or at least reducing their severity. These electronic systems, most of which currently are optional rather than standard equipment, are known collectively as advanced driver-assist systems, or ADAS. Such systems can be found on a variety of green vehicles, from the luxury-class Tesla Model S to the entry-level Scion iA.

Examples of ADAS include blind-spot monitoring, lane-keeping assist, and adaptive cruise control, which are described later in this chapter. These systems act as a safety net, preventing driver error by alerting drivers to possible dangers, such as cars in adjacent lanes that are in a driver's blind spot. In other cases, they reduce the effects of mistakes drivers have already made—such as not noticing that they're about to crash into a vehicle in front of them—by taking temporary control of the vehicle. In doing so, they also make driving more convenient and less stressful.

ADAS typically appear first on high-end vehicles, but they soon migrate down to midpriced and even lower-priced vehicles. Many features are now available on almost every model in a manufacturer's lineups. For example, the new 2016 Scion iA—which has a base price under $18,000—comes with a standard low-speed collision-avoidance system.

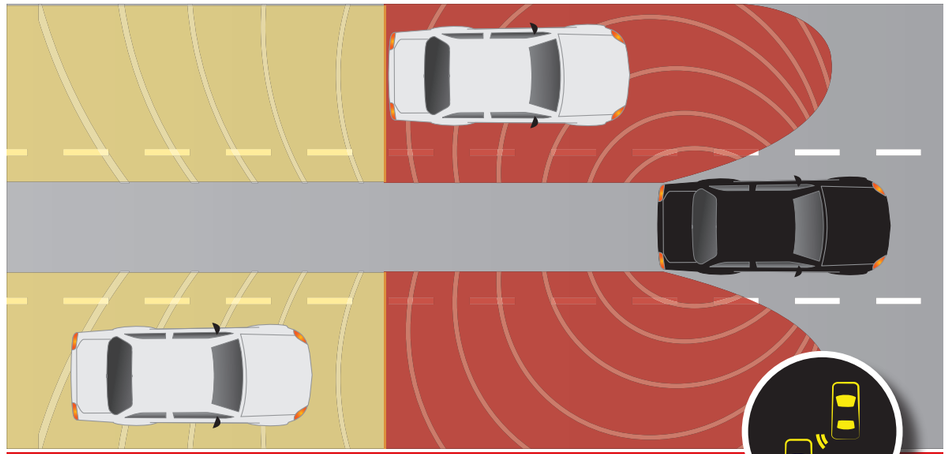
Blind-spot monitoring with cross-traffic alert is available on a 2016 Mazda Mazda3 with an MSRP of about $21,000; blind-spot monitoring, lane-departure warning, and lane-keeping assist on a 2016 Ford Fusion costing about $28,000; and Subaru's effective EyeSight collision-avoidance system on an entry-level Impreza costing about $26,000. Note that the cost of each of these three vehicles is well below the $34,000 price of the average new car.

The following are some examples of ADAS that you can order on green cars right now. The terms used are general categories; individual automakers' systems will vary and may use slightly different nomenclature. In this year's *Guide*, we've included available advanced safety features for each of the vehicles in our reviews section.

## REARVIEW CAMERA

Rearview cameras are hardly new technology. They're an important safety feature, and they'll be required equipment on all new cars sold in the U.S. as of May 2018. But some interesting variations have appeared recently that are worth noting. For example, the Ford F-150, Infiniti Q50, and Mercedes-Benz GLC300 offer the option of cameras that give a bird's-eye view of what's happening all around the vehicle.


Rearview cameras are yesterday's news. The latest lenses gives a BIRD'S-EYE VIEW, as depicted in Infiniti's Around View Monitor.



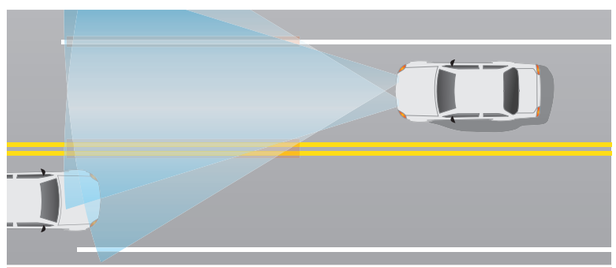
**BLIND-SPOT MONITORING** lets you know if cars are in lanes to your right or left to help you avoid an unsafe lane change. A lighted symbol in your side-view mirror (inset) provides a warning.

## BLIND-SPOT MONITORING/ REAR CROSS-TRAFFIC ALERT

Blind-spot monitoring (BSM) uses radar technology in your car's rear quarter panels to detect cars that are in adjacent lanes beside and behind your vehicle. The system alerts you so that you don't make an unsafe lane change and collide with another car. When a car is in your blind spot, a small icon—typically in your car's side mirror—lights up. If you activate a turn signal while a vehicle is in your blind spot, the light flashes. Sometimes a warning tone sounds as an added alert.

Some systems use cameras to show you what's going on in your car's blind spots. With Honda's LaneWatch, when you activate the right-turn signal, the center screen on the dashboard displays an image of what's happening on the right side of the car.

BSM may also be paired with a rear cross-traffic alert (RCTA) function, which is useful when you're backing out of a parking spot. When your car is in reverse, the system flashes a warning signal in the side mirror and sounds a warning tone to alert you if a vehicle approaches from the left or right.



**LANE-DEPARTURE WARNING SYSTEMS** read road markers to help keep you in your lane.

## LANE-DEPARTURE WARNING/ LANE-KEEPING ASSIST

Typically using cameras or sensors mounted near the rearview mirror, lane-departure warning (LDW) and lane-keeping–assist (LKA) systems read road markings such as painted lines and raised markers to help you stay in your lane. If your vehicle starts to drift out of its lane, LDW alerts you with a sound, a flashing icon on the instrument panel, a pulsing or vibration in the steering wheel or driver's seat, or a combination of all three.

LKA systems go even further: When you start to drift out of your lane, the system nudges the steering wheel to direct the car toward the center of the lane or selectively brakes a single wheel to guide it back into the lane. Such corrections are subtle, and you can always override them by turning the wheel yourself.

LDW and LKA systems don't function when you use your turn signal because they assume (probably correctly) that when you want to change lanes, you won't want an alert.

If you have an LKA system on your vehicle, it doesn't mean you can just take your hands off the wheel and expect the car to do the steering for you. On most vehicles, if the car doesn't sense any steering input from you for a brief period (about 10 seconds), it alerts you to regrip the wheel.





## ADAPTIVE CRUISE CONTROL

With conventional cruise control, you must reset the system once you've sped up and passed a vehicle or hit the brakes to keep a certain distance from the vehicle in front of you. Not so with adaptive cruise control (ACC), which typically uses radar to detect vehicles ahead of you and automatically adjusts your speed to maintain a safe distance from them.

With most ACC systems, you can adjust the gap or following distance from the vehicle in front of you, within limits, to a comfortable range. If a car moves into your lane in front of you, or if the car in front of you slows down or speeds up, your vehicle makes the adjustment, keeping a safe distance all the while. If the car in front of you moves out of your lane, your car accelerates to and maintains the set speed.

## FORWARD-COLLISION WARNING/ MITIGATION/AVOIDANCE SYSTEMS

Several types of systems use cameras and/or radar to help drivers respond safely to traffic in front of them. What follows is a general description of the different systems. Automakers may use one or a combination of such systems in their lineups.

A forward-collision–warning (FCW) system provides audible and visual alerts that warn drivers of a potential crash, but it does nothing to prevent a crash.

A forward-collision–mitigation (FCM) system lets drivers know a collision is imminent and, if the driver doesn't respond, applies the brakes to attempt to minimize the damage of a collision.

A forward-collision–avoidance (FCA) system alerts drivers to the likelihood of a crash and automatically applies the vehicle's brakes to either prevent the crash (i.e., bring the vehicle to a complete stop before it hits an object in front of it) or at least reduce the severity of the crash. It also may retract and increase seatbelt tension.

## LIMITATIONS OF ADAS

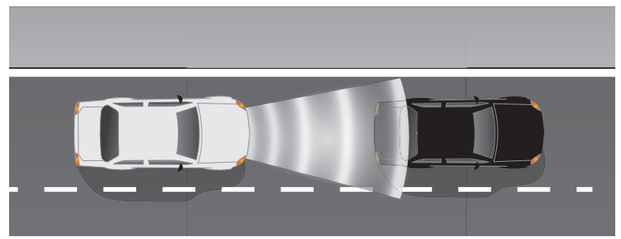
Good driver-assist systems have controls, displays, and touch screens that are easy to understand and operate. Many systems won't activate until drivers go through two or more steps; that way, drivers won't turn the systems on accidentally and will be aware that the systems are operating.

However, as with other electronic systems, ADAS don't work 100 percent of the time. For example, they might not detect other vehicles or lane markers in bad weather (snow, rain, or fog); they might not detect faded lane markers or small objects in the road; and they work better on multilane highways than on narrow country roads. Some systems turn themselves off if they can't "see" what they need to, and all ADAS can be switched off if drivers don't want to use them. Chapter 7 further discusses the effectiveness and limitations of ADAS.

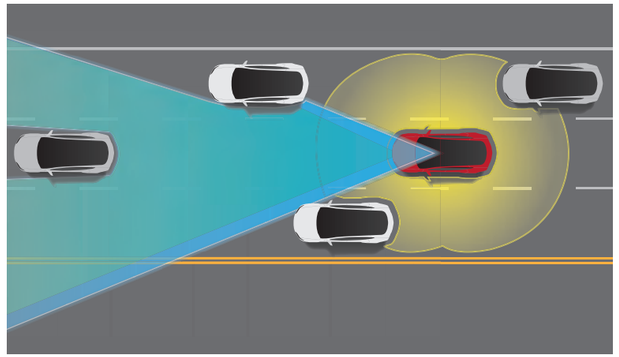
It's also important to understand what any driver-assistance system is designed to do—and not do—before using it. For example, ACC systems may keep your vehicle a safe distance from a moving car in front of it, even when that car comes to a complete stop. But some systems aren't designed to recognize stationary objects, including cars. So when you pull off a freeway, they might not prevent you from hitting a stopped car at the end of the exit ramp.

In short, drivers are responsible for maintaining control of their vehicles. It's fine to enjoy the added safety and convenience that ADAS provide. But it's important not to over-rely on them—they're driver-support systems, not a substitute for safe, alert driving.

**A FORWARD-COLLISION–AVOIDANCE SYSTEM** can prevent you from crashing into a car in front of you.



**ADAPTIVE CRUISE CONTROL** keeps your car a safe distance behind traffic in front of you.



Tesla's **AUTOPILOT SYSTEM** is moving toward vehicle autonomy.

U.S. drivers are ambivalent about self-driving cars, according to a 2014 University of Michigan Transportation Research Institute study. Most people surveyed had heard of self-driving cars and had positive initial feelings about them. Not surprisingly, those whose cars had autonomous features responded more positively to the idea of self-driving cars and expected more benefits from them.

However, the majority of respondents expressed great concern about the safety of riding in self-driving cars (especially those with high levels of automation), and most were very reluctant to allow their children to ride in them. Other concerns included security/privacy issues regarding self-driving cars and whether self-driving cars could perform as well as actual drivers. And although a majority of people expressed a desire to have autonomous technology in their cars, most were unwilling to pay extra for it.

Given existing technical hurdles (which are diminishing) and legal/insurance obstacles (many of which have yet to be raised), it will probably be a decade or more before there are as many self-driving cars on the road as, say, there are EVs on the road today. And it will likely be several decades before self-driving cars are commonplace.

However, as we have mentioned, autonomous elements have been insinuating themselves into mainstream vehicles for years and continue to do so, sometimes in the unlikeliest places. How else to explain that the Ford Focus has a self-parking option? Many autonomous features have been described earlier in this chapter. Completely autonomous vehicles will use all of the ADAS systems, and more.

Luxury car manufacturers, including BMW and Mercedes-Benz, continue to put lots of R&D time and money into vehicle automation. The enhanced ACC on BMW's new 7 Series, for example, can automatically reset the car's speed in response to changes in speed limits, and a side-collision-protection feature is now more aggressive: If you ignore its warning and attempt to change lanes anyway, the steering wheel will resist your efforts.

Mercedes-Benz is loading its new E Class, due out this spring, with even more automated features than its flagship S Class. For example, if the car senses that a collision is imminent but an evasive maneuver isn't possible, its automatic braking system (ABS) can initiate braking earlier. The ABS also works in a greater number of situations, such as when cross traffic enters the car's lane or a pedestrian steps into the car's path.

Finally, consider this: In October 2015, Tesla, one of the leaders in the autonomous vehicle revolution, introduced a public beta version of its Version 7.0 Autopilot software, which controls the main driving functions of its Model S.

This has been part of Tesla's grand plan for a long time. A year earlier, the automaker installed hardware in the Model S that would make use of the software to come. In the automaker's words:

> *Tesla's commitment to developing and refining the technologies to enable self-driving capability is a core part of our mission. … In October of [2014] we started equipping Model S with hardware to allow for the incremental introduction of self-driving technology. … Autopilot allows Model S to steer within a lane, change lanes with the simple tap of a turn signal, and manage speed by using active, traffic-aware cruise control. Digital control of motors, brakes, and steering helps avoid collisions from the front and sides, as well as preventing the car from wandering off the road. Your car can also scan for a parking space, alert you when one is available, and parallel park on command. … While truly driverless cars are still a few years away, Tesla Autopilot functions like the systems that airplane pilots use when conditions are clear. The driver is still responsible for, and ultimately in control of, the car.*

When CEO Elon Musk introduced Autopilot, he urged users to be careful when using it and to keep their hands on the wheel. New features will be added over time, he said, predicting that Tesla will have a fully autonomous car (NHTSA Level 4)—one that can take occupants from point to point safely without any input from them—in about three years.

As we said earlier: Not if, but when.



# WHO'S DRIVING?

They're coming—self-driving cars, that is. It's no longer a question of if, but when.

What do we mean by a self-driving car? NHTSA, which is interested in autonomous cars from a regulatory and safety standpoint, defines self-driving vehicles as "those in which operation of the vehicle occurs without direct driver input to control the steering, acceleration, and braking and [which] are designed so that the driver is not expected to constantly monitor the roadway while operating in self-driving mode." NHTSA has specified five levels (degrees) of vehicle automation:

**(LEVEL 0)**
**NO-AUTOMATION:** The driver is in complete and sole control of the primary vehicle controls—brakes, steering, throttle, and motive power—at all times.

**(LEVEL 1)**
**FUNCTION-SPECIFIC AUTOMATION:** These cars include one or more safety-critical ADAS functions—for example, brake assist, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster. However, the driver maintains overall control.

**(LEVEL 2)**
**COMBINED FUNCTION AUTOMATION:** This involves automation of at least two primary control functions that work in unison to relieve driver control of those functions—for example, adaptive cruise control in combination with lane centering. The driver maintains overall control.

**(LEVEL 3)**
**LIMITED SELF-DRIVING AUTOMATION:** This level of automation enables the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions. It also allows the driver to rely heavily on the vehicle to monitor possible changes in the conditions that might require transitioning the control back to the driver. The driver is expected to be available for occasional control, but only with sufficiently comfortable transition time.

**(LEVEL 4)**
**FULL SELF-DRIVING AUTOMATION:** The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. The driver will provide destination or navigation input but is not expected to be available for control at any time during the trip.

Under these criteria, many cars are already at Level 2. Google's self-driving vehicles are at Level 3. But those are test vehicles, not cars in normal, everyday use.

SILICONVALLEYSTOCK/ALAMY STOCK PHOTO


Google's **SELF-DRIVING** cars have stellar safety records.

CHAPTER 6

Tesla **Model X**

# MORE WAYS TO DRIVE GREEN

Buying a green car isn't the only way to reduce your fuel consumption and minimize your carbon footprint. Everyone can drive more efficiently—saving fuel and money and reducing emissions—regardless of the vehicle they own.

## DRIVING MORE EFFICIENTLY

The Automobile Club's Automotive Research Center (ARC) has studied fuel consumption by recording the mileage motorists achieve while driving normally (or sometimes more aggressively) and comparing that to their mileage when they used the techniques listed below. The results? Driving more efficiently produced mileage improvements ranging from a low of 25 percent to as much as 100 percent (from 10 mpg to 20 mpg).

**DRIVE SENSIBLY.** Generally speaking, the faster you go, the more fuel you burn, because aerodynamic drag increases exponentially with speed. Drive at a steady speed as much as possible, and avoid aggressive driving, which can lower your mpg by up to a third, according to the EPA. For example, a car that gets 30 mpg at 55 mph will get only 25 mpg at 70 mph and 22 mpg at 80 mph.

Consider doing most of your driving in one of the slower freeway lanes. Beyond the mpg benefits, it's less stressful, and you won't lose much time by slowing down. A 30-mile trip driven at an average speed of 55 mph will take only about 5 minutes longer than the same trip driven at an average speed of 65 mph.

**KEEP IT SMOOTH.** Driving at a steady speed is much more fuel-efficient than continuously varying your speed. When you drive on the highway, especially on level pavement, use cruise control when it's safe to do so.

**AVOID JACKRABBIT STARTS.** Instead, accelerate slowly and smoothly. Accelerating uses more fuel than any other single facet of driving and increases pollution. One second of high-powered driving can produce nearly the same volume of carbon monoxide emissions as a half-hour of normal driving, according to the American Council for an Energy-Efficient Economy.

**ANTICIPATE SLOWER TRAFFIC AND TRAFFIC LIGHTS.** When you see stopped or slowed traffic or a red light ahead of you, take your foot off the accelerator and coast. Zooming up to the light and then slamming on the brakes just wastes fuel and is hard on your car's suspension and brakes. Cars use very little fuel when coasting, and if you're driving a hybrid, battery-electric vehicle, or a fuel-cell electric vehicle with regenerative brakes, coasting will recharge the battery, further improving your mileage. Leaving plenty of space between you and the car in front of you allows you to drive in a relaxed manner and is safer, too.

**DRIVE AWAY WITHOUT DELAY.** Unless you're driving a pre-1980 car, you don't need to let it warm up before you start driving; that just wastes gas. Follow the starting instructions in your car's owner's manual. Most likely, it will tell you to start the car, put it in gear, and drive off at a moderate speed until the engine warms up.

**PUT IT IN "ECO."** Many newer cars (for example, the Hyundai Sonata and even the Corvette Stingray) have an "Eco" mode, which enables you to save fuel when you drive. Pressing the Eco button basically does two things: First, it changes the shift points so the transmission shifts earlier, keeping engine revs down; and second, it changes the way the throttle pedal responds—you have to press it down farther to get the same response you would if you weren't in Eco mode. These two measures increase fuel economy at the expense of performance. Many hybrids also have an EV mode, which enables drivers to use only electricity for power, though usually only for a few miles at low speeds. The electric-only range for plug-in hybrids is greater, usually 12 to 50 miles.


**KEEP IT CHARGED.** If you drive a plug-in hybrid, you'll use more electricity and less gas if you keep the battery fully charged. With lithium-ion batteries, topping off a partially charged battery doesn't degrade it or decrease its useful life. However, some manufacturers advise against repeated recharging if the battery is at 95 percent or higher. Check your owner's manual or talk to the service personnel at your dealership.

**AVOID RUSH-HOUR TRAFFIC.** Stop-and-go driving burns more gas and increases pollution.

**AVOID NEEDLESS IDLING.** When you get out of your car, turn it off rather than leaving it idling. Park and walk into a fast-food restaurant or bank instead of using the drive-through.

**GO INTO OVERDRIVE.** If your car has it, use the overdrive gear(s) at highway speeds. If your car has a manual transmission, shift up as soon as possible to decrease RPM, fuel use, and engine wear.

**USE YOUR AIR CONDITIONER WISELY.** Air-conditioning use in newer cars can reduce gas mileage by about 5 percent—even more on older cars. But driving with the windows open increases aerodynamic drag, more so the faster you drive. To cool off on warm days, open your windows when you're driving under 45 mph; close them and turn on the air conditioner at higher speeds.

## VEHICLE MAINTENANCE

Maintaining your vehicle properly can make a big difference in increasing your mpg, too.

**STAY ON SCHEDULE.** Maintain your vehicle according to the manufacturer's service schedule, which you can find in your owner's manual or at the automaker's website. Regular oil and filter changes, inspection of the vehicle's emissions-control system, and other services will keep your vehicle running smoothly, prolong its life, and save fuel. You can find a list of AAA Approved Auto Repair facilities at AAA.com/repair. Each shop is inspected on a regular basis to verify that it meets AAA's strict quality standards.

**KEEP A LOG.** Track your fuel economy; if it drops suddenly, find out why and fix the problem.

**PUMP IT UP.** Keep your tires properly inflated, which reduces rolling resistance. For every 3 pounds below recommended pressure, fuel economy goes down by about 1 percent.

The correct inflation information is on the driver's doorjamb, inside the glove-box lid, or in your owner's manual. Tires normally lose 1–2 pounds of pressure a month, so buy a good tire gauge and check the air pressure regularly.

**GET THE JUNK OUT OF YOUR TRUNK.** Reducing extra weight in your car can save up to 2 percent in fuel economy for every 100 pounds you remove. So take heavy items such as golf clubs or other sporting equipment, tools, clothing, and coolers out of your car's trunk when you're not using them.

**DITCH THE RACK.** Roof racks are great for carrying luggage or sports equipment on top of your car, but they increase aerodynamic drag and can reduce fuel economy even when they're empty. So take the roof rack off when you're not using it.

**ROLL EASY.** When it's time to buy new tires, ask about low-rolling-resistance tires. They have stiffer sidewalls, so they save energy by flexing less. They could compromise your car's ride and handling, though, so check with your mechanic or dealer to find the proper ones for your car.

**DON'T UPGRADE NEEDLESSLY.** Check your owner's manual to see what grade of fuel your car needs. Most cars are designed to run on regular; using anything else is a waste of money. If your owner's manual says "premium required," use premium. But if it says midgrade or premium is recommended, read carefully; sometimes you can use regular, although you may experience reduced power or slightly reduced fuel economy.

**FILL UP WITH CARE.** Gasoline is a hazardous substance. It's extremely flammable, its fumes are toxic and carcinogenic, and it can pollute water and poison wildlife. What's more, spilled gasoline contributes to smog formation when it evaporates. So when you stop to buy gas, don't top off your tank after the automatic nozzle clicks off.

## LIFESTYLE CHOICES

Make the best choice for you among available alternatives.

**DRIVE LESS.** Ask yourself whether you really need to make the trip at all. Consider alternatives such as walking, cycling, or taking public transit.

**PLAN YOUR ROUTE EFFICIENTLY AND COMBINE TRIPS.** Doing this will save gas, time, and wear and tear on your vehicle. Use your navigation system or the map on your phone to plan the most efficient route.

**REVIEW YOUR COMMUTE SCHEDULE.** Can you change your working hours so you don't waste time sitting in bumper-to-bumper traffic? Can you carpool or rideshare a day or two a week? How about telecommuting one or more days a week? All three measures save fuel and reduce vehicle wear.


**CHOOSE YOUR MOST EFFICIENT VEHICLE.** If you own more than one vehicle (nearly 60 percent of American households do), use the one best suited for the trip you're taking. In other words, don't automatically jump into your big SUV if the more fuel-efficient sedan will do. According to the EPA, we could collectively save $25 billion in fuel costs and reduce $CO_2$ emissions by 100 million metric tons (equivalent to taking almost 20 million cars off the road) by taking this simple step.

**CHECK OUT A RENTAL.** If you don't own a fuel-efficient car, consider renting one for vacations and long trips. That way, you'll not only put less wear on your daily driver, you'll use less gas and produce fewer emissions. Similarly, consider renting a pickup truck instead of buying one if you need a truck to haul things only occasionally.

**JUST SAY "NO."** Make high fuel economy a priority the next time you buy a car, and pass on those vehicles that get poor gas mileage.

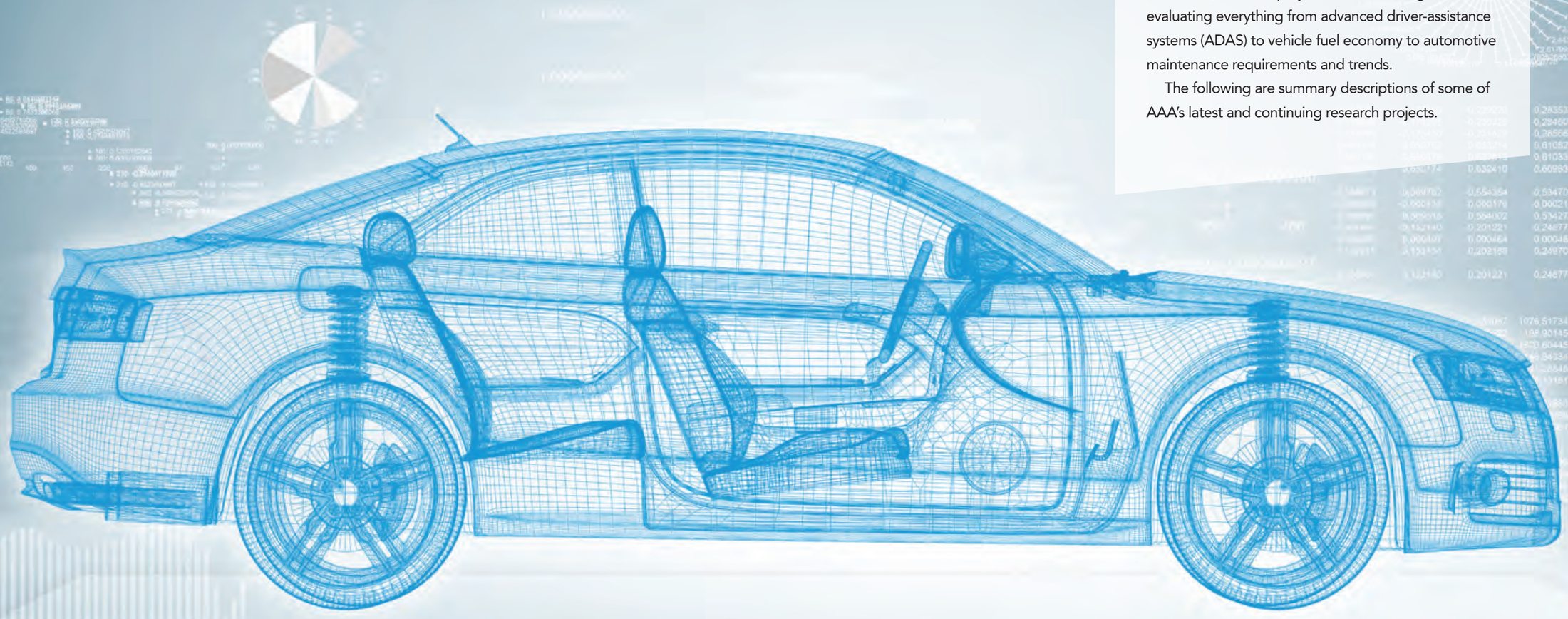
CHAPTER 7

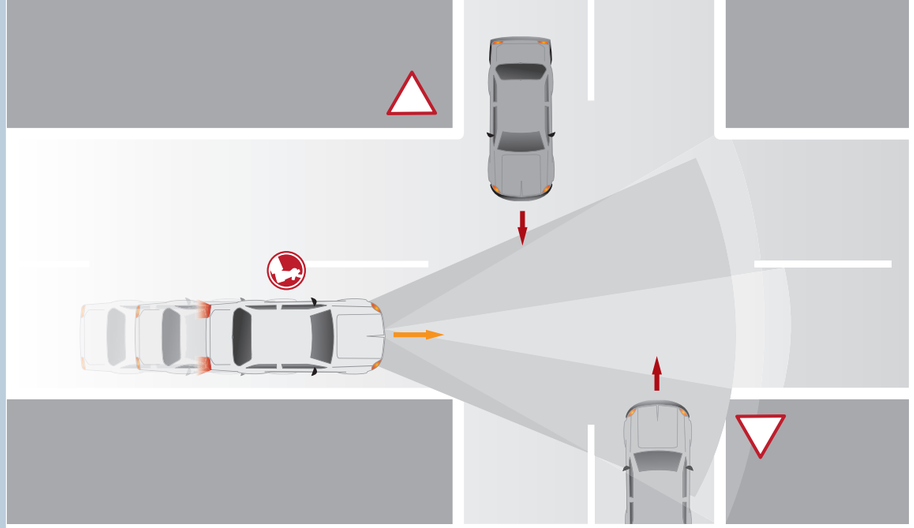
# AAA'S TECHNOLOGY INITIATIVES

Since its founding in 1902, AAA has provided its members with automotive and road-safety information. To help members keep up with advances in automotive technology, AAA also conducts independent, unbiased research and provides in-depth information on automotive trends and technology to AAA members and the motoring public.

AAA also uses its research and findings to advocate for motorists by working with government agencies and the automotive industry to help establish policies and pass beneficial legislation. Besides the *AAA Green Car Guide*, research projects include testing and evaluating everything from advanced driver-assistance systems (ADAS) to vehicle fuel economy to automotive maintenance requirements and trends.

The following are summary descriptions of some of AAA's latest and continuing research projects.





Mercedes-Benz's **BAS PLUS BRAKE ASSIST WITH CROSS-TRAFFIC ALERT** can prevent rear-end collisions and avoid potential collisions with crossing traffic by providing audible and visual signals to the driver and, if necessary, applying full braking force.

## ADVANCED DRIVER-ASSIST SYSTEMS

We described advanced driver-assist systems (ADAS) in detail in Chapter 5. The purpose of these systems is to make driving safer and less stressful by providing drivers with useful information about nearby vehicles (for example, blind-spot monitoring) or temporarily assuming some driver functions like braking or steering (for example, forward-collision avoidance). Most systems perform their intended functions well. All can be overriden with driver input.

AAA Automotive Engineering and the Automobile Club of Southern California's Automotive Research Center (ARC) evaluated the effectiveness of five ADAS technologies. Our goal is to inform members about what the systems can and cannot do.

To test **adaptive cruise control** (ACC) and **autonomous braking functions**, AAA replicated a variety of typical commuting scenarios, which demonstrated that ACC did a good job of maintaining a following distance when traveling behind slower-moving vehicles on a highway. Some systems even brought vehicles to a stop and resumed a safe speed when traffic cleared. However, the systems performed best when cars followed other vehicles more closely than AAA's recommended three-second rule. Furthermore, tracking vehicles while negotiating a mild curve proved difficult for all systems.

To test **forward-collision–avoidance** (FCA) systems, vehicles were driven on a test track at varying speeds toward obstructions, including traffic cones, a weather balloon, and a Mylar "space blanket." This replicated conditions motorists might encounter in real-world driving. The systems didn't always recognize obstacles, provide a warning signal, or engage the brakes to slow or stop the vehicle. In some cases, the systems slowed the vehicles but didn't start braking early enough to avoid making contact with the obstacle. AAA is continuing its research on automated braking.

Also, a system's ability to recognize obstacles varied among vehicles. Although the owner's manuals for these vehicles warn that the systems may not recognize or react to motorcycles, a stopped vehicle, traffic cones, or other obstructions, people who own automobiles with these systems might not read the manuals or become sufficiently informed to use them safely.

For the research on **blind-spot–monitoring** (BSM) systems, vehicles were driven on the oval track at the Auto Club Speedway and evaluated for their ability to spot another vehicle or a motorcycle in their blind spots at varying speeds. The results: Blind-spot–monitoring systems detected target vehicles in most—but not all—conditions. However, the detection distance varied considerably depending on the system being tested and on the speed of the approaching vehicle. Detection of a passing motorcycle was, on average, 26 percent later than detection of passing vehicles. There were instances in every evaluation where a driver needed to take corrective action. AAA concluded that drivers should not become overly reliant on this technology.

Sometimes, a blind-spot–monitoring system has a **rear cross-traffic alert** (RCTA) function, which lets you know if traffic is about to cross at right angles behind your vehicle from either direction. This feature is especially useful if you're about to back out of a parking spot where visibility to the sides is restricted or completely blocked by other vehicles. RCTA systems are designed to detect only other cars. However, the ARC tested whether the systems worked for motorcycles, bicycles, and pedestrians on the assumption that motorists might assume they would.

Some test vehicles performed well, but others missed obstacles or detected them late, and two of the five cars tested couldn't detect vehicles passing behind them when there was a large SUV parked on either side. Only two of the five vehicles could detect a pedestrian crossing behind, and just three in five could detect a bicycle. AAA concluded that motorists with RCTA systems should be aware of the systems' limitations.

Three different vehicles were driven on the road for an evaluation of **lane-departure–warning** (LDW) and **lane-keeping–assist** (LKA) systems. Lane-departure crashes are one of the most common types of collisions, accounting for about 1.6 million crashes a year, according to the AAA Foundation for Traffic Safety. The LDW systems did a good job of detecting various lane markings to alert drivers both visually and audibly that they were crossing into another lane.

AAA found that these systems worked most of the time, but not always, and sometimes their warnings annoyed test drivers—which means that users might be inclined to turn the systems off. Also, some vehicles could detect certain lane markings better than other types of markings, but there was no consistent marker recognition among vehicles. Worn pavement markers, construction zones, and intersections sometimes caused the system to lose track of lane location.

Similarly, LKA systems worked well, although the vibration alert in the steering wheel coupled with the slowing down of the vehicle as it moved back into its lane (typical of some systems) was somewhat disconcerting to test drivers.

AAA recommends that automakers communicate better with car owners to make the limitations of ADAS clear and obvious, and that motorists become thoroughly familiar with the performance of ADAS before operating their vehicles.

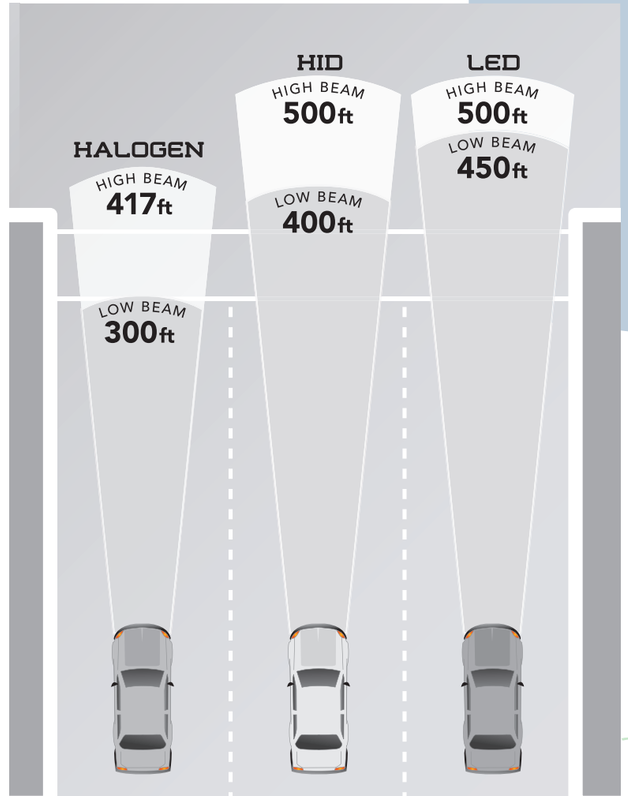
The important takeaway from AAA's research is that all ADAS have limitations, and multitasking drivers could be caught off guard by relying too heavily on the systems. Their benefits could easily be outweighed if motorists don't become familiar with their operation or become overly reliant on the systems and less focused behind the wheel. Technology, no matter how sophisticated, is no substitute for an alert, engaged driver.

## HEADLIGHT-EFFECTIVENESS STUDY

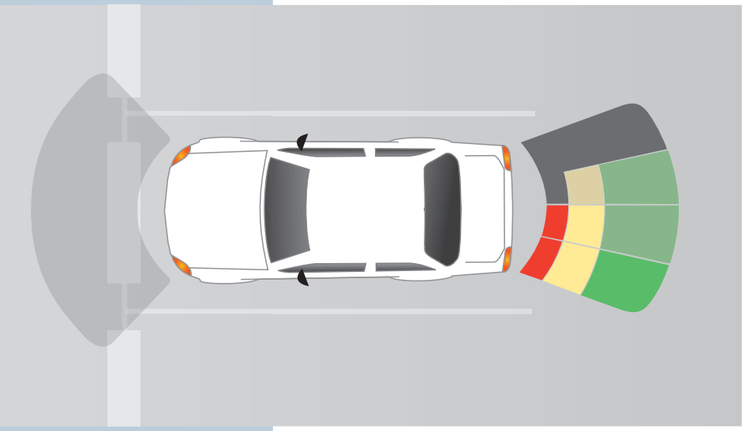
Effective vehicle lighting is critical. Although only 25 percent of driving is done at night, it's when 50 percent of crashes occur, according to the National Highway Traffic Safety Administration (NHTSA).

AAA conducted tests of halogen, high-intensity discharge (HID), and light-emitting diode (LED) headlights to find out, among other things, how much forward lighting is needed for safe nighttime driving, especially, for example, on unlit rural roads. Tests were conducted in collaboration with the ARC.

Testing the three types of headlights side by side revealed that they varied significantly in their




**Both LED AND HID HEADLIGHTS** outperform halogen headlights, AAA testing determined. Furthermore, LED headlights are marginally more effective at low-beam setting.



**REARVIEW CAMERAS** are effective but have limitations. The green, yellow, and red shading in the illustration above indicate maximum, minimum, and zero levels of visibility, respectively.

effectiveness. On a low-beam setting, halogen headlights (found on 80 percent of today's vehicles) could detect a nonreflective object at 300 feet; HID headlights at 400 feet; and LED headlights at 450 feet.

This means that on roadways without overhead lighting, halogen headlights provide inadequate lighting at speeds above 39 mph, and HID or LED headlights provide inadequate lighting at speeds above 45 mph. On high beams, halogen headlights provide adequate lighting for maximum speeds up to 48 mph, and HID or LED headlights for maximum speeds up to 55 mph.

The conclusion: On roadways without overhead lighting, it's possible to outrun your headlights' effective range, even with the most advanced systems now available. Therefore, AAA recommends that when driving at night on unlit roadways, motorists use high beams whenever possible. (Currently, two-thirds of U.S. motorists don't use their high beams on a regular basis.) Furthermore, drivers should carefully monitor and adjust their speed when traveling on unlit roads at night to allow enough time to stop their vehicle to avoid hitting a pedestrian, animal, or object in the roadway.

The study found that dirty or deteriorated lenses could cut the effectiveness of any type of headlight significantly—up to 50 percent with halogen bulbs. But it's possible to restore the clarity of plastic headlight lenses, which become cloudy over time. Doing so dramatically improves headlight intensity and reduces the light scatter that produces glare for drivers in oncoming cars. Car dealerships can perform this task, or car owners can buy kits at auto parts stores and do the job themselves.

## REARVIEW CAMERA EFFECTIVENESS

Back-over crashes account for a fairly small percentage of total collisions, but they are more likely to lead to severe injury or death. NHTSA estimates that more than 200 fatalities and 15,000 injuries occur annually from vehicles backing over people—and 31 percent of those fatalities are children under 5.

Fortunately, such accidents are preventable, because rearview cameras have proven effective in reducing back-over deaths and injuries, as well as property damage due to collisions with walls, fences, light poles, and so on. Because these incidents can have such serious consequences, NHTSA passed legislation requiring rearview cameras to be standard equipment on all new cars and light trucks sold as of May 2018.

AAA, in conjunction with the ARC, tested 17 vehicles from 11 manufacturers with both factory-installed and aftermarket rearview camera systems to measure any improvements in rear visibility.

The study showed that:

- Generally, both factory-installed and aftermarket cameras worked well, producing extremely clear images even at night and in low-light conditions, improving visibility in the blind zone behind cars by an average of 46 percent. This ranged from a 36 percent improvement in smaller sedans to a 75 percent improvement in hatchbacks.
- These systems dramatically improve rearview visibility, but they don't show 100 percent of the space behind the vehicle. They also have limitations: For example, they don't capture the scene much below a car's bumper; and rain, snow, or slush can cloud the camera lens, which results in blurry images.

"Rearview cameras are a great supplement for drivers," says John Nielsen, AAA's managing director of automotive engineering. "They dramatically improve rear visibility. They're especially helpful for viewing the first 10 feet behind the vehicle, which are the most hazardous in terms of back-over risk for young children. But they don't replace the need to check around your vehicle for obstacles before getting in to back up."



AAA recommends that drivers always walk behind their vehicle to visually confirm that there are no obstacles, and use the rearview camera to check that nothing has entered the area since the driver's walk-through inspection. Rearview cameras are not a substitute for safe-driving practices.

## FUEL-ECONOMY TESTING

The media has documented many motorists' complaints that they don't get the mileage stated on the EPA Fuel Economy and Environment window sticker. However, a data search on EPA's website, fueleconomy.gov, found that most motorists who reported their own fuel economy were able to obtain fuel economy within the range of EPA predictions.

So AAA and ARC staff sought out cars with specific combinations of year, make, model, and powertrain that EPA data show were getting worse mileage than indicated on the EPA window sticker. The staff then located examples of some of these vehicles—a 2014 Ford F-150, a 2014 Hyundai Sonata, and a 2012 Nissan Altima—and tested them to see if they got worse mileage than predicted.

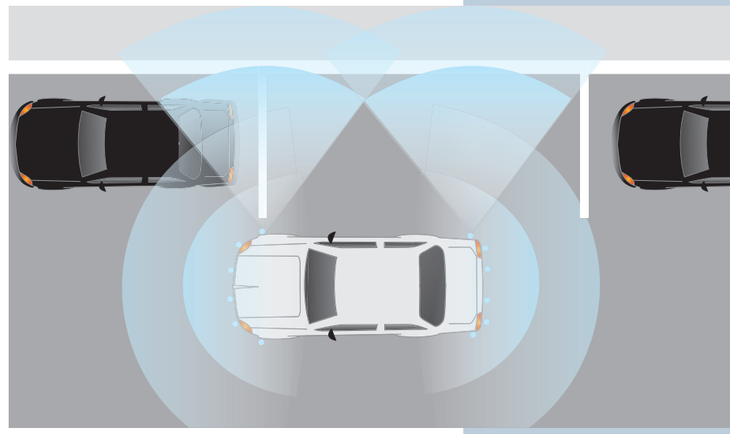
Two kinds of tests were conducted: three EPA dynamometer tests (read about EPA testing on page 15) and four weeklong road tests involving four test drivers engaged in a variety of types of driving.

Vehicles were able to repeat their EPA certification results when tested on the dynamometer, and on-road mpg measurements were within the range of EPA window-sticker values. Each vehicle showed a significant variation between its lowest and highest recorded fuel economy on the road.

Not surprisingly, driving that featured many cold starts (engines use the most fuel when cold-started) and in-town or congested driving conditions tended to have low mpg numbers. Free-flowing freeway driving and driving with long distances between stops tended to have high mpg numbers.

## ACTIVE PARKING-ASSIST SYSTEMS

Introduced in the U.S. in 2006, active parking-assist systems use cameras and sensors to identify a correctly sized parallel-parking spot and automatically back the vehicle into it. (Some systems can also park in perpendicular parking spots.) The vehicle does all the steering; the driver operates the accelerator and brake pedal.



**Using sensors typically located on the front and rear bumpers, ACTIVE PARKING-ASSIST SYSTEMS can find an appropriate parking space and move a car into it with minimal driver input.**

AAA evaluated how well active parking-assist systems parked vehicles compared with nonassisted drivers performing the same task. It found that:

- Drivers using parking-assist systems had 81 percent fewer curb strikes than drivers parking without assistance.
- Parking-assist systems were more efficient and used 47 percent fewer maneuvers.
- Parking-assist systems were 10 percent faster than those who parked manually.
- The single criticism of the various systems was that the systems tended to park vehicles very close to the curb, potentially risking wheel or tire damage.

AAA concluded that automated parking-assist systems can make parallel parking easier and less stressful, especially for people with restricted mobility. Despite such findings, 72 percent of adult drivers surveyed said they wouldn't trust self-parking vehicle technology to park their vehicle.

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As today's automobiles keep advancing technologically, consumers will continue to need a source of objective, honest, reliable automotive information. AAA remains dedicated to providing this type of independent, trusted automotive research. The findings will help our members and other motorists better understand the implications of new automotive technology and trends in the auto industry, and continue to use and enjoy their vehicles for many years.

# OVERALL GREEN CAR SCORES

**TEST RESULTS AND RANKINGS** The green cars tested by the ARC are evaluated on the basis of 13 categories: emissions, fuel economy, crashworthiness, braking, acceleration, handling, cargo-carrying capacity, ride quality, interior noise, ease of entry and exit, maneuverability, roominess, and visibility. The scores for the categories are totaled, and the cars are ranked from high to low.

**CATEGORY**

- SUBCOMPACT
- COMPACT
- MIDSIZE
- LARGE
- PICKUP
- SUV

| RANKING | YEAR | MAKE | MODEL | GCG CATEGORY | SCORE |
|---|---|---|---|---|---|
| 1 | 2015 | Tesla | Model S 70D | CATEGORY WINNER | 92.49 |
| 2 | 2014 | BMW | i3 | CATEGORY WINNER | 88.47 |
| 3 | 2015 | Volkswagen | e-Golf SEL Premium | CATEGORY WINNER | 87.09 |
| 4 | 2016 | Audi | A3 Sportback e-tron Premium | | 83.49 |
| 5 | 2015 | Subaru | Outback 2.5i Premium | CATEGORY WINNER | 81.96 |
| 6 | 2015 | Kia | Soul EV+ | | 81.16 |
| 7 | 2015 | BMW | 328d M Sport | | 81.07 |
| 8 | 2014 | Toyota | Highlander Hybrid Limited | | 80.17 |
| 9 | 2016 | Acura | RLX Sport Hybrid SH-AWD Advance | | 79.32 |
| 10 | 2016 | Nissan | Leaf SL | | 79.15 |
| 11 | 2014 | Mercedes-Benz | E250 BlueTEC 4MATIC | CATEGORY WINNER | 78.27 |
| 12 | 2014 | Mazda | Mazda3 s Grand Touring | | 78.26 |
| 13 | 2016 | Honda | Civic Touring | | 77.88 |
| 14 | 2014 | Chevrolet | Spark EV 2LT | | 77.73 |
| 15 | 2014 | Lexus | GS 450h | | 77.50 |
| 16 | 2016 | Toyota | Prius Two Eco | | 77.35 |
| 17 | 2014 | Lexus | CT 200h | | 77.17 |
| 18 | 2016 | Volkswagen | Passat 1.8T SE | | 76.70 |
| 19 | 2015 | Subaru | Legacy 2.5i Premium | | 76.38 |
| 20 | 2015 | Ford | F-150 Supercab Lariat | CATEGORY WINNER | 75.73 |
| 21 | 2014 | Subaru | Forester 2.5i Touring | | 75.63 |
| 22 | 2016 | Honda | Accord Sport Sensing | | 75.54 |
| 23 | 2014 | Toyota | Prius v Three | | 75.35 |
| 24 | 2015 | Fiat | 500e | | 75.08 |
| 25 | 2015 | Subaru | Impreza 2.0i Sport Limited | | 74.97 |
| 26 | 2013 | Volkswagen | Jetta Hybrid SEL Premium | | 74.91 |
| 27 | 2015 | Audi | A3 Premium | | 74.85 |
| 28 | 2015 | Lexus | NX 300h | | 74.51 |
| 29 | 2014 | Mazda | CX-5 Touring AWD | | 74.41 |
| 30 | 2016 | Chevrolet | Volt Premier | | 74.37 |
| 31 | 2013 | Ford | C-Max Hybrid SE | | 74.32 |
| 32 | 2015 | Toyota | Camry Hybrid SE | | 74.09 |
| 33 | 2016 | Toyota | RAV4 Limited Hybrid | | 73.95 |
| 34 | 2016 | Hyundai | Sonata Hybrid Limited | | 73.67 |
| 35 | 2013 | Honda | CR-Z EX NAVI | | 73.32 |
| 36 | 2015 | Lexus | ES 300h | | 73.29 |
| 37 | 2014 | Buick | LaCrosse | | 73.03 |
| 38 | 2013 | Ford | C-Max Energi SEL | | 72.95 |
| 39 | 2016 | Lexus | RX 450h | | 72.40 |
| 39 | 2014 | Toyota | Prius c Three | | 72.40 |
| 41 | 2014 | Mazda | Mazda6 i Grand Touring | | 72.39 |
| 42 | 2014 | Lexus | LS 600h L | | 72.33 |
| 43 | 2014 | Jeep | Grand Cherokee Summit 4X4 | | 71.98 |
| 44 | 2014 | Chevrolet | Silverado 1500 LT | | 71.74 |
| 45 | 2016 | Mitsubishi | i-MiEV ES | | 71.71 |
| 46 | 2015 | Hyundai | Sonata Eco | | 71.61 |
| 47 | 2016 | Ford | Fusion Hybrid S | | 71.45 |
| 48 | 2015 | Hyundai | Tucson Fuel Cell | | 71.11 |
| 49 | 2014 | Kia | Soul+ | | 71.05 |
| 50 | 2014 | Ford | Fusion Energi Titanium | | 70.92 |
| 51 | 2014 | Subaru | Crosstrek Hybrid | | 70.84 |
| 52 | 2014 | Ford | Focus Electric | | 70.76 |
| 53 | 2013 | Toyota | Avalon Limited | | 70.70 |
| 54 | 2016 | Cadillac | ELR Sport | | 70.56 |
| 55 | 2015 | Ford | Focus SE Ecoboost | | 70.20 |
| 56 | 2014 | Ram | 1500 SLT Outdoorsman Crew Cab | | 69.45 |
| 57 | 2016 | Honda | HR-V EX-L NAVI | | 69.01 |
| 57 | 2016 | Scion | iM | | 69.01 |
| 59 | 2013 | smart | electric drive | | 68.81 |
| 60 | 2016 | Toyota | Avalon Hybrid XLE Plus | | 68.71 |
| 61 | 2015 | Chevrolet | Sonic LTZ | | 68.30 |
| 62 | 2015 | Chrysler | 200 Limited | | 67.72 |
| 63 | 2014 | Toyota | Corolla LE Eco | | 67.45 |
| 64 | 2014 | Kia | Forte EX | | 67.19 |
| 65 | 2015 | Honda | Fit EX-L | | 67.04 |
| 66 | 2016 | Mazda | CX-3 Grand Touring | | 66.52 |
| 67 | 2014 | Ford | Fiesta SE | | 66.38 |
| 68 | 2015 | Chevrolet | Trax LT FWD | | 66.34 |
| 69 | 2015 | Toyota | Yaris LE | | 65.52 |
| 70 | 2014 | Mini | Cooper Countryman | | 65.50 |
| 71 | 2014 | Nissan | Versa SV | | 65.41 |
| 72 | 2014 | Nissan | Versa Note SV | | 65.35 |
| 73 | 2016 | Chevrolet | Spark 2LT | | 64.79 |
| 74 | 2016 | Subaru | Crosstrek 2.0i Premium | | 64.39 |
| 75 | 2013 | Buick | Encore AWD Premium | | 64.02 |
| 76 | 2014 | BMW | i8 | | 63.82 |
| 77 | 2016 | Scion | iA | | 63.48 |
| 78 | 2015 | Chevrolet | Impala 3LT CNG Bi-Fuel | | 63.11 |
| 79 | 2014 | Mitsubishi | Outlander ES | | 63.10 |
| 80 | 2015 | Dodge | Dart SE Aero | | 61.20 |
| 81 | 2016 | Hyundai | Accent SE | | 58.89 |

# RANKING BY PRICE

For the car buyer, there's more to what makes a green car desirable than just performance data. When it comes to purchase price, green cars run the gamut. Here's a breakdown of the 81 cars from this year's Guide listed in ranking order in three price categories. To see how a particular vehicle measured up against all other vehicles regardless of price, refer to the Overall Scores chart on page 72.

**CATEGORY**

- SUBCOMPACT
- COMPACT
- MIDSIZE
- LARGE
- PICKUP
- SUV

## UNDER $30,000

| RANKING | YEAR | MAKE | MODEL | CATEGORY | SCORE | PRICE AS TESTED |
|---|---|---|---|---|---|---|
| 1 | 2014 | Mazda | Mazda3 s Grand Touring | COMPACT | 78.26 | $29,485 |
| 2 | 2016 | Honda | Civic Touring | COMPACT | 77.88 | $27,335 |
| 3 | 2014 | Chevrolet | Spark EV 2LT | SUBCOMPACT | 77.73 | $27,820 |
| 4 | 2016 | Toyota | Prius Two Eco | COMPACT | 77.35 | $25,535 |
| 5 | 2016 | Volkswagen | Passat 1.8T SE | MIDSIZE | 76.70 | $27,100 |
| 6 | 2015 | Subaru | Legacy 2.5i Premium | MIDSIZE | 76.38 | $27,480 |
| 7 | 2016 | Honda | Accord Sport Sensing | MIDSIZE | 75.54 | $26,785 |
| 8 | 2014 | Toyota | Prius v Three | COMPACT | 75.35 | $28,550 |
| 9 | 2015 | Subaru | Impreza 2.0i Sport Limited | COMPACT | 74.97 | $26,885 |
| 10 | 2014 | Mazda | CX-5 Touring AWD | SUV | 74.41 | $29,375 |
| 11 | 2013 | Ford | C-Max Hybrid SE | MIDSIZE | 74.32 | $27,990 |
| 12 | 2013 | Honda | CR-Z EX NAVI | SUBCOMPACT | 73.32 | $24,595 |
| 13 | 2014 | Toyota | Prius c Three | SUBCOMPACT | 72.40 | $23,815 |
| 14 | 2016 | Mitsubishi | i-MiEV ES | SUBCOMPACT | 71.71 | $25,845 |
| 15 | 2015 | Hyundai | Sonata Eco | MIDSIZE | 71.61 | $28,310 |
| 16 | 2016 | Ford | Fusion S Hybrid | MIDSIZE | 71.45 | $26,010 |
| 17 | 2014 | Kia | Soul+ | COMPACT | 71.05 | $19,160 |
| 18 | 2015 | Ford | Focus SE Ecoboost | COMPACT | 70.20 | $21,035 |
| 19 | 2016 | Honda | HR-V EX-L NAVI | SUV | 69.01 | $25,470 |
| 19 | 2016 | Scion | iM | COMPACT | 69.01 | $20,334 |
| 21 | 2013 | smart | electric drive | SUBCOMPACT | 68.81 | $25,750 |
| 22 | 2015 | Chevrolet | Sonic LTZ | COMPACT | 68.30 | $21,010 |
| 23 | 2015 | Chrysler | 200 Limited | MIDSIZE | 67.72 | $25,790 |
| 24 | 2014 | Toyota | Corolla LE Eco | COMPACT | 67.45 | $19,735 |
| 25 | 2014 | Kia | Forte EX | COMPACT | 67.19 | $25,515 |
| 26 | 2015 | Honda | Fit EX-L | SUBCOMPACT | 67.04 | $20,590 |
| 27 | 2016 | Mazda | CX-3 Grand Touring | SUV | 66.52 | $28,340 |
| 28 | 2014 | Ford | Fiesta SE | SUBCOMPACT | 66.38 | $18,785 |
| 29 | 2015 | Chevrolet | Trax LT FWD | SUV | 66.34 | $23,815 |
| 30 | 2015 | Toyota | Yaris LE | SUBCOMPACT | 65.52 | $17,705 |
| 31 | 2014 | Mini | Cooper Countryman | COMPACT | 65.50 | $24,145 |
| 32 | 2014 | Nissan | Versa SV | SUBCOMPACT | 65.41 | $16,050 |
| 33 | 2014 | Nissan | Versa Note SV | SUBCOMPACT | 65.35 | $16,800 |
| 34 | 2016 | Chevrolet | Spark 2LT | SUBCOMPACT | 64.79 | $18,355 |
| 35 | 2016 | Subaru | Crosstrek 2.0i Premium | SUV | 64.39 | $26,240 |
| 36 | 2016 | Scion | iA | SUBCOMPACT | 63.48 | $17,570 |
| 37 | 2014 | Mitsubishi | Outlander ES | SUV | 63.10 | $23,820 |
| 38 | 2015 | Dodge | Dart SE Aero | COMPACT | 61.20 | $20,990 |
| 39 | 2016 | Hyundai | Accent SE | COMPACT | 58.89 | $16,580 |



## $30,000 – $50,000

| RANKING | YEAR | MAKE | MODEL | CATEGORY | SCORE | PRICE AS TESTED |
|---|---|---|---|---|---|---|
| 1 | 2014 | BMW | i3 | CATEGORY WINNER | 88.47 | $48,675 |
| 2 | 2015 | Volkswagen | e-Golf SEL Premium | CATEGORY WINNER | 87.09 | $36,265 |
| 3 | 2016 | Audi | A3 Sportback e-tron Premium | COMPACT | 83.49 | $40,700 |
| 4 | 2015 | Subaru | Outback 2.5i Premium | CATEGORY WINNER | 81.96 | $31,535 |
| 5 | 2015 | Kia | Soul EV+ | COMPACT | 81.16 | $36,625 |
| 6 | 2015 | BMW | 328d M Sport | COMPACT | 81.07 | $49,800 |
| 7 | 2016 | Nissan | Leaf SL | COMPACT | 79.15 | $39,390 |
| 8 | 2014 | Lexus | CT 200h | COMPACT | 77.17 | $39,095 |
| 9 | 2015 | Ford | F-150 Supercab Lariat | CATEGORY WINNER | 75.73 | $39,880 |
| 10 | 2014 | Subaru | Forester 2.5i Touring | SUV | 75.63 | $32,220 |
| 11 | 2015 | Fiat | 500e | SUBCOMPACT | 75.08 | $34,245 |
| 12 | 2013 | Volkswagen | Jetta Hybrid SEL Premium | COMPACT | 74.91 | $32,010 |
| 13 | 2015 | Audi | A3 Premium | COMPACT | 74.85 | $30,795 |
| 14 | 2015 | Lexus | NX 300h | SUV | 74.51 | $47,045 |
| 15 | 2016 | Chevrolet | Volt Premier | COMPACT | 74.37 | $40,225 |
| 16 | 2015 | Toyota | Camry Hybrid SE | MIDSIZE | 74.09 | $31,335 |
| 17 | 2016 | Toyota | RAV4 Limited Hybrid | SUV | 73.95 | $35,865 |
| 18 | 2016 | Hyundai | Sonata Hybrid Limited | MIDSIZE | 73.67 | $35,550 |
| 19 | 2015 | Lexus | ES 300h | MIDSIZE | 73.29 | $45,320 |
| 20 | 2014 | Buick | LaCrosse | LARGE | 73.03 | $36,630 |
| 21 | 2013 | Ford | C-Max Energi SEL | MIDSIZE | 72.95 | $37,930 |
| 22 | 2014 | Mazda | Mazda6 i Grand Touring | MIDSIZE | 72.39 | $31,490 |
| 23 | 2014 | Chevrolet | Silverado 1500 LT | PICKUP | 71.74 | $42,610 |
| 24 | 2014 | Ford | Fusion Energi Titanium | MIDSIZE | 70.92 | $42,485 |
| 25 | 2014 | Subaru | Crosstrek Hybrid | SUV | 70.84 | $30,120 |
| 26 | 2014 | Ford | Focus Electric | COMPACT | 70.76 | $36,990 |
| 27 | 2013 | Toyota | Avalon Limited | LARGE | 70.70 | $42,494 |
| 28 | 2014 | Ram | 1500 SLT Outdoorsman Crew Cab | PICKUP | 69.45 | $45,150 |
| 29 | 2016 | Toyota | Avalon Hybrid XLE Plus | LARGE | 68.71 | $37,485 |
| 30 | 2013 | Buick | Encore AWD Premium | SUV | 64.02 | $32,425 |
| 31 | 2015 | Chevrolet | Impala 3LT CNG Bi-Fuel | LARGE | 63.11 | $42,625 |

## OVER $50,000

| RANKING | YEAR | MAKE | MODEL | CATEGORY | SCORE | PRICE AS TESTED |
|---|---|---|---|---|---|---|
| 1 | 2015 | Tesla | Model S 70D | CATEGORY WINNER | 92.49 | $77,700 |
| 2 | 2014 | Toyota | Highlander Hybrid Limited | SUV | 80.17 | $50,650 |
| 3 | 2016 | Acura | RLX Sport Hybrid SH-AWD Advance | LARGE | 79.32 | $66,870 |
| 4 | 2014 | Mercedes-Benz | E250 BlueTEC 4MATIC | CATEGORY WINNER | 78.27 | $64,295 |
| 5 | 2014 | Lexus | GS 450h | MIDSIZE | 77.50 | $69,769 |
| 6 | 2016 | Lexus | RX 450h | SUV | 72.40 | $59,255 |
| 7 | 2014 | Lexus | LS 600h L | LARGE | 72.33 | $135,025 |
| 8 | 2014 | Jeep | Grand Cherokee Summit 4X4 | SUV | 71.98 | $57,190 |
| 9 | 2015 | Hyundai | Tucson Fuel Cell | SUV | 71.11 | $50,895 |
| 10 | 2016 | Cadillac | ELR Sport | COMPACT | 70.56 | $67,790 |
| 11 | 2014 | BMW | i8 | SUBCOMPACT | 63.82 | $136,219 |


BASE PRICE: **$41,350;** PRICE AS TESTED: **$48,675**

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

LEAF RATING:

# Subcompact

American car buyers tend to think bigger is better, so subcompact cars don't get the respect they deserve. In fact, they have a lot to offer. For one, they cost less, so they're easier for first-time car owners or folks on a budget to afford. They're smaller and lighter, so they get better gas mileage and cost less to operate. Plus they're easier to maneuver, often are fun to drive, and fit in parking spaces bigger cars have to bypass. Many are hatchbacks with backseats that fold flat, so they have space for luggage or other cargo. And these days, many subcompacts also have the latest amenities, often as standard equipment, such as keyless entry and starting, Bluetooth connectivity, and rearview cameras.

## BMW
## i3

The i3 is BMW's first all-electric vehicle. Lightweight materials and sophisticated electronics make it the most efficient vehicle on the market (124 MPGe combined). It's also fast, requiring just 7 seconds to go from 0 to 60 mph. And, like most EVs, the i3 is quiet. But in many respects, it's an odd car. You must first open the front doors to access the reverse-facing rear doors, and no one larger than a child would want to sit in the tiny backseat. The i3's aggressive regenerative braking system engages as soon as you lift your foot from the accelerator, which takes some getting used to. The i3 is available with a small range-extender gasoline motor, which adds about 70 miles to the i3's range and decreases its all-electric range somewhat. But if you want efficient, fast, and quirky, the i3 should be near the top of your list. Neither NHTSA nor the IIHS has yet crash-tested the BMW i3. For 2016, the i3 is essentially a carryover.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

**88.47**

OVERALL RANKING **2**

### STRONG POINTS

- Responsive, powerful motor
- Most efficient EV available
- ZEV emissions rating
- Satellite radio display identifies what's playing on each channel
- Charger display tells what time it will be finished

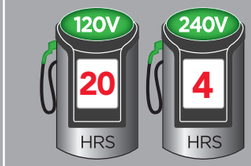
### WEAK POINTS

- Cramped; difficult to enter backseat
- Overly aggressive regenerative braking won't let you coast downhill
- Limited range (81 miles)

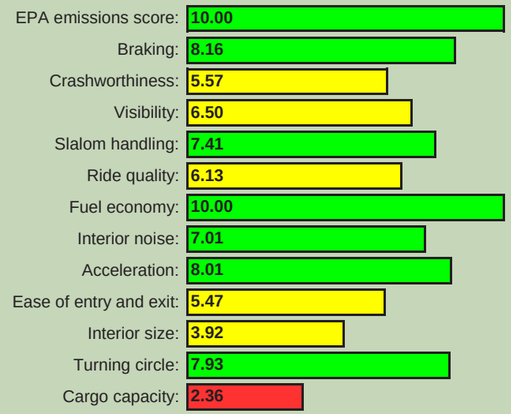
### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **22** |
| EPA urban MPGe: | **138** |
| EPA highway MPGe: | **111** |
| EPA combined MPGe: | **124** |
| EPA estimated range (mi.): | **81** |

### BATTERY CHARGE TIME




### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

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### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **2880** |
| Exterior length (in): | **157.0** |
| Exterior width (in): | **70.0** |
| Exterior height (in): | **62.0** |
| Wheelbase (in): | **101.0** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 175/55R20** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **170 hp (127 kW)** |

# Chevrolet Spark EV 2LT


BASE PRICE: **$27,820;** PRICE AS TESTED: **$27,820**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

77.73

**OVERALL RANKING** 14

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **21** |
| EPA urban MPGe: | **128** |
| EPA highway MPGe: | **109** |
| EPA combined MPGe: | **119** |
| EPA estimated range (mi.): | **82** |

**BATTERY CHARGE TIME**

| 120V | 240V |
|---|---|
| 17 HRS | 7 HRS |

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Chevrolet Spark EV is an all-electric version of the subcompact Spark hatchback. Like most other EVs, it's easy to drive and produces zero emissions, but with an estimated range of 82 miles, it's not practical for long trips. The 140-hp electric motor provides quick acceleration (0–60 mph in 8 seconds). Our test vehicle was well equipped, including Bluetooth, XM radio, heated seats, and a DC fast-charging port. Because of the low cost of electricity and its EPA-combined 119 MPGe fuel-economy rating, the Spark EV has low operating costs. And with a base MSRP under $28,000 before federal and state incentives, it's also one of the most economical EVs on the market. The Spark's battery can be 80 percent recharged in 20 minutes on a DC fast charger, but it takes about seven hours for a full recharge at 240 volts. The Spark EV hasn't been crash-tested by either NHTSA or IIHS. For 2016, the gasoline-powered Spark was redesigned, but the Spark EV carries over unchanged from 2015. Currently, it's available for sale only in California, Maryland, and Oregon.

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

**STRONG POINTS**

- Efficient energy use (119 MPGe)
- Zero tailpipe emissions
- Good power, especially at low speeds
- Quiet powertrain
- Easy to drive and park
- Standard equipment includes XM, Bluetooth, and cruise control

**WEAK POINTS**

- Long recharging time
- Range anxiety
- Small trunk
- Cramped rear seat
- Lacks rear center armrest

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 10.00 |
| Braking: | 3.85 |
| Crashworthiness: | 5.65 |
| Visibility: | 6.40 |
| Slalom handling: | 6.19 |
| Ride quality: | 6.00 |
| Fuel economy: | 10.00 |
| Interior noise: | 4.61 |
| Acceleration: | 6.99 |
| Ease of entry and exit: | 5.55 |
| Interior size: | 4.38 |
| Turning circle: | 6.68 |
| Cargo capacity: | 1.42 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **2940** |
| Exterior length (in): | **146.5** |
| Exterior width (in): | **64.0** |
| Exterior height (in): | **62.6** |
| Wheelbase (in): | **93.5** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Bridgestone 185/55R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **140 hp (104 kW)** |

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# Fiat 500e


BASE PRICE: **$31,800;** PRICE AS TESTED: **$34,245**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

75.08

**OVERALL RANKING** 24

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **24** |
| EPA urban MPGe: | **122** |
| EPA highway MPGe: | **108** |
| EPA combined MPGe: | **115** |
| EPA estimated range (mi.): | **84** |

**BATTERY CHARGE TIME**

| 120V | 240V |
|---|---|
| 24 HRS | 4 HRS |

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Fiat 500e, an all-electric version of the Fiat 500, is reputed to be a "compliance car"—built mainly to satisfy California's ZEV requirements. It's equipped with a 111-hp motor, is easy to drive, and produces zero emissions, but because of its limited range (84 miles) it's not practical for long trips. It takes only four hours to completely recharge the 500e's battery pack with a Level 2 (240 volt) charger, but as long as 24 hours with a Level 1 (120 volt) charging system. Many consider the 500e cute, but its looks don't compensate for its drawbacks. Its steering is responsive, and it's very maneuverable and fun to drive, but it handled poorly at its limits on our slalom course. The 500e is really a two-person car: Its backseat is cramped and its trunk is miniscule. Neither NHTSA nor IIHS has crash-tested the Fiat 500e. For 2016, the 500e gets an updated infotainment and navigation system but is otherwise unchanged. It's available only in California and Oregon.

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

**STRONG POINTS**

- Easy to park
- Charges quickly on a 240-volt charger
- Inexpensive to run because of the low cost of electricity
- ZEV emissions rating
- Heater warms up quickly

**WEAK POINTS**

- Limited range and associated range anxiety (even using the ventilation system reduces the range)
- Cramped rear seats are hard to get in and out of
- Navigation system blocks driver's view and seems tacked on
- Small trunk
- Push-button shifter

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 10.00 |
| Braking: | 5.32 |
| Crashworthiness: | 6.26 |
| Visibility: | 6.80 |
| Slalom handling: | 4.55 |
| Ride quality: | 6.21 |
| Fuel economy: | 10.00 |
| Interior noise: | 5.25 |
| Acceleration: | 5.33 |
| Ease of entry and exit: | 5.18 |
| Interior size: | 1.57 |
| Turning circle: | 8.13 |
| Cargo capacity: | 0.47 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **3020** |
| Exterior length (in): | **142.4** |
| Exterior width (in): | **64.1** |
| Exterior height (in): | **60.1** |
| Wheelbase (in): | **90.6** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Firestone 185/55R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **111 hp (83 kW)** |

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SUBCOMPACT HYBRID

## **Honda** CR-Z EX NAVI

BASE PRICE: **$24,595;** PRICE AS TESTED: **$24,595**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

73.32

**OVERALL RANKING** **35**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **10.6** |
| EPA urban mpg: | **36** |
| EPA highway mpg: | **39** |
| EPA combined mpg: | **37** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0035

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

Honda's CR-Z is the carmaker's second attempt at a small, two-seat sporty hybrid. Its first was the original Insight (the first hybrid in the U.S. market). The CR-Z looks and feels sporty, gets 37 mpg, has above-average acceleration, is loaded with safety and convenience features, has an AT-PZEV emissions rating, and is a well-executed car. However, it's still a small two-seater, which limits its utility.

NHTSA awarded the CR-Z 4 stars (out of 5) overall in its crash tests. For 2016, the CR-Z receives restyled front and rear ends, plus an increase in standard features.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring

### STRONG POINTS

- ⊕ Fuel economy
- ⊕ Certified as an AT PZEV
- ⊕ Easy to drive and park
- ⊕ Sporty/modernistic styling
- ⊕ Priced lower than many hybrids ($25,000)
- ⊕ Loaded with useful features including navigation, Bluetooth, HID headlights

### WEAK POINTS

- ⊖ High levels of road and engine noise when accelerating
- ⊖ Difficult to enter and exit
- ⊖ Choppy ride
- ⊖ Poor rear visibility
- ⊖ Lacks center armrest

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 9.00 |
| Braking: | 8.24 |
| Crashworthiness: | 4.62 |
| Visibility: | 6.50 |
| Slalom handling: | 5.37 |
| Ride quality: | 6.03 |
| Fuel economy: | 5.89 |
| Interior noise: | 2.97 |
| Acceleration: | 5.09 |
| Ease of entry and exit: | 6.50 |
| Interior size: | 2.70 |
| Turning circle: | 5.67 |
| Cargo capacity: | 4.74 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2** |
| Curb weight (lbs): | **2920** |
| Exterior length (in): | **160.6** |
| Exterior width (in): | **68.5** |
| Exterior height (in): | **54.9** |
| Wheelbase (in): | **95.9** |
| Restraint type: | **6 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Dunlop P195/55R14** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.5L SOHC I4** |
| Horsepower @ rpm: | **130 @ 6000** |

AAA.com/greencar



SUBCOMPACT HYBRID

## **Toyota** Prius c Three

BASE PRICE: **$21,765;** PRICE AS TESTED: **$23,815**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

72.40

**OVERALL RANKING** **39**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **9.5** |
| EPA urban mpg: | **53** |
| EPA highway mpg: | **46** |
| EPA combined mpg: | **50** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0041

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Toyota Prius c is a subcompact hatchback variant on the Prius theme. It has a smaller, 1.5-liter engine (versus the 1.8-liter engine in the standard Prius) and a lower-output electric motor (60 hp versus 71), good for 99 hp total.The Prius c gets an EPA-estimated 50 mpg combined. All in all, the Prius c has a lot going for it, like economy, reliability, and maneuverability. But some of its negatives are hard to ignore: a buzzy, underpowered engine, a stiff ride, and an unrefined, noisy cabin. For 2015, the Prius c got refreshed front and rear styling, interior upgrades, and new exterior color choices. For 2016, the Prius c carries over essentially unchanged.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Lane-departure warning
- Forward-collision warning
- Forward-collision avoidance

### STRONG POINTS

- ⊕ Excellent fuel economy
- ⊕ Fits easily in small parking places
- ⊕ Equipped with satellite radio and Bluetooth
- ⊕ Nimble handling, easy to drive
- ⊕ Low emissions (SULEV II)

### WEAK POINTS

- ⊖ Underpowered
- ⊖ Engine sounds buzzy when pushed
- ⊖ Poor rear visibility
- ⊖ Cramped rear seat
- ⊖ Entry and exit are difficult due to limited headroom, especially in the rear
- ⊖ Limited interior storage

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 3.11 |
| Crashworthiness: | 5.62 |
| Visibility: | 6.60 |
| Slalom handling: | 5.84 |
| Ride quality: | 6.22 |
| Fuel economy: | 8.70 |
| Interior noise: | 7.53 |
| Acceleration: | 2.00 |
| Ease of entry and exit: | 6.14 |
| Interior size: | 4.20 |
| Turning circle: | 6.60 |
| Cargo capacity: | 2.83 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2560** |
| Exterior length (in): | **157.3** |
| Exterior width (in): | **66.7** |
| Exterior height (in): | **57.7** |
| Wheelbase (in): | **100.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Bridgestone P175/65R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.5L 16V DOHC VVT-i I4** |
| Horsepower @ rpm: | **73 @ 4800 (99 total)** |
| Electric motor horsepower: | **60 hp (45 kW)** |

AAA.com/greencar

## Mitsubishi i-MiEV ES

BASE PRICE: **$22,995;** PRICE AS TESTED: **$25,845**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.71

**OVERALL RANKING** 45

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **16** |
| EPA urban MPGe: | **126** |
| EPA highway MPGe: | **99** |
| EPA combined MPGe: | **112** |
| EPA estimated range (mi.): | **62** |

**BATTERY CHARGE TIME**

| 120V | 240V |
|---|---|
| 14 HRS | 7 HRS |

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

## OVERALL OBSERVATIONS

The 2016 Mitsubishi i-MiEV ES is a small electric vehicle with a combined range of 62 miles. With its spacious front seating area, excellent front visibility, and nimble handling, the i-MiEV is best suited to urban settings. Its as-tested price of $25,845 (before incentives) makes it one of the least expensive EVs on the market. However, that low price is reflected in the low-quality interior materials and wind and road noise that permeate the cabin. The ride quality is choppy, in part due to its small size, short wheelbase, and skinny tires. Its 66-hp electric motor produces a 0–60 mph acceleration time of 13.8 seconds, making the i-MiEV one of the slowest cars we've tested. A full recharge at 240 volts takes about seven hours; on 120 volts, 14 hours. The i-MiEV received an overall rating of 4 stars (out of 5) in NHTSA's crash-testing.

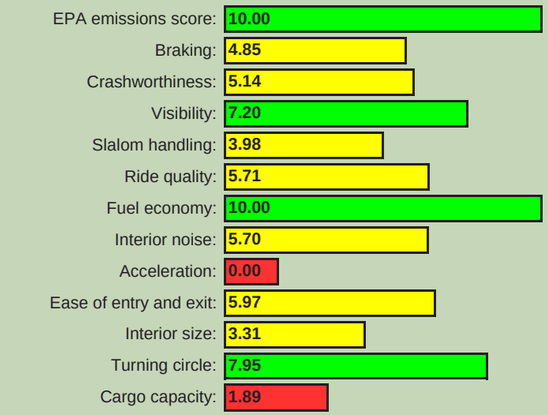
**STRONG POINTS**

- Inexpensive for an EV
- Spacious front seating area
- Excellent front visibility
- Easy to park

**WEAK POINTS**

- Choppy ride
- Lots of wind and road noise
- Low-quality interior materials
- Golf-cart styling

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **2579** |
| Exterior length (in): | **144.7** |
| Exterior width (in): | **62.4** |
| Exterior height (in): | **63.3** |
| Wheelbase (in): | **100.4** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Dunlop 175/60R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **AC Synchronous PM** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **66 @ 3000-6000** |

AAA.com/greencar



## smart electric drive

BASE PRICE: **$25,750;** PRICE AS TESTED: **$25,750**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

68.81

**OVERALL RANKING** 59

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **17.6** |
| EPA urban MPGe: | **122** |
| EPA highway MPGe: | **93** |
| EPA combined MPGe: | **107** |
| EPA estimated range (mi.): | **68** |

**BATTERY CHARGE TIME**

| 120V | 240V |
|---|---|
| 14 HRS | 6 HRS |

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

## OVERALL OBSERVATIONS

Smart released its third generation of fortwo EVs—now called the smart electric drive—into the U.S. in 2013. The electric drivetrain is much smoother than the gas version, and the lower cost of electricity makes operating the smart EV more affordable. Its electric motor generates 47 hp, and it has a "burst mode" that briefly increases that to 70 for passing situations. The EPA-estimated range is 68 miles; top speed is 78 mph. Recharging at 240 volts takes about 6 hours. On the downside, the smart electric drive has a rough ride, slow acceleration, and a noisy cabin. The gas model smart got a redesign for 2016, but the electric drive carries over from 2015. A redesigned 2017 smart EV is slated to arrive at the end of 2016 or the beginning of 2017.

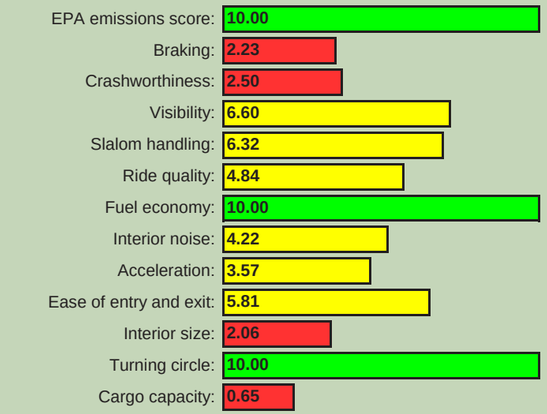
**STRONG POINTS**

- Zero emissions
- Small turning radius
- Easy to park
- Low operating costs (electricity versus gas)
- Cute design

**WEAK POINTS**

- Bouncy ride
- Poor rear visibility
- Poor interior fit and finish
- Small trunk
- Low battery range and associated range anxiety
- Noisy interior
- Spongy brake pedal
- Small sun visors

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2** |
| Curb weight (lbs): | **2120** |
| Exterior length (in): | **107.4** |
| Exterior width (in): | **69.0** |
| Exterior height (in): | **62.1** |
| Wheelbase (in): | **73.5** |
| Restraint type: | **4 air bags** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Kumho P155/60R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **47 hp (35 kW)** |

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SUBCOMPACT NONHYBRID HIGH MPG

## Honda Fit EX-L

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

67.04

OVERALL RANKING: 65

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 10.6 |
| EPA urban mpg: | 32 |
| EPA highway mpg: | 38 |
| EPA combined mpg: | 36 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0033

BASE PRICE: **$19,800;** PRICE AS TESTED: **$20,590**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### OVERALL OBSERVATIONS

After a year's hiatus, the Honda Fit, a compact 4-door hatchback, was completely redesigned for 2015. The 1.5-liter, 4-cylinder engine with CVT transmission (both new) averaged 33 mpg overall in our testing. The Fit has good ABS brakes, nimble handling, and can fit easily into most parking spots. As with many other small cars, the rear seat has no center armrest and no cup holders. And like most Honda models, the Fit comes with few options, but the EX-L trim level is well equipped (including Bluetooth, rear and side cameras, and leather), all for just over $20,000. The Fit does a superior job utilizing interior space for such a small car. As long as the driver or passengers aren't tall, all four seats provide adequate room. The Fit received an overall crash-test rating of 5 stars (out of 5) from NHTSA; IIHS hasn't yet crash-tested it. For 2016, the Fit carried over unchanged.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring

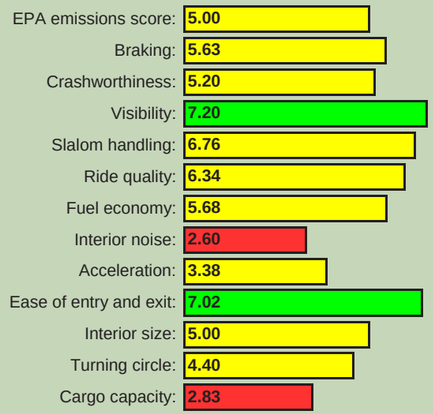
### STRONG POINTS

- ⊕ Very good fuel economy
- ⊕ Nimble handling—easy to drive and park
- ⊕ Good value (well equipped for about $20,000)
- ⊕ Excellent, flexible use of interior space
- ⊕ Rear seat folds flat

### WEAK POINTS

- ⊖ Bouncy ride
- ⊖ Lots of road, engine, and tire noise
- ⊖ Sound system controls are all on the touch screen (no knobs)
- ⊖ Exposed trunk
- ⊖ Lacks rear center armrest and cup holders

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2620 |
| Exterior length (in): | 160.0 |
| Exterior width (in): | 67.0 |
| Exterior height (in): | 60.0 |
| Wheelbase (in): | 99.6 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Bridgestone 185/55R16 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.5L DOHC 16V i-VTEC I4 |
| Horsepower @ rpm: | 130 @ 6600 |

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## Ford Fiesta SE

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

66.38

OVERALL RANKING: 67

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 12.4 |
| EPA urban mpg: | 31 |
| EPA highway mpg: | 43 |
| EPA combined mpg: | 36 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0031

BASE PRICE: **$16,080;** PRICE AS TESTED: **$18,785**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★½

### OVERALL OBSERVATIONS

Ford's Fiesta, which has been available in the U.S. since 2011, is a perennial favorite in Europe. The Fiesta raises the bar for the subcompact category, and comes equipped with seven air bags, Ford's SYNC infotainment system, satellite radio, heated seats, side mirrors, and a host of other comfort and convenience features for just under $19,000. Our test car had the 1.0-liter, 3-cylinder Ecoboost engine, which gets an EPA-rated 36 mpg combined. Its turbocharged engine, though small, has decent power once you get the revs up. The Fiesta is fun and easy to drive. Unfortunately, it also suffers from a subcompact's limitations—for example, the backseat is both cramped and hard to get in and out of. The Fiesta earned a 4-star (out of 5) overall crash-test rating from NHTSA. For 2015, the Fiesta was essentially unchanged; for 2016, it gets Ford's new optional infotainment system, SYNC 3, with a simplified touch screen, and the base S trim level receives a standard remote keyless entry feature.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

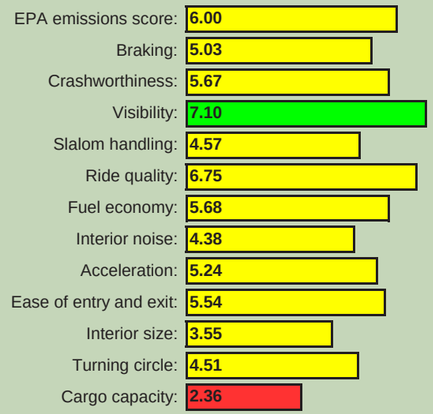
### STRONG POINTS

- ⊕ Fun and easy to drive
- ⊕ Good fuel economy
- ⊕ Responsive steering
- ⊕ Well equipped for the price, including Sync, Sirius radio, and heated seats and mirrors
- ⊕ Easy-to-operate manual transmission
- ⊕ Equipped with blind-spot mirrors on both sides

### WEAK POINTS

- ⊖ Cramped rear seat; hard to enter/exit
- ⊖ Restricted visibility, especially to the rear
- ⊖ Ecoboost engine is available only with a manual transmission
- ⊖ Lacks rear center armrest

### TEST DATA TEST VEHICLES SCORE (0 TO 10 POINTS)




### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2600 |
| Exterior length (in): | 159.7 |
| Exterior width (in): | 62.8 |
| Exterior height (in): | 58.1 |
| Wheelbase (in): | 98.0 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Hankook 185/60R15 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | Manual 5 speed |
| Drivetrain type: | Front wheel |
| Engine size: | 1.0 L Ecoboost I3 |
| Horsepower @ rpm: | 123 @ 6000 |

AAA.com/greencar

# Toyota Yaris LE

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

65.52

OVERALL RANKING **69**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 11.1 |
| EPA urban mpg: | 30 |
| EPA highway mpg: | 36 |
| EPA combined mpg: | 32 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0030

BASE PRICE: **$16,880;** PRICE AS TESTED: **$17,705**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

The Yaris is Toyota's entry in the current crop of subcompacts for the U.S. market. We tested an LE 4-door hatchback with a 1.5-liter, 4-cylinder engine, good for 106 hp, and a 4-speed automatic transmission (a kind of throwback, given that 6-speeds and CVTs are fairly common in this segment). The EPA rates the Yaris's fuel economy at 32 mpg combined. The Yaris suffers from a small trunk, excessive road noise, and cramped rear seats. But with an MSRP of $17,705 (fairly loaded) and Toyota's reputation for reliability, it should prove to be, if not an exciting car to drive, a quality commuter car and a good value. The 2016 Yaris, which carries over unchanged from 2015, scored 4 stars (out of 5) overall in NHTSA's crash tests.

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

**STRONG POINTS**

- Very good fuel economy
- Nimble handling
- Easy to park
- Low purchase price

**WEAK POINTS**

- Cramped interior
- Lots of engine and road noise
- Lacks a rearview camera option
- No center armrests in front or rear
- No interior lights for rear seat
- Small trunk (but rear seats fold down)

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 6.38 |
| Crashworthiness: | 5.30 |
| Visibility: | 6.50 |
| Slalom handling: | 6.12 |
| Ride quality: | 6.21 |
| Fuel economy: | 4.81 |
| Interior noise: | 3.29 |
| Acceleration: | 2.06 |
| Ease of entry and exit: | 6.33 |
| Interior size: | 4.28 |
| Turning circle: | 6.87 |
| Cargo capacity: | 2.36 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2335 |
| Exterior length (in): | 155.5 |
| Exterior width (in): | 66.7 |
| Exterior height (in): | 59.4 |
| Wheelbase (in): | 98.8 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Goodyear P175/65R15 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | Auto 4 speed |
| Drivetrain type: | Front wheel |
| Engine size: | 1.5L DOHC I4 |
| Horsepower @ rpm: | 106 @ 6000 |

AAA.com/greencar



# Nissan Versa SV

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

65.41

OVERALL RANKING **71**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 10.8 |
| EPA urban mpg: | 31 |
| EPA highway mpg: | 40 |
| EPA combined mpg: | 35 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0034

BASE PRICE: **$16,050;** PRICE AS TESTED: **$16,050**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

Nissan's subcompact offering for the U.S. market is the Versa, a small sedan that provides an excellent 35 mpg overall. The 1.6-liter engine makes just 109 hp, and even with the car's light weight, acceleration is underwhelming (and noisy to boot). However, our test car featured excellent ABS brakes and, with an MSRP of just $16,000, provides excellent value. For 2015, the Versa received refreshed exterior styling and cabin upgrades, including standard Bluetooth connectivity. The 2016 model carries over from 2015 largely unchanged. The Versa scored 4 stars (out of 5) overall in NHTSA's crash tests.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Very good fuel economy
- Affordable purchase price
- Roomy interior for a compact car
- ABS brakes provide short, straight stops
- Rear windows open fully

**WEAK POINTS**

- Underpowered
- Noisy cabin
- Cheap-appearing interior materials
- Lack of instrumentation
- Rear visibility limited because of high trunk
- Lacks rear center armrest

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 7.52 |
| Crashworthiness: | 5.19 |
| Visibility: | 6.50 |
| Slalom handling: | 6.12 |
| Ride quality: | 6.25 |
| Fuel economy: | 5.46 |
| Interior noise: | 2.58 |
| Acceleration: | 2.75 |
| Ease of entry and exit: | 6.77 |
| Interior size: | 5.32 |
| Turning circle: | 3.58 |
| Cargo capacity: | 2.36 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2610 |
| Exterior length (in): | 175.7 |
| Exterior width (in): | 66.7 |
| Exterior height (in): | 59.4 |
| Wheelbase (in): | 102.4 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Continental P185/65R15 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.6L DOHC 16V I4 |
| Horsepower @ rpm: | 109 @ 6000 |

AAA.com/greencar

## **Nissan** Versa Note SV

BASE PRICE: **$16,800;** PRICE AS TESTED: **$16,800**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

65.35

OVERALL RANKING **72**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **10.8** |
| EPA urban mpg: | **31** |
| EPA highway mpg: | **40** |
| EPA combined mpg: | **35** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0029

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### OVERALL OBSERVATIONS

The Versa Note is similar to the Versa sedan in many ways, but its hatchback body style provides more luggage space and improved rear visibility. Both Versas are rated at 35 mpg combined city/highway driving by the EPA. But the trade-off to get such good fuel economy is weak performance, largely because of a 1.6-liter, 4-cylinder engine, rated at just 109 hp. The Note's interior is noisy but very efficient in its use of space: It's small on the outside, but four adults can fit comfortably within. The strongest feature of either Versa model is value; you get a solid, functional car for less than $17,000. Changes for 2015 and 2016 consisted mainly of additional optional infotainment and convenience features.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

### STRONG POINTS

- ⊕ Very good fuel economy
- ⊕ Low purchase price
- ⊕ Adequate room for four adults
- ⊕ Easy to park in small spots
- ⊕ Rear windows open fully

### WEAK POINTS

- ⊖ Underpowered
- ⊖ Engine buzzes during acceleration
- ⊖ Rattles at idle
- ⊖ Limited interior storage
- ⊖ Lacks rear center armrest

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.20 |
| Crashworthiness: | 5.01 |
| Visibility: | 6.80 |
| Slalom handling: | 4.92 |
| Ride quality: | 6.63 |
| Fuel economy: | 5.46 |
| Interior noise: | 4.39 |
| Acceleration: | 2.41 |
| Ease of entry and exit: | 6.98 |
| Interior size: | 5.52 |
| Turning circle: | 3.73 |
| Cargo capacity: | 3.30 |

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2480** |
| Exterior length (in): | **163.7** |
| Exterior width (in): | **66.7** |
| Exterior height (in): | **60.5** |
| Wheelbase (in): | **102.4** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Bridgestone P185/65R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.6L 16V DOHC I4** |
| Horsepower @ rpm: | **109 @ 6000** |

AAA.com/greencar



## **Chevrolet** Spark 2LT

BASE PRICE: **$17,285;** PRICE AS TESTED: **$18,355**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

64.79

OVERALL RANKING **73**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **9** |
| EPA urban mpg: | **31** |
| EPA highway mpg: | **41** |
| EPA combined mpg: | **35** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0032

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### OVERALL OBSERVATIONS

The Chevy Spark, completely redesigned for 2016, is priced around $18,000 and averages 35 mpg, making it a very affordable green vehicle. The Spark lacks power (its turbocharged, 1.4-liter engine produces just 98 hp). But it's easy to drive and get around in; it's also nimble and easy to park. The new 2016 2LT model we tested had a lot of the amenities we've seen on more expensive vehicles, such as a leather-wrapped steering wheel, leatherette upholstery, satellite radio, rearview camera, heated front seats, and power mirrors. However, adults will be unhappy in the cramped backseat, and the trunk is tiny. Neither NHTSA nor IIHS had crash-tested the 2016 Spark at press time.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Lane-departure warning
- Forward-collision warning

### STRONG POINTS

- ⊕ Purchase price
- ⊕ Easy to drive and park
- ⊕ Nimble handling
- ⊕ Surprisingly well equipped, including satellite radio, heated seats, and several advanced safety features
- ⊕ High fuel economy

### WEAK POINTS

- ⊖ Underpowered
- ⊖ High powertrain noise
- ⊖ Cramped rear seat
- ⊖ Small trunk
- ⊖ Small sun visors
- ⊖ Lacks rear center armrest and passenger armrests

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 6.61 |
| Crashworthiness: | 5.25 |
| Visibility: | 6.90 |
| Slalom handling: | 6.50 |
| Ride quality: | 5.88 |
| Fuel economy: | 5.46 |
| Interior noise: | 3.96 |
| Acceleration: | 1.72 |
| Ease of entry and exit: | 5.79 |
| Interior size: | 3.00 |
| Turning circle: | 5.30 |
| Cargo capacity: | 1.42 |

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **2300** |
| Exterior length (in): | **143.1** |
| Exterior width (in): | **62.8** |
| Exterior height (in): | **58.4** |
| Wheelbase (in): | **93.9** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Kumho 185/55R15** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L Ecotec DOHC 16V I4** |
| Horsepower @ rpm: | **98 @ 6200** |

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SUBCOMPACT PLUG-IN HYBRID

# BMW i8

BASE PRICE: **$135,269;** PRICE AS TESTED: **$136,219**

## LEAF RATING:

### OVERALL SCORE

58.89 LOWEST — HIGHEST 92.49

63.82

OVERALL RANKING **76**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity/Prmium** |
| Battery capacity (kWh): | **11.1** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **29** |
| EPA combined mpg: | **28** |
| EPA combined MPGe: | **76** |

### BATTERY CHARGE TIME

120V 3.5 HRS — 240V 1.5 HRS

**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0032

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

What is the BMW i8? Is it the automaker's supercar, or is it a high-tech green hybrid? Well, it's both. Introduced in 2014, the i8 is a $136,000 carbon-fiber gullwinged exercise in technology powered by a 3-cylinder gas engine and an electric motor that produce 357 total hp. It looks, sounds, and performs like a sports car, but it's also a PHEV that can travel for more than 15 miles on electricity alone and get 76 MPGe combined. Its styling is like no other car we've ever tested. It handles well and has a composed ride and good acceleration. But the interior is small, entry and exit is extremely difficult, the rear seat is useless, and the trunk has less than 5 cubic feet of capacity. Neither NHTSA nor IIHS has crash-tested the BMW i8. It's essentially unchanged since 2014.

### STRONG POINTS

- Fun to drive
- Good handling, ride, and acceleration
- Styling gets noticed wherever you go
- PHEV drivetrain provides surprisingly high mpg

### WEAK POINTS

- Gullwing doors make it difficult to get in and out
- Cramped backseat
- Poor visibility to sides and rear
- Small trunk
- Requires premium fuel
- High purchase price

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 8.61 |
| Crashworthiness: | 6.88 |
| Visibility: | 6.60 |
| Slalom handling: | 7.77 |
| Ride quality: | 7.42 |
| Fuel economy: | 1.95 |
| Interior noise: | 3.42 |
| Acceleration: | 9.16 |
| Ease of entry and exit: | 3.35 |
| Interior size: | 2.93 |
| Turning circle: | 0.73 |
| Cargo capacity: | 0.00 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **3455** |
| Exterior length (in): | **184.9** |
| Exterior width (in): | **76.5** |
| Exterior height (in): | **50.8** |
| Wheelbase (in): | **110.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 215/45R20** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **1.5L I3 Turbo Gas/Elect.** |
| Horsepower @ rpm: | **228 @ 5800 (357 total)** |
| Electric motor horsepower: | **129 @ 4800** |

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SUBCOMPACT NONHYBRID HIGH MPG

# Scion iA

BASE PRICE: **16,800;** PRICE AS TESTED: **$17,570**

## LEAF RATING:

### OVERALL SCORE

58.89 LOWEST — HIGHEST 92.49

63.48

OVERALL RANKING **77**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **11.6** |
| EPA urban mpg: | **33** |
| EPA highway mpg: | **42** |
| EPA combined mpg: | **37** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0031

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

For 2016, Scion's new subcompact for the U.S. is the iA. Our test vehicle came equipped with a 1.5-liter, 4-cylinder, 106-hp engine and a 6-speed automatic transmission. The good news: the iA's 37 combined mpg fuel-economy rating and a fun-to-drive factor. The bad? Weak acceleration, small trunk, cramped backseat, and excessive road noise. But the as-tested price is only $17,570, and for that you get alloy wheels, a low-speed precollision system, rearview camera, keyless entry and ignition, Bluetooth, 7-inch touch screen, and more. At press time, NHTSA hadn't crash-tested the iA, but IIHS awarded it a Top Safety Pick+ rating. In 2017, the Scion brand disappears; Scion models will be rebranded as Toyotas.

### STRONG POINTS

- Easy to drive and park
- Low purchase price
- Excellent fuel economy
- Rearview camera aids rear visibility
- Tilt/telescopic steering wheel fits any driver

### WEAK POINTS

- Underpowered
- High level of road noise
- Awkward radio controls
- Rear seat is cramped and difficult to enter/exit
- No center armrests, front or rear
- Small sun visors

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 3.32 |
| Crashworthiness: | 4.95 |
| Visibility: | 6.50 |
| Slalom handling: | 6.84 |
| Ride quality: | 5.96 |
| Fuel economy: | 5.89 |
| Interior noise: | 4.40 |
| Acceleration: | 2.81 |
| Ease of entry and exit: | 5.91 |
| Interior size: | 3.73 |
| Turning circle: | 6.27 |
| Cargo capacity: | 1.89 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2440** |
| Exterior length (in): | **171.1** |
| Exterior width (in): | **66.7** |
| Exterior height (in): | **58.5** |
| Wheelbase (in): | **101.2** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Toyo P185/60R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.5L DOHC 16V I4** |
| Horsepower @ rpm: | **106 @ 6000** |

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BASE PRICE: **$35,445;** PRICE AS TESTED: **$36,265**

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

LEAF RATING:

## Compact

The differences between a subcompact and a compact car? Mainly, three things: Compact cars typically cost $2,000 to $3,000 more than subcompacts. Compacts offer more headroom, legroom, and cargo space. Compacts have a greater number of standard or available features than subcompacts offer—some of which have recently been available only on luxury cars. For example, the Toyota Corolla has LED headlights as standard equipment; they're not even an option on the brand's subcompact Yaris.

# VOLKSWAGEN
## e-Golf SEL Premium

The VW e-Golf, new in 2015, is part of a complete lineup of new Golfs. Our SEL trim-level test car included an abundance of features, such as dual-zone automatic climate control, keyless entry and ignition, rearview camera, navigation, and satellite radio. The e-Golf's 115-hp electric motor propels it from 0–60 mph in under 10 seconds, and it handles well enough to be considered fun to drive as well as comfortable. It benefits from the low cost of electricity and the reduced maintenance of an EV, resulting in lower operating costs. Like most EVs, it has a limited range (83 miles) and thus is best used as an around-town car. However, the e-Golf also offers the new SAE "combo" charging connector with Level 2 and 3 capabilities, and it charges faster than most with Level 2 charging. At press time, neither NHTSA nor IIHS had crash-tested an e-Golf. For 2016, the SE, a lower-priced trim level with less content (including fast charging as an option) is available. For 2017, the e-Golf is likely to get a bigger battery, which will increase its range to above 100 miles.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning
- Forward-collision avoidance

### OVERALL SCORE

**58.89** LOWEST — HIGHEST **92.49**

**87.09**

**OVERALL RANKING: 3**

### STRONG POINTS

- ⊕ Fun to drive
- ⊕ Quiet powertrain
- ⊕ Well equipped: satellite radio, Bluetooth, navigation with real-time traffic
- ⊕ Economical to run
- ⊕ Has a high-speed 240-volt charger (7.2-kw) and an SAE DC fast-charge port

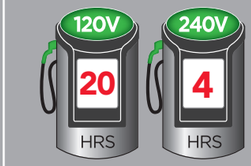
### WEAK POINTS

- ⊖ Limited range (83 miles)
- ⊖ Rear seat is difficult to enter and exit
- ⊖ Minimal rear legroom
- ⊖ Small cup holders

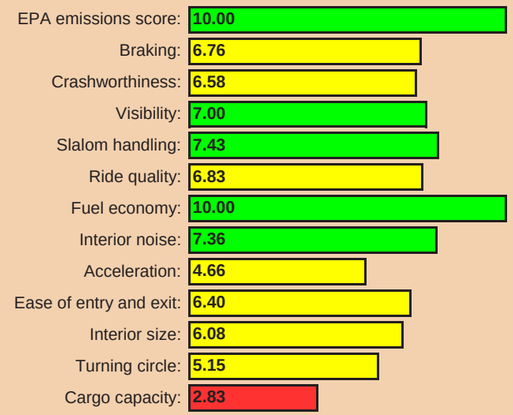
### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **24** |
| EPA urban MPGe: | **126** |
| EPA highway MPGe: | **105** |
| EPA combined MPGe: | **116** |
| EPA estimated range (mi.): | **83** |

### BATTERY CHARGE TIME




### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3600** |
| Exterior length (in): | **168.1** |
| Exterior width (in): | **70.8** |
| Exterior height (in): | **57.1** |
| Wheelbase (in): | **103.6** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Continental 205/55R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **115 hp (85 kW)** |

# **Audi** A3 Sportback e-tron Premium


BASE PRICE: **$37,920;** PRICE AS TESTED: **$40,700**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

83.49

OVERALL RANKING **4**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity/Premium** |
| Fuel capacity (gal): | **10.6** |
| EPA urban mpg: | **35** |
| EPA highway mpg: | **33** |
| EPA combined mpg: | **35** |
| EPA combined MPGe: | **83** |

### BATTERY CHARGE TIME

| 120V | 240V |
|---|---|
| 8 HRS | 2.3 HRS |

**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0037

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

For 2016, Audi enters the world of plug-in hybrids with its A3 e-tron hatchback, which features a turbocharged, 1.4-liter, 4-cylinder engine and electric motor (204 hp total) and a 6-speed automatic transmission. Its 8.8-kWh battery pack is large enough for about 17 miles of electric-only operation. Our test car was well equipped with optional safety and convenience features. Overall, the A3 is a nice car with a good ride and nimble handling, although the trunk is small (14 cubic feet) and the backseat is hard to get in and out of. Unlike most Audis, only FWD is available. Neither NHTSA nor IIHS has crash-tested the A3 e-tron.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control

### STRONG POINTS

- ⊕ Excellent fuel economy
- ⊕ Certified AT PZEV
- ⊕ Quality ride and handling
- ⊕ Comfortable, heated front seats
- ⊕ High-fidelity stereo sound with satellite radio

### WEAK POINTS

- ⊖ Noisy powertrain
- ⊖ Vague brake feel
- ⊖ Small trunk
- ⊖ Confusing infotainment controls
- ⊖ Requires premium fuel
- ⊖ Difficult to enter and exit rear seat

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 8.00 |
| Braking: | 6.88 |
| Crashworthiness: | 7.19 |
| Visibility: | 7.20 |
| Slalom handling: | 8.38 |
| Ride quality: | 7.58 |
| Fuel economy: | 8.00 |
| Interior noise: | 5.62 |
| Acceleration: | 7.32 |
| Ease of entry and exit: | 5.58 |
| Interior size: | 4.44 |
| Turning circle: | 5.17 |
| Cargo capacity: | 2.12 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3680** |
| Exterior length (in): | **169.8** |
| Exterior width (in): | **77.4** |
| Exterior height (in): | **56.1** |
| Wheelbase (in): | **103.5** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Pirelli 225/45R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L TFSI DOHC 16V I4** |
| Horsepower @ rpm: | **150 @ 5000-6000** |
| Electric motor horsepower: | **102 (204 hp total)** |

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# **Kia** Soul EV+


BASE PRICE: **$35,700;** PRICE AS TESTED: **$36,625**

## LEAF RATING:

### OVERALL SCORE

**56.82** LOWEST HIGHEST **92.49**

81.16

OVERALL RANKING **6**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **27** |
| EPA urban MPGe: | **120** |
| EPA highway MPGe: | **92** |
| EPA combined MPGe: | **105** |
| EPA estimated range (mi.): | **92** |

### BATTERY CHARGE TIME

| 120V | 240V |
|---|---|
| 24 HRS | 4-5 HRS |

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Kia Soul EV is an all-electric version of the company's popular Soul hatchback. Powered by a 109-hp electric motor, it's easy to drive and produces zero emissions. Bluetooth, navigation, and a rearview camera are standard on the EV+ trim level. But because of its estimated 92-mile range, it's not practical for long trips. On a Level 2 charging system, the Soul EV can be completely charged in as little as 4–5 hours; on 120 volts, it could take up to 24 hours. It's also equipped with a 480-volt (CHAdeMO) fast-charging port, so it can be charged to 80 percent of capacity in 30 minutes. The Soul EV is pleasant to drive around town and is economical because of the low cost of electricity and minimal required maintenance. At a base price of about $36,000, the Soul EV isn't cheap—though federal and state tax credits will reduce the final cost. Neither NHTSA nor IIHS has crash-tested the Soul EV. Initially, it was for sale only in California; in 2016, Kia plans to sell it in Georgia, Texas, Hawaii, Washington, and Oregon. For 2016, the Soul EV is essentially unchanged.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

### STRONG POINTS

- ⊕ Drives and handles well
- ⊕ Well equipped
- ⊕ Roomy and flexible interior
- ⊕ Zippy acceleration from a dead stop
- ⊕ Zero tailpipe emissions
- ⊕ Economical to operate (low cost of electricity)

### WEAK POINTS

- ⊖ Much more expensive than the gas version
- ⊖ Long 120-volt charging time
- ⊖ Poor braking performance
- ⊖ Lacks backseat center armrest and cup holders

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 10.00 |
| Braking: | 2.72 |
| Crashworthiness: | 6.55 |
| Visibility: | 7.30 |
| Slalom handling: | 5.17 |
| Ride quality: | 6.92 |
| Fuel economy: | 10.00 |
| Interior noise: | 8.16 |
| Acceleration: | 4.36 |
| Ease of entry and exit: | 6.45 |
| Interior size: | 5.83 |
| Turning circle: | 4.40 |
| Cargo capacity: | 3.30 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3580** |
| Exterior length (in): | **163.0** |
| Exterior width (in): | **70.9** |
| Exterior height (in): | **63.0** |
| Wheelbase (in): | **101.2** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Nexen 205/60R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **109 hp (81 kW)** |

AAA.com/greencar

# BMW 328d M Sport

BASE PRICE: **$39,000;** PRICE AS TESTED: **$49,800**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST — HIGHEST **92.49**

81.07

OVERALL RANKING: **7**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Diesel #2** |
| Fuel capacity (gal): | **15** |
| EPA urban mpg: | **32** |
| EPA highway mpg: | **45** |
| EPA combined mpg: | **37** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0033

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

A sport sedan that's a green machine and a diesel to boot? BMW has come up with one: the 328d. Our 2015 test car was good looking and very sporty, with responsive handling and great brakes. Its twin-turbo, 180-hp, 4-cylinder diesel engine took the car from 0–60 mph in under 8 seconds. And not only is the 328d a great-performing car, it also gets 37 mpg in combined driving and has the highest rating—5 stars out of 5—in NHTSA's crash testing. But it also has typical compact sport-sedan downsides, like a cramped backseat that's hard to get in and out of. The 328d is available in both RWD and AWD, and as an AWD wagon. Changes for 2016 are minimal.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision mitigation

### STRONG POINTS

- Excellent handling
- Good fuel economy
- Powerful engine, brakes
- Sporty styling
- Fuel-saving stop-start engine technology

### WEAK POINTS

- Hard to enter and exit backseat
- Narrow front seats don't fit large drivers
- Mirror controls aren't marked
- It's easy to spin the rear wheels when making a turn from a stop on wet roads

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 10.00 |
| Crashworthiness: | 6.83 |
| Visibility: | 7.20 |
| Slalom handling: | 9.80 |
| Ride quality: | 7.72 |
| Fuel economy: | 5.89 |
| Interior noise: | 4.63 |
| Acceleration: | 6.59 |
| Ease of entry and exit: | 6.24 |
| Interior size: | 5.88 |
| Turning circle: | 3.40 |
| Cargo capacity: | 1.89 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3780** |
| Exterior length (in): | **182.2** |
| Exterior width (in): | **71.3** |
| Exterior height (in): | **56.7** |
| Wheelbase (in): | **110.6** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 255/40R18** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 8 speed** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **2.0L I4 Twin Turbo** |
| Horsepower @ rpm: | **180 @ 4000** |

AAA.com/greencar





# Nissan Leaf SL

BASE PRICE: **$36,790;** PRICE AS TESTED: **$39,390**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST — HIGHEST **92.49**

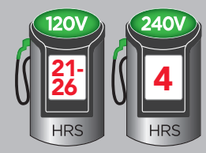
79.15

OVERALL RANKING: **10**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **30** |
| EPA urban MPGe: | **124** |
| EPA highway MPGe: | **101** |
| EPA combined MPGe: | **112** |
| EPA estimated range (mi.): | **107** |

### BATTERY CHARGE TIME




NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

The Nissan Leaf has some surprising qualities, not just for an EV but for a small car. Its body structure is solid and tight, and it provides a very good ride, with excellent bump absorption. Its steering exhibits excellent effort and feedback, and although there's some understeer, handling is even a bit sporty, with minimal body roll. Track testing produced a slow 0–60 mph time of 10.7 seconds, but in normal driving, acceleration is fine, with the electric motor pulling well from low speeds. The Leaf's reasonable size makes it easy to maneuver and park. Unlike some competitors, the Leaf's EV charge, range, and power meters are easy to understand, as are the conventional radio and HVAC controls. However, some ARC testers would have liked better markings on the electronic shift-by-wire gear selector—although it operates smoothly. The Leaf's backseat is fairly cramped, with tight legroom. NHTSA awarded the Leaf 4 stars (out of 5) overall in its crash tests. For 2016, the top two trim levels, SV and SL, get a larger battery pack that extends the range from 84 miles to 107 miles.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

### STRONG POINTS

- Excellent steering ratio, effort, and feedback
- Great body structure and capacity to absorb bumps
- Good handling
- Good low-end power and acceleration
- Easy to maneuver and park

### WEAK POINTS

- Short EV range (107 miles claimed)
- Small backseat
- Drivers may need to become familiar with electronic shift-by-wire system

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 10.00 |
| Braking: | 5.44 |
| Crashworthiness: | 6.30 |
| Visibility: | 6.80 |
| Slalom handling: | 4.00 |
| Ride quality: | 6.92 |
| Fuel economy: | 10.00 |
| Interior noise: | 7.89 |
| Acceleration: | 3.70 |
| Ease of entry and exit: | 6.83 |
| Interior size: | 4.15 |
| Turning circle: | 2.65 |
| Cargo capacity: | 4.48 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3400** |
| Exterior length (in): | **175.0** |
| Exterior width (in): | **69.7** |
| Exterior height (in): | **61.0** |
| Wheelbase (in): | **106.3** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36.000** |
| Tire manufacturer and size: | **Michelin P215/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **80 kW AC Synchronous** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **107 hp (80 kW)** |

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COMPACT PARTIAL-ZERO EMISSIONS

# Mazda Mazda3 s Grand Touring

BASE PRICE: **$29,485;** PRICE AS TESTED: **$29,485**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

78.26

**OVERALL RANKING** 12

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 13.2 |
| EPA urban mpg: | 28 |
| EPA highway mpg: | 38 |
| EPA combined mpg: | 32 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0028

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

Mazda's Mazda3 is the automaker's best-selling model worldwide and the first to incorporate Mazda's Skyactiv powertrain. This system is reputed to maximize the efficiency of conventional gasoline engines while maintaining excellent performance. Our test car, the Mazda3 s Grand Touring, exemplified this well, with good acceleration, excellent handling, and an EPA combined rating of 32 mpg. It also meets stringent PZEV emission standards. The Mazda3 is sporty and fun to drive, although the interior is noisy and, like many compacts, the rear seat is small. It received a 5-star (out of 5) crash-test rating from NHTSA and a Top Safety Pick+ rating from IIHS (with optional front-crash prevention) in 2015 and 2016. It received additional standard features in both years, too, including a rearview camera in 2016.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Fun to drive
- ⊕ Good acceleration
- ⊕ Loaded with useful convenience features
- ⊕ Hi-fi Bose sound system with satellite radio
- ⊕ Meets stringent PZEV emission standards

**WEAK POINTS**

- ⊖ Lack of instrumentation
- ⊖ Cramped rear seat
- ⊖ Rear seat hard to enter/exit
- ⊖ Infotainment joystick control isn't intuitive

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 9.00 |
| Braking: | 7.29 |
| Crashworthiness: | 5.88 |
| Visibility: | 7.20 |
| Slalom handling: | 7.07 |
| Ride quality: | 7.19 |
| Fuel economy: | 4.81 |
| Interior noise: | 3.72 |
| Acceleration: | 6.48 |
| Ease of entry and exit: | 6.19 |
| Interior size: | 5.50 |
| Turning circle: | 3.92 |
| Cargo capacity: | 4.01 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3100 |
| Exterior length (in): | 175.6 |
| Exterior width (in): | 70.7 |
| Exterior height (in): | 57.9 |
| Wheelbase (in): | 106.3 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Dunlop P215/45R18 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | Auto 6 speed |
| Drivetrain type: | Front wheel |
| Engine size: | 2.5L DOHC 16V I4 |
| Horsepower @ rpm: | 184 @ 5700 |

AAA.com/greencar



# Honda Civic Touring

BASE PRICE: **$26,500;** PRICE AS TESTED: **$27,335**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

77.88

**OVERALL RANKING** 13

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 12.4 |
| EPA urban mpg: | 31 |
| EPA highway mpg: | 42 |
| EPA combined mpg: | 35 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0032

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Honda Civic has been one of the most popular small cars in the U.S. for years. We tested the top-of-the-line 2016 Civic Touring, which came with Bluetooth, heated seats (front and rear) and side mirrors, adaptive cruise control, lane-keeping assist, forward-collision warning, and more. That qualifies as a lot of car for just over $27,000, and it gets an average of 35 mpg in combined driving, too. The Civic comes with a turbocharged, 1.5-liter engine and a CVT transmission. It drives well, with a comfortable ride befitting a larger car, but it still has nimble handling. However, the center infotainment control screen is awkward to use and can be a distraction. At press time, NHTSA hadn't crash-tested the new Civic, but IIHS had awarded it a Top Safety Pick+ rating (with optional front-crash prevention). All in all, the 2016 Civic is a clear improvement over the previous iteration (itself a very good car).

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision mitigation

**STRONG POINTS**

- ⊕ Good ride and handling
- ⊕ Very good fuel economy
- ⊕ LED headlights provide good illumination
- ⊕ Modern, aggressive styling
- ⊕ Well equipped with optional safety and convenience features
- ⊕ Right-side camera is a useful safety feature
- ⊕ PZEV available

**WEAK POINTS**

- ⊖ Considerable engine noise
- ⊖ Sound system controls are awkward and distracting
- ⊖ 12-volt power port is hard to reach and see
- ⊖ Seatbelts are hard to buckle

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 8.00 |
| Braking: | 8.99 |
| Crashworthiness: | 5.65 |
| Visibility: | 7.10 |
| Slalom handling: | 6.77 |
| Ride quality: | 7.58 |
| Fuel economy: | 5.46 |
| Interior noise: | 4.64 |
| Acceleration: | 6.56 |
| Ease of entry and exit: | 6.62 |
| Interior size: | 4.15 |
| Turning circle: | 3.99 |
| Cargo capacity: | 2.36 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2016 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2940 |
| Exterior length (in): | 182.3 |
| Exterior width (in): | 70.8 |
| Exterior height (in): | 55.7 |
| Wheelbase (in): | 106.3 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Firestone 215/50R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.5L DOHC 16V I4 |
| Horsepower @ rpm: | 174 @ 6000 |

AAA.com/greencar



COMPACT NONHYBRID HIGH MPG

# Toyota Prius Two Eco

BASE PRICE: **$24,700;** PRICE AS TESTED: **$25,535**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

77.35

**OVERALL RANKING** 16

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 11.3 |
| EPA urban mpg: | 58 |
| EPA highway mpg: | 53 |
| EPA combined mpg: | 56 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0050

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The fourth-generation Toyota Prius has arrived. It's similar to previous generations: excellent hybrid fuel economy, compact size, and funky exterior and interior styling. But you get more of everything in the new Prius. Fuel economy for the Eco version is now an EPA-combined 56 mpg. The new exterior is bold and anime-like in character. Inside, the styling is similar to the previous Chevrolet Volt, with white plastics that evoke the look and feel of Apple's iPhone. The biggest surprise, however, is its vehicle dynamics. Steering and handling are now much better and, compared with the previous Prius, downright sporty. The brakes are also more natural feeling, without as much regenerative effect, and the transition from EV operation to the gas engine is smoother than before. A variety of advanced safety features—a precollision system, adaptive cruise control, auto high beams, and lane-departure warning—are available. The Prius received 5 stars (out of 5) in NHTSA's crash tests and a Top Safety Pick+ rating from IIHS.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

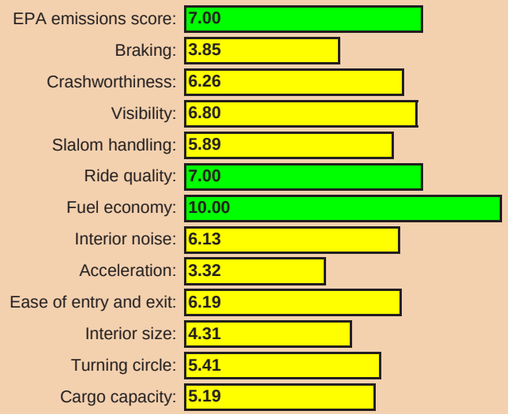
### STRONG POINTS

- Excellent fuel economy
- Surprisingly sporty handling
- Very good steering feel and accuracy, especially for an economy car
- Natural-feeling brakes
- High-tech interior appearance
- High-tech displays and gauges
- Smooth hybrid power, with a nearly transparent transition from EV to ICE power

### WEAK POINTS

- Polarizing anime-like styling
- Seats are a bit hard, with slightly narrow seatbacks
- Rear visibility is hampered by a horizontally split window
- Difficult-to-understand hybrid-system displays
- Annoying beeping alert when driving in reverse

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2016 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3020 |
| Exterior length (in): | 178.7 |
| Exterior width (in): | 69.3 |
| Exterior height (in): | 58.1 |
| Wheelbase (in): | 106.3 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Bridgestone P195/65R15 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.8L DOHC 16V VVT-i I4 |
| Horsepower @ rpm: | 95 @ 5200 (121 total) |
| Electric motor horsepower: | 71 (53 kW) |

AAA.com/greencar





# Lexus CT 200h

BASE PRICE: **$32,960;** PRICE AS TESTED: **$39,095**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

77.17

**OVERALL RANKING** 17

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 11.9 |
| EPA urban mpg: | 43 |
| EPA highway mpg: | 40 |
| EPA combined mpg: | 42 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0036

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

A few years ago, you'd never have imagined a 42-mpg Lexus sporty compact, but that changed in model year 2011. The CT 200h has been billed as the "highest-mpg luxury car," although it's nowhere near as luxurious as other Lexus models. Using a powertrain similar to that of a Prius, it has a controller that lets you set the driving mode (Eco, Normal, or Sport) that suits you. The CT 200h's styling is sporty, its handling is nimble, and its brakes provide short, straight stops. It's also developed a reputation for high reliability. But it's underpowered, the interior is noisier than a Lexus should be, and the backseat and trunk are small. NHTSA hasn't crash-tested the CT 200h, but IIHS awarded it a Top Safety Pick+ rating (with optional front-crash prevention) for 2015 and 2016. Changes for 2015 and 2016 have been mostly cosmetic; a wide-mouth grille is the most obvious.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning
- Forward-collision avoidance

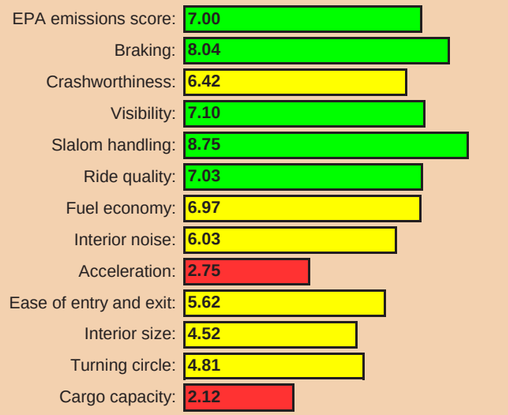
### STRONG POINTS

- Excellent fuel economy
- Nimble, sporty handling
- Equipped with lots of luxury features
- Powerful brakes

### WEAK POINTS

- Slightly underpowered
- Noisy cabin for an entry-level luxury vehicle
- Mushy brake-pedal feel
- Backseat cramped; hard to enter/exit
- Sound system and other controls are operated by a joystick

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3130 |
| Exterior length (in): | 171.2 |
| Exterior width (in): | 69.5 |
| Exterior height (in): | 57.3 |
| Wheelbase (in): | 102.4 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 48/50,000 |
| Tire manufacturer and size: | Michelin P215/45R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.8L DOHC 16V I4 |
| Horsepower @ rpm: | 98 @ 5200 (134 total) |
| Electric motor horsepower: | Not Available |

AAA.com/greencar

## Toyota Prius v Three

BASE PRICE: **$27,515;** PRICE AS TESTED: **$28,550**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST — HIGHEST **92.49**

**75.35**

**OVERALL RANKING: 23**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **11.9** |
| EPA urban mpg: | **44** |
| EPA highway mpg: | **40** |
| EPA combined mpg: | **42** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0034

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

In 2012, Toyota literally raised the roof to turn its Prius sedan into the Prius v (for versatile), a compact station wagon with the extra room and flexibility to compete with small SUVs. The v uses the sedan's sophisticated hybrid powertrain, which mates a 1.8-liter, 4-cylinder engine with an 80-hp electric motor (134 total hp) and a CVT transmission to deliver an estimated 42 mpg in combined city/highway driving. The Prius v is certified as a SULEV II. It's equipped with many advanced convenience and safety technologies, such as standard automatic climate control and keyless ignition/entry, and an optional precollision safety system. For 2015, the v received updated front and rear styling, new upholstery fabric, and a new trim level. For 2016, the 2015 model carried over.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Excellent fuel economy
- ⊕ Roomy, flexible interior
- ⊕ Well equipped, including satellite radio and voice-operated navigation system
- ⊕ Adjustable rear seat
- ⊕ Fully automatic window controls

**WEAK POINTS**

- ⊖ Underpowered
- ⊖ Numb driving dynamics
- ⊖ Engine sounds buzzy when pushed hard
- ⊖ Poor traction at handling limits
- ⊖ Lacks traditional instrumentation

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 5.11 |
| Crashworthiness: | 6.69 |
| Visibility: | 7.10 |
| Slalom handling: | 4.17 |
| Ride quality: | 6.56 |
| Fuel economy: | 6.97 |
| Interior noise: | 5.68 |
| Acceleration: | 2.96 |
| Ease of entry and exit: | 6.90 |
| Interior size: | 6.22 |
| Turning circle: | 3.13 |
| Cargo capacity: | 6.84 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3320** |
| Exterior length (in): | **181.7** |
| Exterior width (in): | **69.9** |
| Exterior height (in): | **62.0** |
| Wheelbase (in): | **109.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Bridgestone P205/60R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.8L 16V DOHC VVT-i I4** |
| Horsepower @ rpm: | **98 @ 5200 (134 total)** |
| Electric motor horsepower: | **80 hp (60 kW)** |

AAA.com/greencar





## Subaru Impreza 2.0i Sport Limited

BASE PRICE: **$23,295;** PRICE AS TESTED: **$26,885**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST — HIGHEST **92.49**

**74.97**

**OVERALL RANKING: 25**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14.5** |
| EPA urban mpg: | **27** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **31** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0026

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

Subaru's Impreza went through a minor refresh in 2015. We tested the top-of-the-line 2.0i Sport Limited, which was loaded with features, especially for a compact car. Powered by a 148-hp "boxer" 4-cylinder engine and CVT, it included Subaru's excellent EyeSight crash-prevention system, Bluetooth, navigation, leather seating, and satellite radio. It also had steering-responsive fog lights, which come on automatically when you turn the car, to shine light around a corner. Like all Subarus except the BRZ, the Impreza has AWD, but it's still rated at 31 mpg in combined driving. The interior is quieter than previous models, but engine noise is intrusive. The hatchback design, with individual folding rear seats, gives it almost the versatility of a small SUV. The Impreza received a 5 star (out of 5) overall crash-test rating from NHTSA, and, for 2015 and 2016, a Top Safety Pick+ rating from IIHS (with optional front-crash prevention). Icing on the cake: The Impreza can be ordered as a PZEV.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Well equipped with Bluetooth, navigation, satellite radio, EyeSight crash-prevention system, and more
- ⊕ AWD traction
- ⊕ Certified as a PZEV
- ⊕ Rear windows open fully

**WEAK POINTS**

- ⊖ Underpowered
- ⊖ Excessive engine noise
- ⊖ Touch-screen controls are small and crowded together
- ⊖ Limited instrumentation

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 7.75 |
| Crashworthiness: | 6.80 |
| Visibility: | 7.20 |
| Slalom handling: | 7.19 |
| Ride quality: | 6.88 |
| Fuel economy: | 4.59 |
| Interior noise: | 5.53 |
| Acceleration: | 2.48 |
| Ease of entry and exit: | 6.53 |
| Interior size: | 5.58 |
| Turning circle: | 4.18 |
| Cargo capacity: | 4.25 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3400** |
| Exterior length (in): | **174.0** |
| Exterior width (in): | **68.5** |
| Exterior height (in): | **59.4** |
| Wheelbase (in): | **104.1** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Yokohama P205/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.0L DOHC Flat 4** |
| Horsepower @ rpm: | **148 @ 6200** |

AAA.com/greencar

# Volkswagen Jetta Hybrid SEL Premium

BASE PRICE: **$31,180;** PRICE AS TESTED: **$32,010**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

74.91

OVERALL RANKING **26**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **11.8** |
| EPA urban mpg: | **42** |
| EPA highway mpg: | **48** |
| EPA combined mpg: | **45** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0040

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Jetta Hybrid combines European styling and responsive handling with great gas mileage. Its turbocharged, 1.4-liter, 4-cylinder engine and 27-hp electric motor produce 170 hp total. We tested the top-of-the-line SEL Premium trim level. At $31,180, it's both well priced and well equipped. Amenities include heated front seats, a rearview camera, and a Fender sound system. The EPA's combined mileage estimate for the Jetta Hybrid is 45 mpg; our test vehicle averaged 40 mpg. The downside is that the Jetta Hybrid requires premium fuel, minimizing the savings achieved by high fuel economy. The 2016 Jetta received 5 stars (out of 5) overall in NHTSA's crash-testing. In 2015 and 2016, the Jetta Hybrid got a number of styling, materials, and equipment updates.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring

**STRONG POINTS**

- ⊕ Good power
- ⊕ Attractive styling
- ⊕ Heated seats
- ⊕ Certified PZEV

**WEAK POINTS**

- ⊖ Requires premium fuel
- ⊖ Compromised visibility
- ⊖ Small trunk
- ⊖ Awkward radio controls
- ⊖ Not enough gauges/ instrumentation

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 3.34 |
| Crashworthiness: | 6.23 |
| Visibility: | 6.80 |
| Slalom handling: | 7.89 |
| Ride quality: | 7.21 |
| Fuel economy: | 5.62 |
| Interior noise: | 5.75 |
| Acceleration: | 5.51 |
| Ease of entry and exit: | 6.27 |
| Interior size: | 5.70 |
| Turning circle: | 5.00 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3350** |
| Exterior length (in): | **182.8** |
| Exterior width (in): | **70.0** |
| Exterior height (in): | **57.2** |
| Wheelbase (in): | **104.4** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Continental P205/55R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 7 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L DOHC I4 Turbo** |
| Horsepower @ rpm: | **150 @ 5000 (170 total)** |
| Electric motor horsepower: | **27 hp (20 kW)** |

AAA.com/greencar



# Audi A3 Premium

BASE PRICE: **$29,900;** PRICE AS TESTED: **$30,795**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

74.85

OVERALL RANKING **27**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **13.2** |
| EPA urban mpg: | **23** |
| EPA highway mpg: | **33** |
| EPA combined mpg: | **27** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

With its 2015 redesign, the Audi A3 has morphed from a small station wagon into a compact entry-level luxury sedan. Our test car was powered by a turbocharged,1.8-liter, 4-cylinder engine that produces 170 hp, matched with a 6-speed automated manual transmission. The A3 excelled on our slalom course, and it rides well, accelerates responsively, and has extremely short stopping distances. Typical for Audi, the A3's cabin is luxurious, but the backseat is cramped and hard to get in and out of. The trunk is small, too, but the rear seats fold down. Nevertheless, Audi still meets stringent PZEV emission standards with a turbocharged sporty car. NHTSA gave the A3 an overall crash-test rating of 5 stars (out of 5); IIHS awarded it a 2015 and 2016 Top Safety Pick+ rating (with optional front-crash prevention). For 2016, a rearview camera is standard.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision mitigation

**STRONG POINTS**

- ⊕ Fun to drive
- ⊕ Quality ride and handling
- ⊕ Powerful brakes
- ⊕ Has a turbocharged engine but still meets PZEV emissions standards
- ⊕ Trunk opens completely at the push of a button

**WEAK POINTS**

- ⊖ Poor rear visibility
- ⊖ Cramped rear seat
- ⊖ Difficult to enter and exit
- ⊖ Requires premium fuel

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 9.00 |
| Braking: | 8.76 |
| Crashworthiness: | 6.77 |
| Visibility: | 6.80 |
| Slalom handling: | 7.20 |
| Ride quality: | 7.78 |
| Fuel economy: | 1.73 |
| Interior noise: | 4.46 |
| Acceleration: | 5.49 |
| Ease of entry and exit: | 5.68 |
| Interior size: | 5.28 |
| Turning circle: | 4.25 |
| Cargo capacity: | 1.65 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3380** |
| Exterior length (in): | **175.4** |
| Exterior width (in): | **77.2** |
| Exterior height (in): | **55.7** |
| Wheelbase (in): | **103.8** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Continental 225/40R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.8L 16V DOHC I4** |
| Horsepower @ rpm: | **170 @ 4500** |

AAA.com/greencar

COMPACT PLUG-IN HYBRID

# Chevrolet Volt Premier

BASE PRICE: **$37,520;** PRICE AS TESTED: **$40,225**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST — HIGHEST **92.49**

74.37

OVERALL RANKING **30**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity/Premium** |
| Fuel capacity (gal): | **8.9** |
| EPA urban mpg: | **42** |
| EPA highway mpg: | **43** |
| EPA combined mpg: | **42** |
| EPA combined MPGe: | **106** |

### BATTERY CHARGE TIME

120V: 13 HRS

240V: 4.5 HRS

**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0068

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The second-generation Chevrolet Volt plug-in hybrid is a big improvement over the first version, which already was a pretty good car. The new Volt's exterior is sleeker, and the interior design is more mainstream and less futuristic. The powertrain has a more powerful gasoline engine (101 hp), two electric motors (149 hp), and a bigger battery (18.4 kWh versus 16 kWh). As a result, the all-electric range jumps from 38 miles to 53, and the combined fuel-economy rating improves from 37 to 42 mpg and from 98 to 106 MPGe. Also, premium gas is no longer required. Acceleration is decent—our 0–60 time at the track was 8.2 seconds—and the ride is quiet and comfortable. However, the steering isn't responsive, and the backseat is cramped and hard to get in and out of. Full recharging time is about 4.5 hours on 240 volts and about 13 hours on 120 volts. At press time, neither NHTSA or IIHS had crash-tested the new Volt.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Forward-collision warning
- Forward-collision avoidance

### STRONG POINTS

- Efficient use of energy; good fuel economy
- 53-mile electric range is a big improvement
- Uses no gasoline in EV mode, but gas engine eliminates range anxiety
- Rear windows open fully
- Certified as an AT PZEV; has HOV-lane access in some states

### WEAK POINTS

- Poor rear visibility
- Vague/mushy brake feel
- Rear seat is cramped and hard to enter and exit
- No accessory position on ignition
- Nonadjustable seat belt rubs the throat of shorter drivers

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 8.00 |
| Braking: | 3.30 |
| Crashworthiness: | 7.05 |
| Visibility: | 6.90 |
| Slalom handling: | 4.80 |
| Ride quality: | 6.96 |
| Fuel economy: | 6.97 |
| Interior noise: | 7.88 |
| Acceleration: | 6.26 |
| Ease of entry and exit: | 5.11 |
| Interior size: | 4.45 |
| Turning circle: | 3.38 |
| Cargo capacity: | 3.30 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3580** |
| Exterior length (in): | **180.4** |
| Exterior width (in): | **71.2** |
| Exterior height (in): | **56.4** |
| Wheelbase (in): | **106.1** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin 215/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.5L DOHC I4 Ecotec** |
| Horsepower @ rpm: | **101 @ 5600** |
| Electric motor horsepower: | **(2) 111 kW (149 total)** |

AAA.com/greencar



COMPACT NONHYBRID HIGH MPG

# Kia Soul+

BASE PRICE: **$18,995;** PRICE AS TESTED: **$19,160**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST — HIGHEST **92.49**

71.05

OVERALL RANKING **49**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14.2** |
| EPA urban mpg: | **23** |
| EPA highway mpg: | **31** |
| EPA combined mpg: | **26** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

Like many Kias, the boxy Soul comes well equipped, with a surprisingly low MSRP of just $19,000. Add to that a 10-year/100,000-mile powertrain warranty, and you've got good value. Its 2.0-liter, 164-hp engine could use a little more power, is noisy at full bore, and the steering feels overassisted. But the Soul is fun to drive; its youth-oriented styling creates a roomy interior; build quality is decent; and it gets 26 mpg in combined driving (27 mpg for the Eco version). In NHTSA's crash testing, the Kia Soul received an overall rating of 5 stars (out of 5). In 2015 and 2016, IIHS awarded the Soul its Top Safety Pick+ status (with optional front-crash prevention). Since 2014, Kia has added a number of optional features packages to the Soul, but little else about it has changed.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Lane-departure warning
- Forward-collision warning

### STRONG POINTS

- Reasonable price
- Economical to operate
- Good forward visibility
- Strong brakes
- Roomy interior
- Well equipped; easy-to-use controls
- Rear windows roll down fully

### WEAK POINTS

- Noisy engine during acceleration
- Overassisted "twitchy" steering, especially on rough roads

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 7.70 |
| Crashworthiness: | 5.68 |
| Visibility: | 7.30 |
| Slalom handling: | 4.89 |
| Ride quality: | 6.59 |
| Fuel economy: | 3.51 |
| Interior noise: | 4.90 |
| Acceleration: | 4.75 |
| Ease of entry and exit: | 6.17 |
| Interior size: | 5.56 |
| Turning circle: | 4.51 |
| Cargo capacity: | 4.48 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2960** |
| Exterior length (in): | **163.0** |
| Exterior width (in): | **70.9** |
| Exterior height (in): | **63.0** |
| Wheelbase (in): | **101.2** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Kumho 215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L DOHC GDI I4** |
| Horsepower @ rpm: | **164 @ 6200** |

AAA.com/greencar

# Ford Focus Electric

BASE PRICE: **$35,995;** PRICE AS TESTED: **$36,990**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

70.76

OVERALL RANKING **52**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **23** |
| EPA urban MPGe: | **110** |
| EPA highway MPGe: | **99** |
| EPA combined MPGe: | **105** |
| EPA estimated range (mi.): | **76** |

### BATTERY CHARGE TIME

120V: 22 HRS

240V: 4 HRS

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

## OVERALL OBSERVATIONS

The Ford Focus Electric, introduced for 2013, is the all-electric version of the Ford Focus compact sedan. It's equipped with a 143-hp electric motor and a 23-kWh lithium-ion battery, is easy to drive, and produces zero emissions. But it's impractical for long commutes or road trips because of its limited range (76 miles). Our test vehicle was well equipped and included the Ford SYNC and MyFord Touch systems and a rearview camera. The Focus Electric has low operating costs because of the low cost of electricity. Unfortunately, it can take up to 22 hours to charge the Focus Electric on a 120-volt system; with a 240-volt charger, that number drops to four hours, Ford says.

### STRONG POINTS

- Well equipped
- Quiet ride
- Zero emissions
- Low cost to operate (electricity versus gasoline)
- Easy to drive

### WEAK POINTS

- Much more expensive than gas version
- Insufficient range (76 miles)
- Limited trunk space
- Long 120-volt charging time
- Cramped rear seat
- Poor traction on wet roads

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 10.00 |
| Braking: | 0.87 |
| Crashworthiness: | 7.42 |
| Visibility: | 7.50 |
| Slalom handling: | 4.09 |
| Ride quality: | 7.19 |
| Fuel economy: | 10.00 |
| Interior noise: | 6.24 |
| Acceleration: | 4.50 |
| Ease of entry and exit: | 5.79 |
| Interior size: | 4.60 |
| Turning circle: | 0.45 |
| Cargo capacity: | 2.12 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3840** |
| Exterior length (in): | **172.9** |
| Exterior width (in): | **71.8** |
| Exterior height (in): | **58.2** |
| Wheelbase (in): | **104.3** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P225/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **N/A** |
| Horsepower @ rpm: | **N/A** |
| Electric motor horsepower: | **143 hp (107 kW)** |

AAA.com/greencar





# Cadillac ELR Sport

BASE PRICE: **$65,000;** PRICE AS TESTED: **$67,790**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

70.56

OVERALL RANKING **54**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **9.3** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **33** |
| EPA combined mpg: | **30** |
| EPA combined MPGe: | **80** |

### BATTERY CHARGE TIME

120V: 13-18 HRS

240V: 5 HRS

**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0050

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning

## OVERALL OBSERVATIONS

The Cadillac ELR has a beautifully finished interior, with luxury styling and appointments that extend to a power cupholder cover. The exterior styling is also quite handsome—with the exception of the short wheelbase, which make the overall profile look truncated. Acceleration is fairly quick, with a 0–60 time of 7.6 seconds, and handling is very sporty, with just a bit of understeer. The ride, though, may be the ELR's best attribute—it's plush without being at all floaty. On the downside, the instruments that indicate electric power and charging state are busy and confusing. The front spoiler, which is for improved aerodynamics, frequently scrapes on road dips and driveway entrances. And the rear seat is cramped, although legroom is sufficient if the front seats are moved far enough forward. Neither NHTSA nor IIHS has crash-tested the Cadillac ELR. The ELR can travel up to an EPA-estimated 36 miles on electricity alone.

### STRONG POINTS

- Excellent ride quality
- Electric motor is powerful
- Sporty handling, with only a bit of understeer
- Beautifully finished interior

### WEAK POINTS

- Instrument displays are busy and confusing
- Cramped backseat
- Small rear window restricts visibility
- Front spoiler scrapes on dips and driveway entrances
- Tiny trunk-opening height

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 5.87 |
| Crashworthiness: | 7.72 |
| Visibility: | 7.00 |
| Slalom handling: | 8.85 |
| Ride quality: | 8.54 |
| Fuel economy: | 2.38 |
| Interior noise: | 6.34 |
| Acceleration: | 7.23 |
| Ease of entry and exit: | 5.20 |
| Interior size: | 1.96 |
| Turning circle: | 1.04 |
| Cargo capacity: | 1.42 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **4060** |
| Exterior length (in): | **186.0** |
| Exterior width (in): | **72.7** |
| Exterior height (in): | **55.9** |
| Wheelbase (in): | **106.1** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Dunlop 245/40ZR20** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L DOHC 16V I4** |
| Horsepower @ rpm: | **84 @ 4800 (63 kW)** |
| Electric motor horsepower: | **233 (174 kW)** |

AAA.com/greencar

# Ford Focus SE Ecoboost

BASE PRICE: **$18,460;** PRICE AS TESTED: **$21,035**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

70.20

OVERALL RANKING **55**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **12.4** |
| EPA urban mpg: | **29** |
| EPA highway mpg: | **40** |
| EPA combined mpg: | **33** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0030

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Focus is Ford's attempt to compete with the successful Japanese/Korean entry-level compacts, and it does so quite well. We tested a Focus SE, with the 1.0-liter, 3-cylinder Ecoboost engine, which gets 33 mpg in combined driving. This turbocharged engine, though small, has decent power once you get the revs up. The SE trim on our test car included attractive 17-inch alloy wheels and Cooper 215/50R17 tires, which provided surprisingly good handling and a solid ride. The Focus's backseat and trunk are small, although the rear seats do fold down to increase cargo capacity. This is an easy-to-drive car and is reasonably equipped for only $21,000.

The Focus was awarded a 5-star (out of 5) overall crash-test rating from NHTSA and a Top Safety Pick rating from IIHS. For 2016, a 6-speed automatic is available, as well as Ford's SYNC 3 touch-screen interface.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Good ride quality for a small car
- Responsive handling and ease of use in day-to-day driving
- Good value (a solid, small sedan for $21,000)
- High fuel economy
- Easy-to-use manual shifter
- Sporty styling in SE trim

**WEAK POINTS**

- When selecting an HVAC mode, the driver must take his/her eyes off the road
- Window controls don't have auto-up for driver's side, needed with a manual transmission
- When engine stop-start with manual transmission engages, it feels like the engine has stalled
- Cramped rear seat with no center armrest

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 7.29 |
| Crashworthiness: | 6.21 |
| Visibility: | 6.90 |
| Slalom handling: | 7.22 |
| Ride quality: | 6.81 |
| Fuel economy: | 5.03 |
| Interior noise: | 5.41 |
| Acceleration: | 4.19 |
| Ease of entry and exit: | 6.04 |
| Interior size: | 4.45 |
| Turning circle: | 2.76 |
| Cargo capacity: | 1.89 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2980** |
| Exterior length (in): | **178.5** |
| Exterior width (in): | **80.5** |
| Exterior height (in): | **57.7** |
| Wheelbase (in): | **104.3** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Cooper 215/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Manual 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.0L Ti-VCT Ecoboost I3** |
| Horsepower @ rpm: | **123 @ 6000** |

AAA.com/greencar



# Scion iM

BASE PRICE: **$19,200;** PRICE AS TESTED: **$20,334**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

69.01

OVERALL RANKING **57**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **37** |
| EPA combined mpg: | **32** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0028

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The iM, one of two new Scions for 2016, is the marque's compact hatchback. It's easy to drive and park, with responsive steering and nimble handling, and it has a decent cargo capacity. Cabin materials are good quality, with lots of padded and soft-touch surfaces; dual-zone automatic climate control is standard. Yet the front seats are narrow and the backseat is cramped, suitable only for small children. Visibility to the rear and sides is poor, and ride comfort could be better. The 1.8-liter, 4-cylinder engine produces 137 hp, which isn't quite enough for this car; its acceleration times were slow. With its CVT transmission, the iM gets 32 mpg in combined driving. At press time, neither NHTSA nor IIHS had crash-tested the iM. In 2017, the Scion brand will disappear, and this vehicle will be rebadged as a Toyota.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Responsive steering, sporty handling
- Easy to drive and park
- Good fuel economy
- Rearview camera aids visibility
- Equipped with power folding mirrors

**WEAK POINTS**

- Underpowered
- Engine/CVT drones under hard acceleration
- Poor visibility, especially to the left and rear
- Radio touch screen can be distracting to use
- Cramped interior for large occupants

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 7.02 |
| Crashworthiness: | 6.29 |
| Visibility: | 6.30 |
| Slalom handling: | 7.20 |
| Ride quality: | 6.79 |
| Fuel economy: | 4.81 |
| Interior noise: | 5.54 |
| Acceleration: | 3.22 |
| Ease of entry and exit: | 5.82 |
| Interior size: | 3.66 |
| Turning circle: | 3.58 |
| Cargo capacity: | 3.78 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3040** |
| Exterior length (in): | **170.5** |
| Exterior width (in): | **69.3** |
| Exterior height (in): | **55.3** |
| Wheelbase (in): | **102.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Toyo P225/45R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.8L DOHC 16V I4** |
| Horsepower @ rpm: | **137 @ 6100** |

AAA.com/greencar

# Chevrolet Sonic LTZ

BASE PRICE: **$18,835;** PRICE AS TESTED: **$21,010**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

68.30

OVERALL RANKING: **61**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 12.2 |
| EPA urban mpg: | 27 |
| EPA highway mpg: | 37 |
| EPA combined mpg: | 31 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Chevrolet Sonic is a small car that makes good use of its interior space. It's roomy for front-seat occupants and adequate in the rear if you're not too tall. We tested the well-equipped LTZ package with the turbocharged, 1.4-liter, 4-cylinder engine (138 hp) and a 6-speed automatic transmission. This package makes more torque than the standard naturally aspirated 1.8-liter engine and gets better fuel economy to boot—31 mpg combined. General Motors likes to tout its advances in infotainment, but our evaluators uniformly panned the Sonic's touch-screen interface. Hopefully, the MyLink infotainment system standard on LTZ models in 2016 is an improvement. The 2016 Sonic received a 5 star (out of 5) overall crash-test evaluation from NHTSA and a Top Safety Pick rating from IIHS (with optional front-crash prevention).

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Forward-collision warning

**STRONG POINTS**

- Turbocharged, 1.4-liter engine provides surprising power
- Good fuel economy
- Easy to drive and park
- Roomy front seats for a small car
- Heated seats

**WEAK POINTS**

- Cramped backseat
- Radio controls are on the touch screen, can be distracting
- Small sun visors
- Lacks rear center armrest

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 7.94 |
| Crashworthiness: | 6.01 |
| Visibility: | 7.00 |
| Slalom handling: | 6.09 |
| Ride quality: | 6.38 |
| Fuel economy: | 4.59 |
| Interior noise: | 2.93 |
| Acceleration: | 3.70 |
| Ease of entry and exit: | 5.98 |
| Interior size: | 5.20 |
| Turning circle: | 3.17 |
| Cargo capacity: | 3.30 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2840 |
| Exterior length (in): | 159.0 |
| Exterior width (in): | 68.3 |
| Exterior height (in): | 59.7 |
| Wheelbase (in): | 99.4 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Hankook P205/50R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | Auto 6 speed |
| Drivetrain type: | Front wheel |
| Engine size: | 1.4L Ecotec Turbo I4 |
| Horsepower @ rpm: | 138 @ 6300 |

AAA.com/greencar



# Toyota Corolla LE Eco

BASE PRICE: **$19,510;** PRICE AS TESTED: **$19,735**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

67.45

OVERALL RANKING: **63**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 13.2 |
| EPA urban mpg: | 30 |
| EPA highway mpg: | 42 |
| EPA combined mpg: | 35 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0036

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Corolla has been a stalwart for Toyota for many years, the standard for quality in a compact car. The current model, which was completely redesigned in 2014, continues to live up to this reputation. Our test car, which was equipped with a 4-cylinder, 140-hp engine and a CVT, got excellent gas mileage (we averaged 36 mpg, including a day of testing at the Auto Club Speedway). Our LE trim-level test car had standard and optional equipment that made it seem more like a luxury car than a high-mpg compact. It was easy to drive, smooth, and drama-free. The Corolla earns a 5-star (out of 5) overall rating in NHTSA's crash testing. Most 2015 trim levels received standard features upgrades; for 2016, the Corolla received updated Entune audio systems.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Fuel economy
- Easy to drive
- Well equipped for the price, including Bluetooth and tilt/telescopic steering wheel
- Bright LED headlights

**WEAK POINTS**

- Noisy cabin
- Limited rear visibility, although the rearview camera helps
- Difficult backseat entry/exit
- Lacks rear center armrest
- Low front nose hits curbs

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.51 |
| Crashworthiness: | 6.04 |
| Visibility: | 6.80 |
| Slalom handling: | 5.78 |
| Ride quality: | 6.91 |
| Fuel economy: | 5.46 |
| Interior noise: | 4.04 |
| Acceleration: | 4.30 |
| Ease of entry and exit: | 6.32 |
| Interior size: | 5.57 |
| Turning circle: | 3.84 |
| Cargo capacity: | 1.89 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2860 |
| Exterior length (in): | 182.6 |
| Exterior width (in): | 69.9 |
| Exterior height (in): | 57.3 |
| Wheelbase (in): | 106.3 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Hankook P195/65R15 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.8L DOHC 16V I4 |
| Horsepower @ rpm: | 140 @ 6100 |

AAA.com/greencar

# Kia Forte EX

BASE PRICE: **$20,200;** PRICE AS TESTED: **$25,515**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

67.19

OVERALL RANKING: **64**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **13.2** |
| EPA urban mpg: | **24** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **28** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0026

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Kia Forte, which was completely redesigned for 2014, is a good example of how the automaker has greatly improved its styling and quality while maintaining excellent affordability. Our EX trim test vehicle, which was equipped with a 2.0-liter, 4-cylinder, 173-hp engine and a 6-speed automatic transmission, is certified as a PZEV and got 28 mpg in combined driving. It came with the Premium package, which includes a sunroof, heated and cooled seats, and an HD radio; still, the MSRP was just over $25,000 as tested. Although the Forte handles and rides well, the hatchback's roofline is low, making entry and exit difficult. The general exterior fit was good, but some materials inside the vehicle lacked quality. NHTSA has not crash-tested the Forte hatchback. The Forte has changed little since 2014; a redesigned 2017 edition is reportedly in the works and will likely be on sale later this year.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Great handling
- Active Eco mode for improved fuel economy
- Front and rear heated seats
- Rearview camera
- Three different steering modes

**WEAK POINTS**

- Low roofline restricts entry and exit
- Small steering wheel controls
- Insufficient number of gauges/warning lights

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.45 |
| Crashworthiness: | 5.69 |
| Visibility: | 7.10 |
| Slalom handling: | 6.00 |
| Ride quality: | 7.13 |
| Fuel economy: | 3.95 |
| Interior noise: | 4.39 |
| Acceleration: | 5.01 |
| Ease of entry and exit: | 6.40 |
| Interior size: | 5.14 |
| Turning circle: | 3.81 |
| Cargo capacity: | 2.12 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2970** |
| Exterior length (in): | **179.5** |
| Exterior width (in): | **70.1** |
| Exterior height (in): | **56.9** |
| Wheelbase (in): | **106.3** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Nexen P215/45R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L DOHC GDI I4** |
| Horsepower @ rpm: | **173 @ 6500** |

AAA.com/greencar



# Mini Cooper Countryman

BASE PRICE: **$24,145;** PRICE AS TESTED: **$24,145**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

65.50

OVERALL RANKING: **70**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **12.4** |
| EPA urban mpg: | **25** |
| EPA highway mpg: | **30** |
| EPA combined mpg: | **27** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0027

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Econoboxes that aren't econoboxes? That would be the line of Mini Coopers from BMW. Based on the iconic little British sports car, the Mini is tiny, cute, and immense fun to drive. We tested the larger, four-door Countryman version, whose sole econobox trait is its stingy, 27-mpg EPA combined fuel-economy rating. The Countryman's handling and brakes are fantastic, and the car is easy to drive and to park. However, it seems like Mini went out of its way to equip it with small, odd, and awkward "British" controls for the heating and air-conditioning, radio, doors, rear hatch, and most other functions. Apart from changes to some option packages, the 2015 and 2016 Countryman remain the same. NHTSA has not crash-tested the Countryman.

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

**STRONG POINTS**

- Fun to drive
- Responsive steering feel
- ABS brakes provide short stops
- Cute styling
- Fits in small parking spaces

**WEAK POINTS**

- Noisy cabin
- Sluggish throttle response
- Poor rear visibility
- Small, unusual controls
- Requires premium fuel
- Lacks front and rear center armrests

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 9.22 |
| Crashworthiness: | 6.63 |
| Visibility: | 7.00 |
| Slalom handling: | 8.40 |
| Ride quality: | 6.91 |
| Fuel economy: | 1.73 |
| Interior noise: | 2.61 |
| Acceleration: | 1.88 |
| Ease of entry and exit: | 5.71 |
| Interior size: | 4.46 |
| Turning circle: | 3.36 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3280** |
| Exterior length (in): | **161.7** |
| Exterior width (in): | **70.4** |
| Exterior height (in): | **61.5** |
| Wheelbase (in): | **102.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 205/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.6L I4** |
| Horsepower @ rpm: | **121 @ 6000** |

AAA.com/greencar

# Dodge Dart SE Aero

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

61.20

OVERALL RANKING **80**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **13.2** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **41** |
| EPA combined mpg: | **33** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0028

BASE PRICE: **$19,995;** PRICE AS TESTED: **$20,990**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Dodge Dart name harks back to the 1960s and recalls memories of a reliable small sedan. We tested the Aero version, which comes equipped with a turbocharged, 1.4-liter, inline-4 engine, good for 160 hp, and a 6-speed manual transmission. This combination provides the best fuel economy of any Dart, 33 mpg combined. The Dart is based on Alfa Romeo mechanicals, from parent company Fiat, but the connection isn't apparent. The styling is sporty, and the Dart is well equipped for its $21,000 price tag. Additionally, it scores 5 stars (out of 5) overall in NHTSA's crash tests. On the downside, many of the Dart's controls are on a large touch screen, which can be distracting. And its bumpy ride makes selecting a radio preset (icons in a row at the top of the screen) an exercise in trying to hit a moving target. Changes for 2016 are minor and basically cosmetic.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

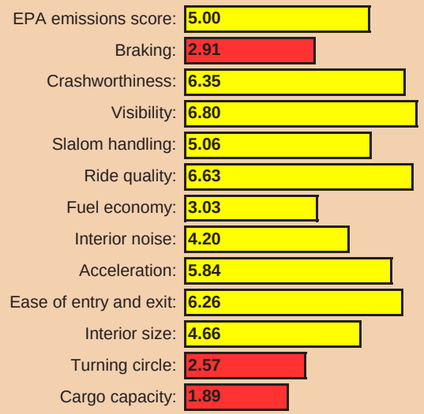
**STRONG POINTS**

- Very good fuel economy
- Large infotainment screen with Bluetooth and satellite radio
- Sporty styling

**WEAK POINTS**

- Bumpy, noisy ride
- Requires premium fuel
- No exterior trunk release
- Lacks rear center armrest
- Mirror controls are not backlit

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3081** |
| Exterior length (in): | **183.9** |
| Exterior width (in): | **72.0** |
| Exterior height (in): | **57.7** |
| Wheelbase (in): | **106.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Kumho 205/55R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Manual 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L DOHC Turbo** |
| Horsepower @ rpm: | **160 @ 5500** |

AAA.com/greencar



# Hyundai Accent SE

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

58.89

OVERALL RANKING **81**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **11.4** |
| EPA urban mpg: | **26** |
| EPA highway mpg: | **37** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0029

BASE PRICE: **$15,745;** PRICE AS TESTED: **$16,580**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★½

## OVERALL OBSERVATIONS

The Accent is Hyundai's entry-level compact car. We tested the base Accent SE four-door sedan. At 137 hp, the direct-injected, 1.6-liter, 4-cylinder engine could use a bit more power, but the Accent is rated at 30 mpg in combined driving with a 6-speed automatic transmission. It's easy to drive, is reasonably comfortable, fits in small parking spaces, and has Hyundai's excellent warranty. However, the rear seat is cramped, the trunk is small, and lots of road noise gets into the cabin. And some desirable features—keyless ignition, navigation system, Bluetooth, cruise control, and a rearview camera—simply aren't available. Still, the Accent has an MSRP of only $16,580, and with its good mpg and extensive warranty, operating costs should be low. The Accent received a 4-star (out of 5) overall rating in NHTSA's crash tests.

**AVAILABLE ADVANCED SAFETY FEATURES**

None available

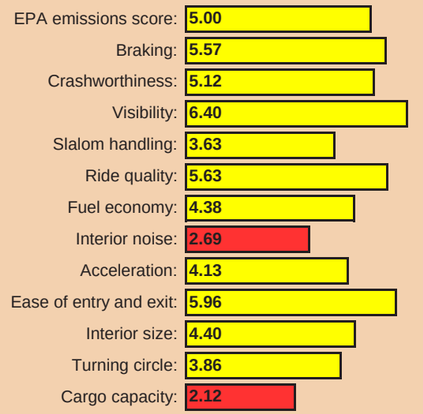
**STRONG POINTS**

- Affordable purchase price
- Very good fuel economy
- Controls are simple and easy to use
- Excellent warranty
- Fits in small parking places

**WEAK POINTS**

- Choppy ride, especially on the freeway
- Cramped rear seat
- Lots of cheap-looking plastic in the interior
- Lacks rear center armrest
- Lacks rear-seat cup holders

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2560** |
| Exterior length (in): | **172.0** |
| Exterior width (in): | **66.9** |
| Exterior height (in): | **57.1** |
| Wheelbase (in): | **101.2** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Hankook P175/70R14** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.6L DOHC 16V GDI I4** |
| Horsepower @ rpm: | **137 @ 6300** |

AAA.com/greencar



# Midsize

Last year, we reported that the best-selling type of cars were midsize cars. No longer—crossovers/SUVs have recently grabbed that crown. Nonetheless, if a compact car is too small for your needs and you prefer a sedan or coupe body style over a crossover, chances are you can find a midsize car that suits your fancy. Midsize cars are spacious enough to accommodate at least four adults, their cabins have higher-quality materials and are quieter than those of smaller cars, they have plenty of cargo space, and they deliver the ride comfort—especially for longer trips—that subcompacts and compacts just can't match. Midsize cars can also be fun to drive, with precise steering and responsive handling. And let's not skip over high fuel economy. Many of the top sellers—and not just hybrids or EVs—boast highway mpg numbers in the mid to high 30s.

BASE PRICE: **$54,825;** PRICE AS TESTED: **$64,295**

## MERCEDES-BENZ
## E250 BlueTEC 4MATIC

Mercedes-Benz has long been an industry leader in diesel-powered automobiles. We tested an E250 BlueTEC 4MATIC sedan equipped with a twin-turbo, 2.1-liter, 4-cylinder diesel rated at 195 hp. It ran from 0-60 in 8.5 seconds, was extremely quiet, and got 32 mpg in our testing. There's a little throttle lag; otherwise, you wouldn't know a diesel engine is under the hood. The E250's $64,000 price tag buys lots of safety and convenience features, including adaptive cruise control, surround-view camera, lane-keeping assist, rear cross-traffic alert, parking assist, navigation, and satellite radio. NHTSA awarded the Mercedes E Class 4 stars (out of 5) in its crash tests; IIHS gave it a Top Safety Pick+ rating. The bottom line: The E250 BlueTEC is a high-quality luxury car that delivers excellent fuel economy. A redesigned E Class is due some time this summer.

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

### AVAILABLE ADVANCED SAFETY FEATURES

- Surround-view camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

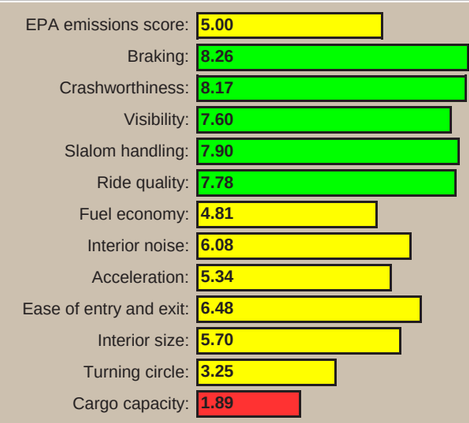
### STRONG POINTS

- ⊕ Very good fuel economy (32 mpg combined)
- ⊕ Loaded with safety and convenience features
- ⊕ Easy to drive, comfortable ride
- ⊕ Powerful brakes
- ⊕ AWD traction
- ⊕ Good front seat adjustability and comfort

### WEAK POINTS

- ⊖ High purchase price
- ⊖ Slow, odd-shifting transmission
- ⊖ M-B Comand control system is complicated and distracting
- ⊖ Three stalks on left side of steering wheel can be confusing
- ⊖ Throttle lag

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

**78.27**

OVERALL RANKING **11**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Diesel #2** |
| Fuel capacity (gal): | **21.1** |
| EPA urban mpg: | **27** |
| EPA highway mpg: | **42** |
| EPA combined mpg: | **32** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

**0032**

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4380** |
| Exterior length (in): | **191.7** |
| Exterior width (in): | **81.5** |
| Exterior height (in): | **57.9** |
| Wheelbase (in): | **113.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 245/45R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 7 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.1L Biturbo Diesel I4** |
| Horsepower @ rpm: | **195 @ 3800** |

# Lexus GS 450h


BASE PRICE: **$59,600;** PRICE AS TESTED: **$69,769**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

77.50

OVERALL RANKING **15**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **17.5** |
| EPA urban mpg: | **29** |
| EPA highway mpg: | **34** |
| EPA combined mpg: | **31** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

With the GS 450h, Lexus combines a 3.5-liter, V6 gasoline engine, two electric motors (338 hp total), and a CVT transmission, taking advantage of a hybrid powertrain's strong points (electric motors provide maximum torque at low speeds) and delivering both excellent performance and high fuel economy. Our GS 450h test car got 31 mpg combined—35 percent higher than the comparable nonhybrid GS 350, yet it provided equal or better performance. Our test car was loaded with safety and convenience features, including LED headlights, Bluetooth, voice-activated navigation, satellite radio, and much more. NHTSA has not crash-tested the GS 450h. For 2016, the GS 450h receives a restyled front and rear bumper and taillights, plus standard navigation, 12-inch touch screen, and several advanced safety features.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

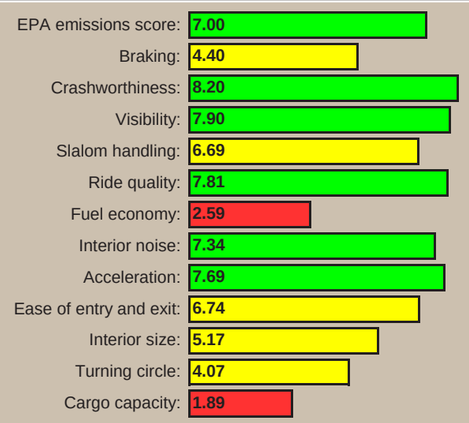
**STRONG POINTS**

- Powerful engine, excellent acceleration
- Balance of good ride and handling
- Loaded with safety, convenience, and comfort extras
- Quiet, comfortable interior
- Good fuel economy for a sport sedan

**WEAK POINTS**

- Requires premium fuel
- Too many controls on the touch screen; can be confusing and distracting
- Small trunk; rear seat doesn't fold down
- Poor rear visibility
- Cramped rear seat is difficult to enter
- High purchase price

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4400** |
| Exterior length (in): | **190.7** |
| Exterior width (in): | **72.4** |
| Exterior height (in): | **57.3** |
| Wheelbase (in): | **112.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Michelin P235/45R18** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **3.5L 24V DOHC V6** |
| Horsepower @ rpm: | **286 @ 6000 (338 total)** |
| Electric motor horsepower: | **197 hp (147 kW)** |

AAA.com/greencar



# Volkswagen Passat 1.8T SE


BASE PRICE: **$26,280;** PRICE AS TESTED: **$27,100**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

76.70

OVERALL RANKING **18**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **18.5** |
| EPA urban mpg: | **25** |
| EPA highway mpg: | **38** |
| EPA combined mpg: | **29** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0024

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

Our 2016 Volkswagen Passat test vehicle—the German automaker's roomy, sophisticated midsize sedan—was a midlevel 1.8T SE model. It was equipped with a turbocharged, 1.8-liter, direct-injected engine and a 6-speed automatic transmission good for 170 hp and 29 mpg in combined driving. The Passat is fun to drive, with good power and a smooth, quiet, comfortable ride under all driving conditions. A rearview camera is now standard on all Passats, and numerous convenience features are standard at this trim level, including rear air-conditioning vents, adaptive cruise control, and a collision-mitigation system with automated braking. NHTSA awarded the 2016 Passat 5 stars (out of 5) overall in its crash-testing. IIHS rated the Passat a Top Safety Pick+ (with optional front-crash prevention).

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Adaptive cruise control
- Forward-collision warning
- Forward-collision mitigation
- Forward-collision avoidance

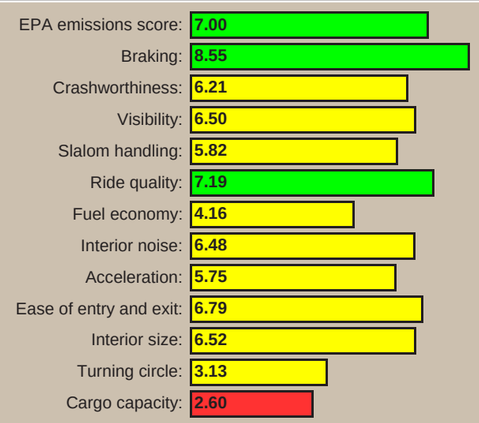
**STRONG POINTS**

- Good handling; fun to drive
- Good braking performance
- Plenty of backseat legroom

**WEAK POINTS**

- Noisy engine, especially when cold
- Small center console
- Seat controls, and adaptive cruise control are difficult to understand

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3340** |
| Exterior length (in): | **191.9** |
| Exterior width (in): | **72.2** |
| Exterior height (in): | **58.5** |
| Wheelbase (in): | **110.4** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Continental 215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.8L TSI DOHC Turbo I4** |
| Horsepower @ rpm: | **170 @ 4800** |

AAA.com/greencar

# Subaru Legacy 2.5i Premium

BASE PRICE: **$23,495;** PRICE AS TESTED: **$27,480**

## LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST — HIGHEST **92.49**

**76.38**

**OVERALL RANKING** **19**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **18.5** |
| EPA urban mpg: | **26** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Legacy is Subaru's entry in the popular midsized sedan segment. Like other Subarus with the 2.5-liter, 4-cylinder "boxer" engine, it's a PZEV. Changes to the engine provide more power and better fuel economy—30 mpg combined—than in the past. Our test vehicle was the well-equipped Premium trim level, which included heated front seats and mirrors, satellite radio, windshield-wiper deicers, and, of course, Subaru's trademark AWD. Also worth noting was the optional EyeSight crash-prevention system, which features lane-departure warning, adaptive cruise control, and forward-collision avoidance. The Legacy's ride is comfortable, its handling responsive, and its instrumentation simple and straightforward. The Legacy received 5 stars (out of 5) in all NHTSA's crash-test categories. Ever since 2013, it's been awarded a Top Safety Pick+ (with optional front-crash prevention) rating by IIHS.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Well equipped with crash-avoidance technology
- ⊕ Large trunk for a midsize sedan
- ⊕ AWD traction
- ⊕ Certified as a PZEV

**WEAK POINTS**

- ⊖ Too many controls on the touch screen
- ⊖ Lack of instrumentation
- ⊖ It's easy to accidentally switch radio stations while adjusting the volume

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 9.97 |
| Crashworthiness: | 6.49 |
| Visibility: | 7.10 |
| Slalom handling: | 8.48 |
| Ride quality: | 6.50 |
| Fuel economy: | 4.38 |
| Interior noise: | 5.05 |
| Acceleration: | 4.34 |
| Ease of entry and exit: | 6.88 |
| Interior size: | 6.59 |
| Turning circle: | 2.24 |
| Cargo capacity: | 2.36 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3540** |
| Exterior length (in): | **188.8** |
| Exterior width (in): | **72.4** |
| Exterior height (in): | **59.0** |
| Wheelbase (in): | **108.3** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Goodyear 225/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.5L DOHC Flat 4** |
| Horsepower @ rpm: | **175 @ 5800** |

AAA.com/greencar



# Honda Accord Sport Sensing

BASE PRICE: **$25,965;** PRICE AS TESTED: **$26,785**

## LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST — HIGHEST **92.49**

**75.54**

**OVERALL RANKING** **22**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **17.2** |
| EPA trban mpg: | **26** |
| EPA highway mpg: | **35** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0024

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Honda Accord is extremely popular, routinely finishing as one of the top-selling cars in nationwide sales. For 2016, there were no big changes to the Accord, just small refinements. The standard 2.4-liter, 189-hp, inline 4 engine in our Accord Sport Sensing model test car was certified as a PZEV. This means you can experience all the qualities that make the Accord so popular (high build quality and reliability, powerful brakes, smooth but taut ride, good handling, roomy and comfortable interior) while contributing to cleaner air. At the same time, you can get a well-equipped car with 30 mpg in combined driving, as well as a 5-star (out of 5) overall NHTSA crash-test rating for under $27,000. In addition, IIHS has awarded the Accord a Top Safety Pick+ rating (with optional front-crash prevention) every year since 2013.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Loaded with safety and convenience features
- ⊕ Good handling in slalom course
- ⊕ Lots of interior storage
- ⊕ Roomy front seat
- ⊕ Certified as a PZEV

**WEAK POINTS**

- ⊖ Slightly underpowered
- ⊖ High tire noise
- ⊖ Cramped rear seat
- ⊖ Lack of instrumentation
- ⊖ With rear seat folded down, the opening to the trunk is narrow

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 8.00 |
| Braking: | 7.36 |
| Crashworthiness: | 6.27 |
| Visibility: | 7.00 |
| Slalom handling: | 7.77 |
| Ride quality: | 7.46 |
| Fuel economy: | 4.38 |
| Interior noise: | 6.19 |
| Acceleration: | 5.39 |
| Ease of entry and exit: | 7.18 |
| Interior size: | 5.65 |
| Turning circle: | 0.30 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3380** |
| Exterior length (in): | **192.5** |
| Exterior width (in): | **72.8** |
| Exterior height (in): | **57.7** |
| Wheelbase (in): | **109.3** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Continental 235/40R19** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.4L DOHC 16V i-VTEC I4** |
| Horsepower @ rpm: | **189 @ 6400** |

AAA.com/greencar

# Ford C-Max Hybrid SE

BASE PRICE: **$25,995;** PRICE AS TESTED: **$27,990**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

74.32

OVERALL RANKING: **31**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 13.5 |
| EPA urban mpg: | 42 |
| EPA highway mpg: | 37 |
| EPA combined mpg: | 40 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0035

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

The C-Max Hybrid is Ford's first dedicated hybrid vehicle. It's powered by a 2.0-liter, 4-cylinder engine and an electric motor, good for 188 total hp; EPA-estimated fuel economy is 40 mpg combined. It has good acceleration and a comfortable ride. Options on our test car included reverse-parking sensors, a power liftgate, and the MyFord Touch infotainment system, which brought the MSRP up to just under $28,000. The C-Max's wagon body style has a good-sized cargo compartment (24 cu. ft. with the backseat up, 53 cu. ft. with it down). NHTSA's overall crash-test rating is 4 stars (out of 5). From 2014–2016, the C-Max Hybrid has had no major changes. For 2016, it gets Ford's SYNC 3 infotainment system and an 8-inch touch screen.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

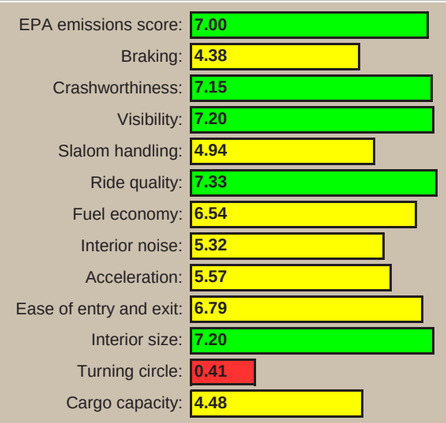
**STRONG POINTS**

- ⊕ Great forward visibility
- ⊕ Lots of cargo space
- ⊕ Excellent fuel economy
- ⊕ Power rear liftgate

**WEAK POINTS**

- ⊖ Limited rear visibility
- ⊖ Interior controls are not user friendly nor well marked
- ⊖ Lack of instruments and warning lights
- ⊖ Large turning radius

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2013 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3650 |
| Exterior length (in): | 173.6 |
| Exterior width (in): | 72.0 |
| Exterior height (in): | 63.9 |
| Wheelbase (in): | 104.3 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Michelin P225/50R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 2.0L I4 |
| Horsepower @ rpm: | 141 @ 6000 (188 Total) |
| Electric motor horsepower: | 118 hp |

AAA.com/greencar



# Toyota Camry Hybrid SE

BASE PRICE: **$27,995;** PRICE AS TESTED: **$31,335**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

74.09

OVERALL RANKING: **32**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 17 |
| EPA urban mpg: | 40 |
| EPA highway mpg: | 38 |
| EPA combined mpg: | 40 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0030

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

Toyota completely redesigned its best-selling Camry, including the Hybrid, for 2015. Introduced in 2007, the Hybrid now gets 43 percent better overall mpg than the standard 4-cylinder Camry—40 versus 28. That means proportionally lower $CO_2$ emissions, and the Hybrid meets stringent PZEV emissions standards, too. Its powertrain consists of a 2.5-liter, 4-cylinder engine; a CVT; an electric motor; and a battery pack. Combined power output is 200 hp. The Hybrid Camry retains most of every Camry's strengths—it's quiet, reliable, reasonably priced, roomy for a midsize car, and rides better than most. However, the battery takes up trunk space, and although the rear seatback folds, there's only a small opening connecting to the trunk. NHTSA awarded the Camry Hybrid 5 stars (out of 5) overall in its crash tests. For 2015 and 2016, IIHS gave the gasoline-powered Camry a Top Safety Pick+ rating (with optional front-crash prevention); it hasn't tested the Camry Hybrid. The Camry Hybrid carries over into 2016 essentially unchanged.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

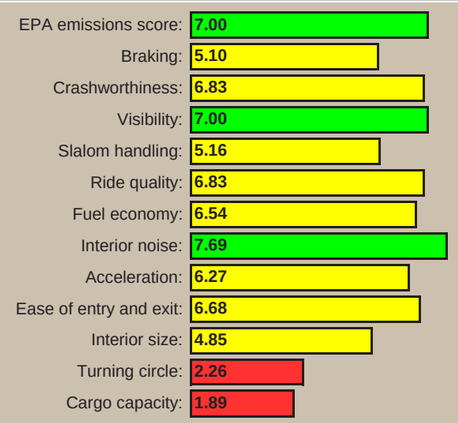
**STRONG POINTS**

- ⊕ Excellent fuel economy
- ⊕ Certified as an AT PZEV
- ⊕ Roomy rear seat
- ⊕ Equipped with satellite radio and Bluetooth
- ⊕ Rear windows open fully

**WEAK POINTS**

- ⊖ Poor handling in our slalom course
- ⊖ Vague steering feel
- ⊖ Small trunk
- ⊖ The rear seats fold down, but there's only a small pass-through opening
- ⊖ Engine auto-start can be startling

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3420 |
| Exterior length (in): | 190.9 |
| Exterior width (in): | 71.7 |
| Exterior height (in): | 57.9 |
| Wheelbase (in): | 109.3 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Michelin P215/55R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 2.5L DOHC Dual VVT-i I4 |
| Horsepower @ rpm: | 156 @ 5700 (200 total) |
| Electric motor horsepower: | 141 hp (105 kW) |

AAA.com/greencar

# **Hyundai** Sonata Hybrid Limited

BASE PRICE: **$30,100;** PRICE AS TESTED: **$35,550**

## LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

73.67

OVERALL RANKING **34**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **15.9** |
| EPA urban mpg: | **39** |
| EPA highway mpg: | **43** |
| EPA combined mpg: | **41** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0033

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The midsize Hyundai Sonata Hybrid, introduced in 2011, has been completely redesigned for 2016. Its drivetrain, with a new 2.0-liter engine and electric motor (193 total hp), delivers an EPA-estimated 41 mpg combined, a nearly 10 percent improvement. Our test car, with the Limited trim and the Ultimate package, had an MSRP of just under $36,000, which provides a vast array of comfort, safety, and convenience technologies. All in all, the Sonata Hybrid is well executed and a pleasure to drive. Its steering is precise, and its 6-speed automatic transmission shifts smoothly. The cabin is nicely designed, roomy, and has plenty of backseat legroom. Another plus is Hyundai's extensive warranty, one of the best in the industry. NHTSA awarded the Sonata Hybrid a 5 stars (out of 5) overall in its crash tests.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning

**STRONG POINTS**

- ⊕ Smooth ride
- ⊕ High fuel economy
- ⊕ Loaded with features, including satellite radio, front and rear heated seats, Bluetooth, and navigation
- ⊕ Good backseat legroom
- ⊕ Front seat entry and exit is easy
- ⊕ Excellent, extensive warranty

**WEAK POINTS**

- ⊖ Slightly underpowered
- ⊖ Engine noisy at low speeds
- ⊖ Grabby brakes
- ⊖ Sloppy handling in slalom course
- ⊖ Small trunk
- ⊖ No spare tire

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 6.56 |
| Crashworthiness: | 7.19 |
| Visibility: | 7.10 |
| Slalom handling: | 3.87 |
| Ride quality: | 7.25 |
| Fuel economy: | 6.76 |
| Interior noise: | 7.31 |
| Acceleration: | 5.44 |
| Ease of entry and exit: | 6.80 |
| Interior size: | 5.05 |
| Turning circle: | 3.47 |
| Cargo capacity: | 1.89 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3680** |
| Exterior length (in): | **191.1** |
| Exterior width (in): | **73.4** |
| Exterior height (in): | **57.9** |
| Wheelbase (in): | **110.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Solus 215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L GDI I4 Hybrid** |
| Horsepower @ rpm: | **154 @ 6000 (193 total)** |
| Electric motor horsepower: | **51 @ 1770-2000** |

AAA.com/greencar



# **Lexus** ES 300h

BASE PRICE: **$40,430;** PRICE AS TESTED: **$45,320**

## LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

73.29

OVERALL RANKING **36**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **17.2** |
| EPA urban mpg: | **40** |
| EPA highway mpg: | **39** |
| EPA combined mpg: | **40** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0034

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The ES 300h is Lexus's entry-level luxury midsize hybrid sedan, powered by a 2.5-liter, 4-cylinder engine and an electric motor that produce 200 hp total. A CVT and FWD are standard. The ES 300h is rated at 40 mpg for combined driving, excellent mileage for a car its size. Our test ES, equipped with a rearview camera, navigation system, heated and cooled front seats, blind-spot monitoring, and lane-departure warning, had an MSRP just over $45,000. The 300h has a well-designed and comfortable interior, with one major drawback—the cumbersome joystick used to control the radio, Bluetooth, and other features. Also, like many hybrid sedans, the trunk is small and the rear seats don't fold down. The ES 300h received 5 stars overall (out of 5) in NHTSA's crash-test ratings. For 2016, the gasoline-powered ES 350 is an IIHS Top Safety Pick+ (with optional front-crash prevention); the IIHS hasn't crash-tested the 300h. The 2016 ES 300h gets better sound deadening, a new grille, and an available safety package.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Strong performance with excellent fuel economy
- ⊕ Comfortable and luxurious
- ⊕ Very quiet ride
- ⊕ Ample rear-seat legroom
- ⊕ SULEV rated

**WEAK POINTS**

- ⊖ Poor handling in our slalom course
- ⊖ Small trunk; rear seat doesn't fold down
- ⊖ Too many joystick-controlled features

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 4.81 |
| Crashworthiness: | 7.16 |
| Visibility: | 7.30 |
| Slalom handling: | 3.01 |
| Ride quality: | 7.75 |
| Fuel economy: | 6.54 |
| Interior noise: | 7.85 |
| Acceleration: | 5.82 |
| Ease of entry and exit: | 6.71 |
| Interior size: | 5.64 |
| Turning circle: | 2.03 |
| Cargo capacity: | 1.65 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3660** |
| Exterior length (in): | **192.7** |
| Exterior width (in): | **71.1** |
| Exterior height (in): | **57.1** |
| Wheelbase (in): | **111.0** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Michelin P215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.5L DOHC 16V I4** |
| Horsepower @ rpm: | **156 @ 5700 (200 Total)** |

AAA.com/greencar

# Ford C-Max Energi SEL

BASE PRICE: **$33,745;** PRICE AS TESTED: **$37,930**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

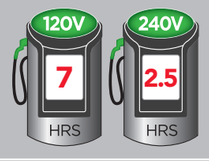
72.95

**OVERALL RANKING** 38

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Electricity/Regular** |
| Fuel capacity (gal): | **14** |
| EPA urban mpg: | **40** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **38** |
| EPA combined MPGe: | **88** |

**BATTERY CHARGE TIME**




**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0045

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

## OVERALL OBSERVATIONS

The C-Max Energi, which debuted in 2013, is Ford's first plug-in hybrid. It's powered by a 2.0-liter, 4-cylinder engine and an electric motor that produce 188 hp. Our test vehicle cost nearly $38,000, about $10,000 more than the standard C-Max Hybrid SE we tested, but this doesn't take any federal and state tax incentives into account. In addition, the Energi's 20-mile all-electric range can lower operating costs further. The C-Max Energi rides well but feels a bit underpowered. It handled well on our slalom course, but it has a large turning radius, and its large battery reduces trunk space. On a positive note, we averaged 45 mpg overall. Its NHTSA overall crash-test score is 4 stars (out of 5). For 2016, the Energi gets Ford's SYNC 3 infotainment system and an 8-inch touch screen.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

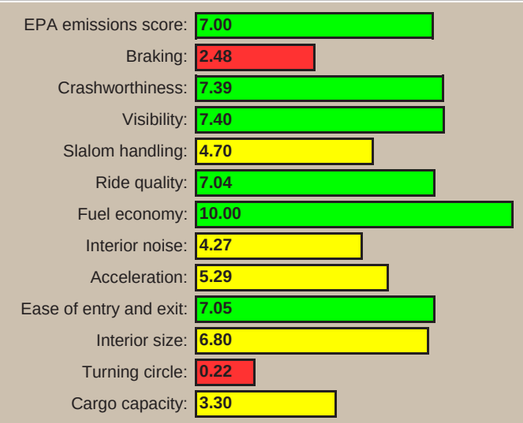
**STRONG POINTS**

- Comfortable seating
- Good headroom
- Certified as AT PZEV

**WEAK POINTS**

- Poor rear visibility
- Small trunk
- Insufficient instrumentation
- Radio controls are difficult to use
- Large turning radius

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3820** |
| Exterior length (in): | **173.6** |
| Exterior width (in): | **72.0** |
| Exterior height (in): | **63.8** |
| Wheelbase (in): | **104.3** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P225/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L ATK IVCT I4** |
| Horsepower @ rpm: | **141 @ 6000 (188 Total)** |
| Electric motor horsepower: | **118 @ 6000** |

AAA.com/greencar



# Mazda Mazda6 i Grand Touring

BASE PRICE: **$30,290;** PRICE AS TESTED: **$31,490**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

72.39

**OVERALL RANKING** 41

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **16.4** |
| EPA urban mpg: | **26** |
| EPA highway mpg: | **38** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB** 0027

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Mazda6 was completely redesigned for 2014. We drove the top-of-the-line Mazda6 i Grand Touring version, which had a 2.5-liter, 4-cylinder, 184-hp engine and a 6-speed automatic transmission. It's rated by the EPA at an impressive 30 mpg in combined driving; in our testing, we averaged 27 mpg. The Mazda6 has strong acceleration and handled well on the slalom course. With a base price of $30,290, it's not cheap, but it's well equipped and provides good value. For about $1,200, you can add many safety technologies, including forward-collision warning, lane-departure warning, and blind-spot monitoring. The Mazda6 received an overall crash-test rating of 5 stars (out of 5) from NHTSA. And it's been an IIHS Top Safety Pick+ vehicle (with optional front-crash prevention) from 2014–2016. In 2015 and 2016, the Mazda6 received only minor cosmetic and features changes.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

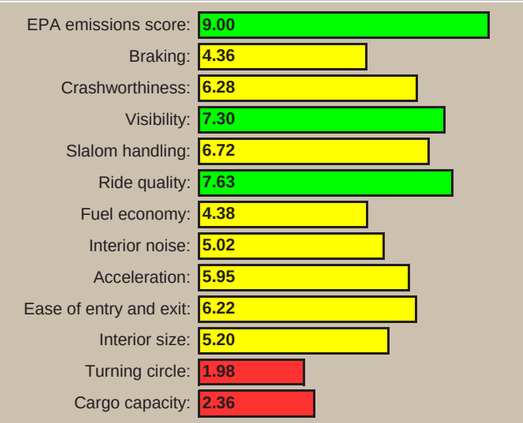
**STRONG POINTS**

- Very good fuel economy
- Good handling and ride quality
- Heated seats

**WEAK POINTS**

- Cramped interior
- Limited rear visibility
- Touch screen difficult to use
- Limited luggage capacity

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3390** |
| Exterior length (in): | **191.5** |
| Exterior width (in): | **72.4** |
| Exterior height (in): | **57.1** |
| Wheelbase (in): | **111.4** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Dunlop P225/45R19** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.5L DOHC I4** |
| Horsepower @ rpm: | **184 @ 5700** |

AAA.com/greencar

## **Hyundai** Sonata Eco

BASE PRICE: **$23,275;** PRICE AS TESTED: **$28,310**

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.61

OVERALL RANKING **46**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **18.5** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **38** |
| EPA combined mpg: | **32** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0026

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### OVERALL OBSERVATIONS

Redesigned for 2015, the midsize Hyundai Sonata sedan offers a surprising number of standard features for the price. Our test vehicle, the new Eco trim level, had a turbocharged, 1.6-liter, 4-cylinder engine rated at 178 hp and a 7-speed automatic transmission. It was extremely well equipped—including navigation, satellite radio, heated leather front seats, and Bluetooth—for just over $28,000. The new Sonata provides a quiet, comfortable ride and responsive handling; its EPA combined fuel economy is estimated at 32 mpg. The downside of the Sonata's sleek styling is poor visibility close to the vehicle, especially to the rear—although the rearview camera helps. The Sonata received an overall rating of 5 stars (out of 5) in NHTSA's crash tests and, for 2015 and 2016, a Top Safety Pick+ ranking from IIHS (with optional front-crash prevention). For 2016, the Sonata gets a standard rearview camera and automatic headlights.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera (on this trim level)

### STRONG POINTS

- ⊕ Good value; lots of features for the price
- ⊕ Excellent fuel economy
- ⊕ Long, extensive warranty
- ⊕ Modern styling

### WEAK POINTS

- ⊖ Long stopping distance in emergency braking
- ⊖ Poor rear visibility
- ⊖ Sluggish handling in slalom test

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 2.61 |
| Crashworthiness: | 6.69 |
| Visibility: | 7.30 |
| Slalom handling: | 6.47 |
| Ride quality: | 7.17 |
| Fuel economy: | 4.81 |
| Interior noise: | 6.21 |
| Acceleration: | 6.29 |
| Ease of entry and exit: | 6.94 |
| Interior size: | 6.37 |
| Turning circle: | 3.17 |
| Cargo capacity: | 2.60 |

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3320** |
| Exterior length (in): | **191.1** |
| Exterior width (in): | **73.4** |
| Exterior height (in): | **58.1** |
| Wheelbase (in): | **110.4** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Hankook 205/65R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 7 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.6L Turbo GDI I4** |
| Horsepower @ rpm: | **178 @ 5500** |

AAA.com/greencar





## **Ford** Fusion Hybrid S

BASE PRICE: **$25,185;** PRICE AS TESTED: **$26,010**

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.45

OVERALL RANKING **47**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **13.5** |
| EPA urban mpg: | **44** |
| EPA highway mpg: | **41** |
| EPA combined mpg: | **42** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0047

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

### OVERALL OBSERVATIONS

Fully redesigned in 2013, the Ford Fusion Hybrid has seen only incremental changes since. We found the 2016 model we tested to be a mixed bag. On one hand, it provided a solid, comfortable ride. The steering feel is excellent, as is brake pedal feel, with short stopping distances. The backseat, too, is comfortable, with good legroom. The EPA-estimated fuel economy is an excellent 42 mpg combined, and the base price of around $25,000 is reasonable. On the other hand, the Fusion Hybrid's acceleration is just mediocre, the engine is loud and rough, the transition from EV power to ICE power could be smoother, trunk space is compromised by the position of the hybrid battery pack, and some controls look cheap and are overly complicated. A redesigned 2017 Fusion Hybrid is expected later this year.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control

### STRONG POINTS

- ⊕ Great steering feel
- ⊕ Good ride quality
- ⊕ Firm brake-pedal feel
- ⊕ Short stopping distances
- ⊕ Release switch raises the trunk to fully-open position

### WEAK POINTS

- ⊖ Very noisy powertrain, especially during acceleration
- ⊖ Some torque steer
- ⊖ Confusing center stack (too many small buttons)
- ⊖ Tiny rearview camera display

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 4.13 |
| Crashworthiness: | 7.13 |
| Visibility: | 7.00 |
| Slalom handling: | 5.74 |
| Ride quality: | 7.38 |
| Fuel economy: | 6.97 |
| Interior noise: | 6.92 |
| Acceleration: | 5.05 |
| Ease of entry and exit: | 6.29 |
| Interior size: | 3.82 |
| Turning circle: | 2.35 |
| Cargo capacity: | 1.65 |

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3640** |
| Exterior length (in): | **191.8** |
| Exterior width (in): | **83.5** |
| Exterior height (in): | **58.2** |
| Wheelbase (in): | **112.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P225/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L IVCT I4 HEV** |
| Horsepower @ rpm: | **141 @ 6000 (188 total)** |
| Electric motor horsepower: | **118 @ 6000 (88 kW)** |

AAA.com/greencar

# Ford Fusion Energi Titanium

BASE PRICE: **$41,295;** PRICE AS TESTED: **$42,485**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

70.92

OVERALL RANKING **50**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity/Regular** |
| Fuel capacity (gal): | **14** |
| EPA urban mpg: | **40** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **38** |
| EPA combined MPGe: | **88** |

### BATTERY CHARGE TIME

120V: 7 HRS

240V: 2.5 HRS

**AVERAGE MPG** (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0040

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control

## OVERALL OBSERVATIONS

The Ford Fusion is a popular midsize sedan with excellent design inside and out. The plug-in hybrid Energi version features a large battery pack that allows for all-electric operation for about 20 miles, providing lower operating costs. As with the Fusion Hybrid, the Energi's acceleration is good. Our test car was well equipped, easy to drive, and very comfortable. The battery pack takes up a lot of space in the trunk, however, giving it much less capacity than a standard Fusion's. Additionally, the MSRP was high, but federal and state tax credits offset some of the cost. The Fusion Energi received 5 stars (out of 5) overall in NHTSA's crash tests. For 2015, the Fusion Energi got a standard rearview camera; there were no significant changes for 2016.

### STRONG POINTS

- Excellent fuel economy
- Meets AT PZEV requirements
- Quality fit and finish
- Comfortable, quiet ride
- Well equipped with safety features

### WEAK POINTS

- Limited trunk size
- A/C and radio controls are hard to use
- Poor braking performance
- Rear seat backfold opens only a tiny slot
- Nose can drag when exiting steep driveways

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 0.31 |
| Crashworthiness: | 7.89 |
| Visibility: | 7.30 |
| Slalom handling: | 4.05 |
| Ride quality: | 7.56 |
| Fuel economy: | 10.00 |
| Interior noise: | 5.86 |
| Acceleration: | 5.46 |
| Ease of entry and exit: | 6.38 |
| Interior size: | 5.57 |
| Turning circle: | 2.84 |
| Cargo capacity: | 0.71 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4180** |
| Exterior length (in): | **191.8** |
| Exterior width (in): | **83.5** |
| Exterior height (in): | **58.0** |
| Wheelbase (in): | **112.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P225/50R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L IVCT I4** |
| Horsepower @ rpm: | **141 @ 6000 (188 total)** |
| Electric motor horsepower: | **118 @ 6000 (88 kW)** |

AAA.com/greencar





# Chrysler 200 Limited

BASE PRICE: **$23,255;** PRICE AS TESTED: **$25,790**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

67.72

OVERALL RANKING **62**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **15.8** |
| EPA urban mpg: | **23** |
| EPA highway mpg: | **36** |
| EPA combined mpg: | **28** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0024

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

The 2015 Chrysler 200 is the latest entry from Fiat Chrysler Automobiles (FCA) into the crowded midsize sedan category. Our test vehicle had the Limited trim level and was well equipped but still had an MSRP of less than $26,000. The 2.4-liter, inline 4-cylinder engine combined with a new 9-speed automatic transmission gives respectable acceleration and fuel economy (EPA-estimated 28 mpg combined). But the 200 really shines on the highway, where it's quiet, comfortable, and rides well. The 200 scored 5 stars (out of 5) overall in NHTSA's crash tests and earned a 2016 Top Safety Pick+ rating from IIHS (with optional front-crash prevention). On the downside, many of the 200's controls are on a touch screen, and they're small, nonintuitive, and potentially distracting. But the 200's attractive looks and performance have finally made FCA a player in the highly contested midsize sedan market. For 2016, the Chrysler 200 is basically unchanged.

### STRONG POINTS

- Good value; well equipped, including Bluetooth, and satellite radio
- New 9-speed automatic transmission
- Quiet on the highway
- Comfortable, roomy front seats
- Smooth ride, except when hitting bumps at freeway speeds

### WEAK POINTS

- Touch screen and controls are small
- Visibility is poor close to the front and rear of the car
- Shifter is a round knob
- Rear-seat entrance is impeded by a low door

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 5.41 |
| Crashworthiness: | 6.88 |
| Visibility: | 6.80 |
| Slalom handling: | 6.05 |
| Ride quality: | 7.04 |
| Fuel economy: | 3.95 |
| Interior noise: | 4.74 |
| Acceleration: | 3.98 |
| Ease of entry and exit: | 6.17 |
| Interior size: | 6.36 |
| Turning circle: | 1.75 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3460** |
| Exterior length (in): | **192.3** |
| Exterior width (in): | **73.6** |
| Exterior height (in): | **58.7** |
| Wheelbase (in): | **108.0** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Goodyear 215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 9 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.4L MultiAir I4** |
| Horsepower @ rpm: | **184 @ 6250** |

AAA.com/greencar


## Large

Sometimes, only a big car will do. If you often need to transport four or five adults in comfort, for instance, or you do a lot of long-distance driving, nothing beats a large car for roominess and comfort. But you can still drive a green machine. The current selection includes the best-selling EV in the world; a car that runs on both gasoline and CNG; a sophisticated hybrid that gets 40 mpg; and high-mpg gasoline-powered cars. Some of these cars are pricey, but several have MSRPs between $30,000 and $40,000—just a little more than the average price of a car today.

BASE PRICE: **$75,000;** PRICE AS TESTED: **$77,700**

# TESLA
## Model S 70D

The Tesla Model S 70D defies EV stereotypes. Sleek styling, blazing acceleration, sporty handling, and an air of sophistication separate the Model S from other alternative-fueled vehicles. Inside, you'll immediately notice the massive 17-inch center display that handles navigation, audio, vehicle settings, and even Internet browsing, although it may confuse those who are less tech-savvy. The standard interior is surprisingly stark and plain. This carries over to the seats, which are flatbottomed, a bit hard, and covered with a utilitarian fabric. Dynamically, the Model S is excellent, with quick, smooth acceleration that makes passing other vehicles a breeze. The ride is comfortably firm. However, on rough road surfaces, drivers feel vibration through the chassis and the steering column. The 70D also exhibits excessive regenerative braking, but it's easy to get accustomed to it. If you're fortunate enough to live or work near a Tesla Supercharger station (next page, upper right), you'll find that a no-cost charge is about as easy as plugging in your phone. NHTSA awarded the Model S 5 stars (out of 5) overall in its crash tests.

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

LEAF RATING:

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision mitigation

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

92.49

OVERALL RANKING **1**

### STRONG POINTS

- ⊕ Excellent power and acceleration
- ⊕ Responsive handling and steering
- ⊕ 17-inch information/entertainment display is a technophile's dream
- ⊕ Radar display shows surrounding vehicles

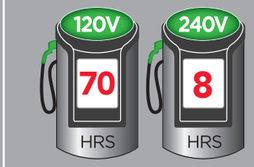
### WEAK POINTS

- ⊖ Center display may be too complicated for some drivers and can be distracting
- ⊖ The driver can feel rough roads through the chassis and steering column
- ⊖ Minimal interior storage except for the large center floor tray
- ⊖ Lower lip of front fascia scrapes on driveways

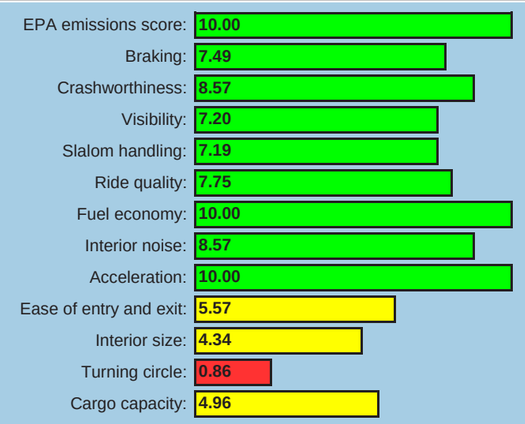
### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Electricity** |
| Battery capacity (kWh): | **70** |
| EPA urban MPGe: | **101** |
| EPA highway MPGe: | **102** |
| EPA combined MPGe: | **101** |
| EPA estimated range (mi.): | **240** |

### BATTERY CHARGE TIME




### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4660** |
| Exterior length (in): | **196.0** |
| Exterior width (in): | **77.3** |
| Exterior height (in): | **56.5** |
| Wheelbase (in): | **116.5** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Michelin 245/45R19** |
| Towing cap. (lbs) w/wo brakes: | **Not Recommended** |
| Transmission type: | **Auto 1 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **3-phase 4-pole AC induction** |
| Horsepower @ rpm: | **328 total** |

AAA.com/greencar

# Acura RLX Sport Hybrid SH-AWD Advance


BASE PRICE: **$65,950;** PRICE AS TESTED: **$66,870**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

79.32

OVERALL RANKING: **9**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **15.1** |
| EPA urban mpg: | **28** |
| EPA highway mpg: | **32** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0021

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Acura's luxury flagship, the RLX sedan, has a hybrid variant, introduced in 2014. It features a 3.5-liter V6 and three electric motors (one on the front axle and two on the rear), which produce a total of 377 hp. The Technology Package, with many advanced safety features—such as forward-collision mitigation with automatic braking, lane-departure intervention, and blind-spot monitoring—is standard on the Sport Hybrid. Our test vehicle also had the high-end Advance package, which features a 360-degree camera. The RLX Hybrid is comfortable, powerful, and rides well, with decent handling. The EPA fuel-economy estimate is 30 mpg in combined driving. Like most hybrid sedans, the trunk is smaller and the rear seat doesn't fold down because of the battery placement. NHTSA hasn't crash tested the Sport Hybrid.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- Comfortable ride
- Loaded with safety and convenience technology
- AWD traction
- LED headlights
- Rear windows open fully

**WEAK POINTS**

- Small trunk; rear seat doesn't fold down
- Uses premium fuel
- Infotainment controls are all on a touch screen, except for a small volume knob that is not backlit
- Complicated controls
- Large turning radius

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 8.11 |
| Crashworthiness: | 8.15 |
| Visibility: | 7.80 |
| Slalom handling: | 6.79 |
| Ride quality: | 8.04 |
| Fuel economy: | 2.38 |
| Interior noise: | 7.55 |
| Acceleration: | 8.47 |
| Ease of entry and exit: | 6.98 |
| Interior size: | 5.70 |
| Turning circle: | 0.00 |
| Cargo capacity: | 2.36 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4360** |
| Exterior length (in): | **196.1** |
| Exterior width (in): | **74.4** |
| Exterior height (in): | **57.7** |
| Wheelbase (in): | **112.2** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Michelin 245/40R19** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 7 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **3.5L SOHC 24V i-VTEC V6** |
| Horsepower @ rpm: | **310 @ 6500 (377 total)** |
| Electric motor horsepower: | **F: 47@3000 / R: 36@4000** |

AAA.com/greencar



# Buick LaCrosse


BASE PRICE: **$36,135;** PRICE AS TESTED: **$36,630**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

73.03

OVERALL RANKING: **37**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **18.6** |
| EPA urban mpg: | **18** |
| EPA highway mpg: | **28** |
| EPA combined mpg: | **21** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0020

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The LaCrosse is Buick's flagship large sedan. The base price for our test car was just over $36,000, and included leather upholstery, heated front seats, rear parking assist, and a rearview camera. Equipped with a 3.6-liter V6 that puts out 304 hp mated to a 6-speed automatic transmission, the LaCrosse rides very well. Without the rearview camera, however, visibility to the rear is limited, because the rear-quarter panels create blind spots, a problem compounded by small side mirrors. (Fortunately, in 2015 a rearview camera became standard.) The overall capacity of the trunk is adequate, but the shape and design present a problem for some cargo. Overall, the LaCrosse has the look and feel of a sedan that costs much more. It scored 5 stars (out of 5) overall in NHTSA's crash tests. For 2016, the IntelliLink infotainment system was updated. A redesigned model year 2017 LaCrosse is due to go on sale later in 2016.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- Good ride quality
- Strong performance
- Roomy, comfortable front seats
- Well equipped, including Bluetooth, satellite radio, and automatic climate control
- Meets stringent PZEV emission standards

**WEAK POINTS**

- Difficult to see to the rear and sides
- Too much road noise
- Vague steering feel
- Mushy brake-pedal feel
- Start-stop button is hidden behind the steering wheel

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 6.35 |
| Crashworthiness: | 7.84 |
| Visibility: | 6.90 |
| Slalom handling: | 5.21 |
| Ride quality: | 7.53 |
| Fuel economy: | 2.43 |
| Interior noise: | 5.60 |
| Acceleration: | 6.72 |
| Ease of entry and exit: | 6.65 |
| Interior size: | 6.26 |
| Turning circle: | 1.94 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4140** |
| Exterior length (in): | **196.9** |
| Exterior width (in): | **73.1** |
| Exterior height (in): | **59.2** |
| Wheelbase (in): | **111.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Goodyear P235/50R18** |
| Towing cap. (lbs) w/wo brakes: | **1000/1000** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **3.6L DOHC 24V VVT V6** |
| Horsepower @ rpm: | **304 @ 6800** |

AAA.com/greencar

# Lexus LS 600h L

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

72.33

OVERALL RANKING **42**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **22.2** |
| EPA urban mpg: | **19** |
| EPA highway mpg: | **23** |
| EPA combined mpg: | **20** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0019

BASE PRICE: **$135,025;** PRICE AS TESTED: **$135,025**

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Lexus thinks that green and performance can go together, so the automaker decided to put the hybrid LS 600h L model at the top of its lineup. The LS 600h L is a marvelous luxury/performance sedan that's powerful, quiet, comfortable, and loaded with just about every convenience and safety feature you can imagine. Its 5.0-liter V8, two electric motors, and CVT move the LS 600h L quickly down the road. Total output is 438 hp, which is still good for a respectable 20 mpg combined and meets strict SULEV II emissions standards. Priced starting at $135,000, the LS 600h L's luxury and performance don't come cheap, but it can compete with offerings from the elite manufacturers of the world and still offer the environmental benefits of a hybrid. Neither NHTSA nor IIHS has crash-tested the LS 600h L.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Powerful, seamless hybrid powertrain
- ⊕ Excellent ride quality
- ⊕ 20 mpg and SULEV II emissions from a 5,700-pound car
- ⊕ Quiet, comfortable, roomy interior
- ⊕ Long list of convenience and safety features
- ⊕ Equipped with a full-size spare tire on a matching wheel

**WEAK POINTS**

- ⊖ Seats only four people
- ⊖ Small trunk; rear seat doesn't fold
- ⊖ High purchase price
- ⊖ Requires premium fuel

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 4.71 |
| Crashworthiness: | 10.00 |
| Visibility: | 7.50 |
| Slalom handling: | 2.03 |
| Ride quality: | 8.44 |
| Fuel economy: | 0.22 |
| Interior noise: | 8.57 |
| Acceleration: | 8.13 |
| Ease of entry and exit: | 7.59 |
| Interior size: | 6.90 |
| Turning circle: | 0.07 |
| Cargo capacity: | 1.18 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/2** |
| Curb weight (lbs): | **5680** |
| Exterior length (in): | **205.1** |
| Exterior width (in): | **73.8** |
| Exterior height (in): | **58.3** |
| Wheelbase (in): | **121.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Michelin 245/45R19** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **5.0L 32V DOHC V8** |
| Horsepower @ rpm: | **389 @ 6400 (438 total)** |
| Electric motor horsepower: | **221 hp (37 kW)** |

AAA.com/greencar





# Toyota Avalon Limited

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

70.70

OVERALL RANKING **53**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **17** |
| EPA urban mpg: | **21** |
| EPA highway mpg: | **31** |
| EPA combined mpg: | **25** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0021

BASE PRICE: **$40,445;** PRICE AS TESTED: **$42,494**

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Toyota redesigned the Avalon in 2013, aiming to attract a younger demographic. Equipped with dynamic radar cruise control, automatic high beams, and a precollision system, our top-of-the-line Limited version was priced at more than $42,000. Blind-spot monitoring and rear cross-traffic alert systems are standard on the 2016 edition of this trim level. With its 3.5-liter V6, which produces 268 hp, the Avalon has great acceleration, handled well on the slalom course, and provides a smooth, comfortable ride (albeit on the firm side). It's EPA-rated at 25 mpg combined, decent for a large nonhybrid sedan. From 2014–2016, the Avalon received only minor feature changes and upgrades.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Quiet, comfortable ride
- ⊕ Easy-to-use navigation system
- ⊕ Bluetooth connectivity
- ⊕ Certified as a ULEV

**WEAK POINTS**

- ⊖ Rear seats don't fold down
- ⊖ High interior noise level
- ⊖ Wide center console limits front legroom
- ⊖ Rear windows don't open fully

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.15 |
| Crashworthiness: | 6.84 |
| Visibility: | 7.20 |
| Slalom handling: | 6.71 |
| Ride quality: | 7.33 |
| Fuel economy: | 3.30 |
| Interior noise: | 4.51 |
| Acceleration: | 7.17 |
| Ease of entry and exit: | 6.87 |
| Interior size: | 6.46 |
| Turning circle: | 1.57 |
| Cargo capacity: | 2.60 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3430** |
| Exterior length (in): | **195.2** |
| Exterior width (in): | **72.2** |
| Exterior height (in): | **57.5** |
| Wheelbase (in): | **111.0** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P255/45R18** |
| Towing cap. (lbs) w/wo brakes: | **1000/1000** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **3.5L DOHC 24V V6** |
| Horsepower @ rpm: | **268 @ 6200** |

AAA.com/greencar

# Toyota Avalon Hybrid XLE Plus

BASE PRICE: **$36,650;** PRICE AS TESTED: **$37,485**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

68.71

OVERALL RANKING **60**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **17** |
| EPA urban mpg: | **40** |
| EPA highway mpg: | **39** |
| EPA combined mpg: | **40** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0031

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

The Toyota Avalon handles well for a big car, is extremely quiet, and delivers a smooth, luxurious ride. It combines a 2.5-liter, 4-cylinder gasoline engine with two electric motors (good for 200 hp total) and a CVT transmission to provide strong acceleration, excellent fuel economy (40 mpg), and low emissions (AT PZEV). There's plenty of room inside, including good backseat legroom. Trunk space is reduced somewhat because of the hybrid battery pack but is still decently sized. Our base-level XLE Plus test car was well equipped, with features such as keyless ignition and entry, dual-zone automatic climate control, leather upholstery, heated front seats, an eight-way power driver's seat, and a rearview camera. Neither NHTSA nor IIHS has crash-tested the Avalon Hybrid.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

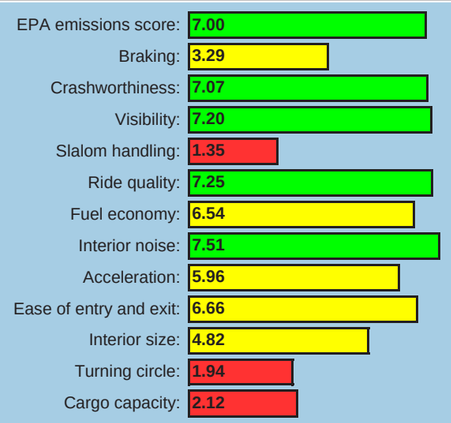
**STRONG POINTS**

- ⊕ Excellent fuel economy
- ⊕ Excellent highway ride quality
- ⊕ Very quiet cabin
- ⊕ Good hybrid power

**WEAK POINTS**

- ⊖ Soft brake-pedal feel
- ⊖ Surprisingly long stopping distances in everyday driving
- ⊖ Very little steering feel
- ⊖ Rear seats don't fold down
- ⊖ Almost no regenerative braking effect

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3594** |
| Exterior length (in): | **195.3** |
| Exterior width (in): | **72.2** |
| Exterior height (in): | **57.5** |
| Wheelbase (in): | **111.0** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin P215/55R17** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.5L DOHC 16V VVT-i I4** |
| Horsepower @ rpm: | **156 @ 5700 (200 total)** |
| Electric motor horsepower: | **141 @ 4500 (105 kW)** |

AAA.com/greencar





# Chevrolet Impala 3LT CNG Bi-Fuel

BASE PRICE: **$40,510;** PRICE AS TESTED: **$42,625**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

63.11

OVERALL RANKING **78**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Natural Gas** |
| Fuel capacity (gal): | **7.8** |
| EPA urban mpg: | **16** |
| EPA highway mpg: | **24** |
| EPA combined MPGe: | **19** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0018

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

With the demise of the Honda Civic Natural Gas, the Chevrolet Impala Bi-Fuel, which has an MSRP of just under $41,000, is the only passenger car sold in the U.S. that runs on CNG (or, in this case, on gasoline, too). It has a special tank in the trunk that holds enough CNG for about 150 miles of city driving; a switch on the dashboard lets the driver shift between the two fuels. EPA-estimated MPGe when burning CNG is 19. The Impala Bi-Fuel has a stylish cabin (apart from some low-grade plastics), plenty of interior room, and a comfortable ride. However, its handling is lackluster, with a mushy brake pedal and a vague steering feel. Also, there's an audible, high-pitched whine during CNG operation.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-Spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Forward-collision warning

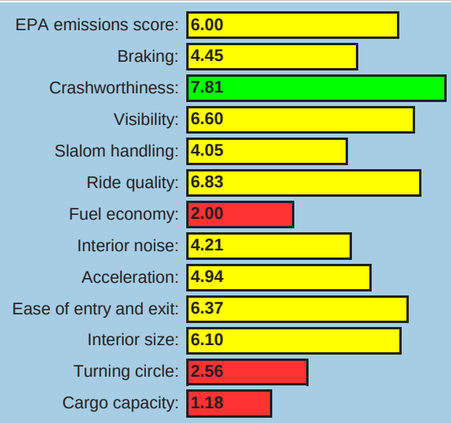
**STRONG POINTS**

- ⊕ Option to drive on either CNG or gasoline, with the combined range of both tanks
- ⊕ Roomy interior
- ⊕ Plenty of interior storage
- ⊕ Stylish leather seats and dashboard

**WEAK POINTS**

- ⊖ Little steering feel
- ⊖ Uninspired handling
- ⊖ Soft brake-pedal feel
- ⊖ Some hard interior plastic materials
- ⊖ Audible high-pitched whine during CNG operation
- ⊖ Small trunk for a large car (because of the CNG tank)

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4120** |
| Exterior length (in): | **201.3** |
| Exterior width (in): | **73.0** |
| Exterior height (in): | **58.9** |
| Wheelbase (in): | **111.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Firestone P235/50R18** |
| Towing cap. (lbs) w/wo brakes: | **1000/454** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **3.6L DOHC Bi-Fuel V6** |
| Horsepower @ rpm: | **230 @ 4800 (CNG)** |

AAA.com/greencar


## Pickup

We've said it before and we'll say it again: Americans love their trucks. Want proof? The Ford F-150, reviewed on this page, has been the country's best-selling truck for 35 years straight and best-selling vehicle in the U.S. for 30 years in a row. But pickup trucks ain't what they used to be—they're better. Pickups have always been tough—you can get more than 200,000 miles out of one if you take care of it—but today's pickups are cushy, too. You want LED lighting, front-collision warning, remote starting, DVD/Blu-ray players, power sunroofs, or 360-degree cameras? No problem. Fuel-saving engines are part of the mix, too, with highway mpg numbers in the mid-20s. And of course there's the utility of that spacious truck bed behind you that can haul up to a ton of anything you can cram into it.

BASE PRICE: **$38,685;** PRICE AS TESTED: **$39,880**

# FORD
## F-150 Supercab Lariat

The Ford F-series has been the top-selling vehicle in the U.S. for many years, and for good reason. Our test vehicle, the aluminum-bodied 2015 Ford F-150, with Ford's turbocharged, 2.7-liter, V6 Ecoboost engine, is rated at 22 mpg in combined driving by EPA, placing at the top in mpg for full-size trucks. The 325-hp V6 performed more like a V8, accelerating our 4,600-pound test truck (down from 5,400 pounds for the 2014 model) from 0 to 60 mph in under 7 seconds. The front seats were capacious, and the rear seats can be folded to achieve SUV-like storage inside the cab. The F-150 was also surprisingly quiet at cruising speeds. However, because it's a full-size truck, the F-150 is hard to get into, U-turns are a challenge, and it won't fit into many parking spots. It earned a 5 star (out of 5) overall safety rating from NHTSA and, with optional front-crash prevention, a Top Safety Pick rating from IIHS. The F-150's payload is up to 2,178 pounds. For 2016, Ford's improved SYNC 3 infotainment system is available.

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Forward-collision warning

### STRONG POINTS

- ⊕ Roomy interior with tremendous cargo capacity and utility
- ⊕ Heated/cooled front seats
- ⊕ Well equipped with standard and optional features including satellite radio, Bluetooth, and a power tailgate opener
- ⊕ Visibility, especially to the front

### WEAK POINTS

- ⊖ Entry/exit is difficult because of ride height (needs running boards)
- ⊖ Large turning radius, difficult to park
- ⊖ Electric parking brake is placed low on the dash

LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

**75.73**

OVERALL RANKING **20**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **23** |
| EPA urban mpg: | **19** |
| EPA highway mpg: | **26** |
| EPA combined mpg: | **22** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

**0017**

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 5.96 |
| Crashworthiness: | 8.01 |
| Visibility: | 7.20 |
| Slalom handling: | 1.45 |
| Ride quality: | 7.04 |
| Fuel economy: | 2.65 |
| Interior noise: | 9.09 |
| Acceleration: | 7.42 |
| Ease of entry and exit: | 6.56 |
| Interior size: | 7.58 |
| Turning circle: | 0.00 |
| Cargo capacity: | 6.77 |

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **3/3** |
| Curb weight (lbs): | **4620** |
| Exterior length (in): | **231.9** |
| Exterior width (in): | **96.8** |
| Exterior height (in): | **75.5** |
| Wheelbase (in): | **145.0** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Michelin 265/60R18** |
| Towing cap. (lbs) w/wo brakes: | **7600/1000** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Rear wheel** |
| Engine size: | **2.7L V6 Ecoboost** |
| Horsepower @ rpm: | **325 @ 5750** |

# Chevrolet Silverado 1500 LT

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.74

OVERALL RANKING **44**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 26 |
| EPA urban mpg: | 17 |
| EPA highway mpg: | 22 |
| EPA combined mpg: | 19 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0016

BASE PRICE: **$41,515;** PRICE AS TESTED: **$42,610**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Chevrolet Silverado 1500 LT is equipped with a 4.3-liter, 285-hp V6. Our test vehicle was a flex fuel–capable 4x4 rated at 19 mpg. The Silverado's cabin is huge and comfortable, and its ride quality is surprisingly good. Full-size trucks have the best instrumentation layouts in the industry, and the Silverado's controls are especially easy to use. This truck sits high off the ground, providing excellent distance visibility, but it's virtually impossible to see anything close to the truck below the hood line. Like other full-size 4x4s, the Silverado is hard to get into, hard to execute U-turns with, and won't fit in many parking spots. NHTSA awarded it a 5-star (out of 5) overall rating in its crash testing. The Silverado's payload is up to 2,133 pounds. Full-size trucks sell in high quantities, and the Chevy Silverado has earned its ranking near the top.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Lane-keeping assist
- Forward-collision warning

**STRONG POINTS**

- Roomy interior with tremendous cargo capacity and utility
- Quiet
- Easy-to-use full instrumentation
- Good ride quality for a 4x4 truck
- Flex-fuel vehicle

**WEAK POINTS**

- Entry/exit difficult due to ride height: needs running boards
- Large turning radius
- Difficult to park
- Poor rear visibility

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 2.11 |
| Crashworthiness: | 9.39 |
| Visibility: | 7.30 |
| Slalom handling: | 1.50 |
| Ride quality: | 6.94 |
| Fuel economy: | 2.00 |
| Interior noise: | 6.26 |
| Acceleration: | 4.90 |
| Ease of entry and exit: | 6.80 |
| Interior size: | 9.06 |
| Turning circle: | 0.00 |
| Cargo capacity: | 9.49 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 3/3 |
| Curb weight (lbs): | 5600 |
| Exterior length (in): | 239.6 |
| Exterior width (in): | 80.0 |
| Exterior height (in): | 73.8 |
| Wheelbase (in): | 153.0 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Bridgestone LT255/70R17 |
| Towing cap. (lbs) w/wo brakes: | 6600 |
| Transmission type: | Auto 6 speed |
| Drivetrain type: | all wheel - part time |
| Engine size: | 4.3L EcoTec3 V6 |
| Horsepower @ rpm: | 285 @ 5300 |

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# Ram 1500 SLT Outdoorsman Crew Cab 4x4

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

69.45

OVERALL RANKING **56**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 32 |
| EPA urban mpg: | 16 |
| EPA highway mpg: | 23 |
| EPA combined mpg: | 19 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0016

BASE PRICE: **$39,445;** PRICE AS TESTED: **$45,150**

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Our Ram 1500 Outdoorsman Crew Cab test vehicle, equipped with a 3.6-liter V6 and an 8-speed automatic transmission, was a 4x4 rated at 19 mpg combined. Truck creature comforts have come a long way in recent years, and the Ram is no exception. At cruising speeds, the cabin was one of the quietest we've tested. The V6 is surprisingly powerful; the Crew Cab has plenty of room for the largest occupants; and there's enough cargo room to haul just about anything (the Ram's payload is up to 1.909 pounds). On the downside, the Ram still rides and handles like a truck. Changes to the Ram 1500 have been minor since 2014.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

**STRONG POINTS**

- Roomy interior with tremendous utility and cargo capacity
- Well equipped, including lockable bed boxes
- 8-speed auto transmission and adjustable ride height help get good mpg for a truck
- Rear windows open fully

**WEAK POINTS**

- The shift lever is a knob that you turn
- Even at low height, step-in is too high
- Confusing HVAC controls
- Rides and handles like a truck
- Poor rear visbility

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 0.00 |
| Crashworthiness: | 8.39 |
| Visibility: | 7.30 |
| Slalom handling: | 1.33 |
| Ride quality: | 6.53 |
| Fuel economy: | 2.00 |
| Interior noise: | 7.98 |
| Acceleration: | 4.49 |
| Ease of entry and exit: | 7.04 |
| Interior size: | 8.39 |
| Turning circle: | 0.00 |
| Cargo capacity: | 10.00 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 5600 |
| Exterior length (in): | 229.0 |
| Exterior width (in): | 79.4 |
| Exterior height (in): | 77.5 |
| Wheelbase (in): | 140.0 |
| Restraint type: | 6 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Goodyear LT265/70R17 |
| Towing cap. (lbs) w/wo brakes: | 7650 Max |
| Transmission type: | Auto 8 speed |
| Drivetrain type: | All wheel - part time |
| Engine size: | 3.6L V6 Flex Fuel |
| Horsepower @ rpm: | 305 @ 6350 |

AAA.com/greencar


BASE PRICE: **$26,995;** PRICE AS TESTED: **$31,535**

# SUV

SUVs are all about utility and versatility. Most SUVs today are actually crossovers, with carlike unibodies rather than traditional body-on-frame construction. And most spend their time only on paved roads. The greenest SUVs are compact and midsize, like Honda's new HR-V or the venerable Toyota Highlander Hybrid. Because SUVs are tall, they have more room inside than comparably sized sedans or hatchbacks, and they provide a higher seating position that makes driving easier. They also have liftgates that, like those on a hatchback, make it easier to load cargo into the rear. And if you need to tow a trailer but don't care for pickups, most SUVs are up to the challenge. Finally, there are plenty of green SUVs to choose from—hybrids, diesels, and SUVs with conventional internal combustion engine powertrains.

## SUBARU
## Outback 2.5i Premium

Redesigned for 2015, the Subaru Outback is a 4-door SUV equipped with a 2.5-liter 4-cylinder "boxer" engine and AWD. Dual-zone automatic climate control, heated seats, and Bluetooth connectivity are also standard. Our Premium test vehicle also had Subaru's excellent EyeSight crash-prevention system. For 2015, Subaru introduced steering-responsive fog lights, which come on automatically when you turn the car, shining light around the corner. Overall, the Outback handles well, and has decent room inside and a comfortable ride. And since the Outback is a PZEV, you get a rugged vehicle that's easier on the environment. It gets a 5 star (out of 5) overall crash-test rating from NHTSA. It's also an IIHS Top Safety Pick+ for 2015 and 2016 (with optional front-crash prevention).





NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Adaptive cruise control
- Lane-departure warning
- Lane-keeping assist
- Forward-collision warning
- Forward-collision mitigation
- Forward-collision avoidance

### STRONG POINTS

- Roomy, flexible interior
- AWD traction
- Certified as a PZEV

### WEAK POINTS

- Slightly underpowered
- Too many potentially distracting controls on the touch screen
- Cargo in the trunk is in plain view
- High doorsills impede entry and exit

### TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 8.11 |
| Crashworthiness: | 7.50 |
| Visibility: | 7.60 |
| Slalom handling: | 6.14 |
| Ride quality: | 7.13 |
| Fuel economy: | 3.95 |
| Interior noise: | 6.79 |
| Acceleration: | 4.20 |
| Ease of entry and exit: | 6.51 |
| Interior size: | 7.36 |
| Turning circle: | 3.47 |
| Cargo capacity: | 7.20 |

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LEAF RATING:

### OVERALL SCORE

58.89 LOWEST — HIGHEST 92.49

81.96

OVERALL RANKING 5

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 18.2 |
| EPA urban mpg: | 25 |
| EPA highway mpg: | 33 |
| EPA combined mpg: | 28 |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0024

### VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3900 |
| Exterior length (in): | 189.6 |
| Exterior width (in): | 72.4 |
| Exterior height (in): | 66.1 |
| Wheelbase (in): | 108.1 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Bridgestone 225/65R17 |
| Towing cap. (lbs) w/wo brakes: | 2700/1000 |
| Transmission type: | CVT |
| Drivetrain type: | All wheel - full time |
| Engine size: | 2.5L DOHC Flat 4 |
| Horsepower @ rpm: | 175 @ 5800 |

## Toyota Highlander Hybrid Limited


BASE PRICE: **$47,300;** PRICE AS TESTED: **$50,650**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

80.17

**OVERALL RANKING** 8

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 17.2 |
| EPA urban mpg: | 27 |
| EPA highway mpg: | 28 |
| EPA combined mpg: | 28 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0021

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

Redesigned for 2014, the Toyota Highlander Hybrid has most traditional SUV virtues but avoids typical SUV vices. For example, it's versatile and has lots of room, but it's not so large as to appear arrogant, and it gets better combined fuel economy—28 mpg—than many sedans. What's more, its safety and toughness are more than skin deep: It scores an overall 5-star (out of 5) crash-test rating from NHTSA and comes equipped with front, side, driver's knee, and three-row side curtain air bags. Another plus is Toyota's well-deserved reputation for reliability. All in all, the Highlander Hybrid is a rare example of being able to "have your cake and eat it, too." For 2015 and 2016, the Highlander Hybrid is unchanged.

**STRONG POINTS**

- ⊕ Roomy, adaptable interior
- ⊕ Good mpg for an SUV
- ⊕ Loaded with safety and convenience features
- ⊕ Comfortable ride
- ⊕ California versions meet SULEV emissions

**WEAK POINTS**

- ⊖ High purchase price
- ⊖ Lots of body roll and sloppy handling in slalom course
- ⊖ Dash controls are too far away from shorter drivers
- ⊖ Vague steering feel with some torque steer
- ⊖ Tall door sill impedes entry and exit
- ⊖ Large turning circle

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 7.00 |
| Braking: | 3.18 |
| Crashworthiness: | 8.85 |
| Visibility: | 7.40 |
| Slalom handling: | 5.99 |
| Ride quality: | 7.25 |
| Fuel economy: | 3.95 |
| Interior noise: | 6.79 |
| Acceleration: | 6.33 |
| Ease of entry and exit: | 6.72 |
| Interior size: | 7.02 |
| Turning circle: | 0.90 |
| Cargo capacity: | 8.80 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/2/3 |
| Curb weight (lbs): | 4861 |
| Exterior length (in): | 191.1 |
| Exterior width (in): | 75.8 |
| Exterior height (in): | 70.1 |
| Wheelbase (in): | 110.0 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Toyo P245/55R19 |
| Towing cap. (lbs) w/wo brakes: | 3500 |
| Transmission type: | CVT |
| Drivetrain type: | All wheel - full time |
| Engine size: | 3.5L DOHC 24V V6 |
| Horsepower @ rpm: | 231 @ 5800 (280 total) |

AAA.com/greencar





## Subaru Forester 2.5i Touring


BASE PRICE: **30,820;** PRICE AS TESTED: **$32,220**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

75.63

**OVERALL RANKING** 21

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 15.9 |
| EPA urban mpg: | 24 |
| EPA highway mpg: | 32 |
| EPA combined mpg: | 27 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

The Subaru Forester was completely redesigned for 2014. Our 2.5i Touring version, powered by a 2.5-liter "boxer" 4-cylinder engine that delivers 170 hp, was a certified PZEV that delivered a comfortable, quiet ride. A worthy family vehicle, the Forester has an EPA combined rating of 27 mpg, excellent for an AWD SUV; our test vehicle averaged 25 mpg. Although it's not as large as some SUVs, the Forester has a roomy interior and great visibility. The adaptive cruise control and lane-departure warning systems are nice safety features to have, although the lane-departure system in our test car didn't always function perfectly. The Forester scored 5 stars (out of 5) overall in NHTSA's crash tests and received a Top Safety Pick+ rating from IIHS for 2014–2016 (with optional front-crash prevention). Noteworthy changes include a standard rearview camera for 2015 and an improved touch-screen interface for 2016.

**STRONG POINTS**

- ⊕ Comfortable ride, excellent visibility
- ⊕ Flexible interior
- ⊕ Certified PZEV
- ⊕ Power liftgate
- ⊕ Bluetooth connectivity

**WEAK POINTS**

- ⊖ Underpowered
- ⊖ Too much road noise in the cabin
- ⊖ Soft brake feel
- ⊖ Rear windows don't open fully
- ⊖ Insufficient instrumentation

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 5.68 |
| Crashworthiness: | 6.90 |
| Visibility: | 7.50 |
| Slalom handling: | 4.32 |
| Ride quality: | 7.17 |
| Fuel economy: | 3.73 |
| Interior noise: | 5.68 |
| Acceleration: | 3.86 |
| Ease of entry and exit: | 6.88 |
| Interior size: | 7.17 |
| Turning circle: | 4.48 |
| Cargo capacity: | 6.25 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3470 |
| Exterior length (in): | 180.9 |
| Exterior width (in): | 70.7 |
| Exterior height (in): | 68.2 |
| Wheelbase (in): | 103.9 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Yokohama P225/60R17 |
| Towing cap. (lbs) w/wo brakes: | 1500/1000 |
| Transmission type: | CVT |
| Drivetrain type: | All wheel - full time |
| Engine size: | 2.5L DOHC Flat 4 |
| Horsepower @ rpm: | 170 @ 5800 |

AAA.com/greencar

## Lexus NX 300h

BASE PRICE: **$47,045;** PRICE AS TESTED: **$47,045**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

74.51

OVERALL RANKING **28**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel Type: | **Regular** |
| Fuel Capacity (gal): | **14.8** |
| EPA Urban mpg: | **33** |
| EPA Highway mpg: | **30** |
| EPA Combined mpg: | **32** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0027

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Lexus NX series is the automaker's entry into the luxury compact crossover category. We tested the NX 300h, a hybrid featuring a 2.5-liter, 154-hp gasoline engine and three electric motors (one powers the rear axle to provide AWD). This combination provides high fuel economy (32 mpg combined) and meets stringent SULEV 30 emission standards, but it lags somewhat in performance: The gas engine drones under hard acceleration. Our test vehicle was well equipped, handled nimbly, and proved easy and comfortable to drive around town. It had the expected flexibility of an SUV, but its small windows limit visibility, and the trunk area is small with the rear seats in place. NHTSA gave the NX 300h a 5 star (out of 5) overall crash-test rating. IIHS awarded the 2016 NX series a Top Safety Pick+ (with optional front-crash prevention). For 2016, the NX 300h is basically unchanged.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Forward-collision warning
- Forward-collision avoidance

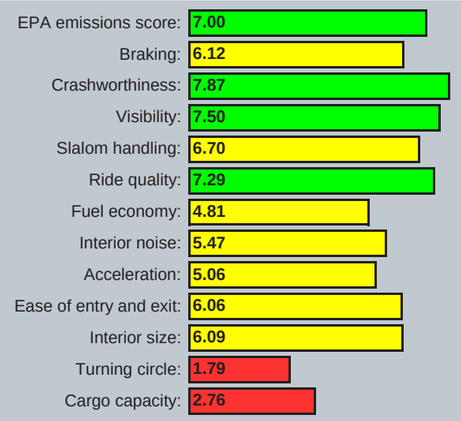
**STRONG POINTS**

- ⊕ High fuel economy
- ⊕ Nimble handling; easy to drive
- ⊕ Comfortable ride quality on the freeway
- ⊕ Flexible interior can hold many combinations of luggage and passengers
- ⊕ Well equipped, including navigation, satellite radio, and heated/cooled seats

**WEAK POINTS**

- ⊖ Underpowered
- ⊖ Too much engine noise
- ⊖ Too many controls on the touch screen; can be distracting
- ⊖ Some controls are hard to reach
- ⊖ Engine stop/start is abrupt, can be startling
- ⊖ Feels top-heavy in near-limit maneuvers

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4160** |
| Exterior length (in): | **182.3** |
| Exterior width (in): | **83.9** |
| Exterior height (in): | **64.8** |
| Wheelbase (in): | **104.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 225/60R18** |
| Towing cap. (lbs) w/wo brakes: | **1500 Max.** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.5L DOHC 16V I4** |
| Horsepower @ rpm: | **154 @ 5700 (194 total)** |
| Electric motor horsepower: | **141 hp (105 kW)** |

AAA.com/greencar





## Mazda CX-5 Touring AWD

BASE PRICE: **$26,660;** PRICE AS TESTED: **$29,375**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

74.41

OVERALL RANKING **29**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **15.3** |
| EPA urban mpg: | **24** |
| EPA highway mpg: | **30** |
| EPA combined mpg: | **26** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★½

## OVERALL OBSERVATIONS

The CX-5 is Mazda's compact SUV, known for its responsive handling, good fuel economy, and reliability. We tested the Touring version with a 2.5-liter, 4-cylinder engine rated at 184 hp, a 6-speed automatic transmission, and AWD. It's EPA rated at 26 mpg combined, has a base price of about $27,000, and enough room to haul kids around or take a family on vacation. Another nice feature was its adaptive HID headlamps, which make nighttime driving easier and safer. The CX-5's downsides are few but significant: high interior noise levels and a harsh ride. Still, with all its optional equipment, the CX-5 delivered good value, with an MSRP under $30,000. NHTSA awarded the CX-5 an overall crash-test rating of 4 stars (out of 5). And from 2014–2016, IIHS has awarded the CX-5 a Top Safety Pick+ rating (with optional front-crash prevention). For 2016, the CX-5 gets minor exterior styling changes, better materials in the cabin, an upgraded infotainment system, and more sound insulation.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

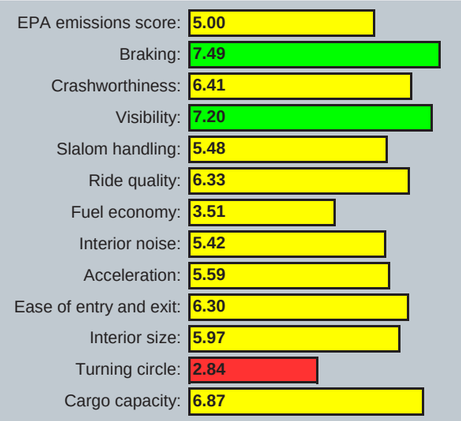
**STRONG POINTS**

- ⊕ Utility, versatility
- ⊕ Bright, adaptive HID headlamps

**WEAK POINTS**

- ⊖ Excessive engine noise
- ⊖ Small rear window limits visibility
- ⊖ Blind spots in the rear quarter panels
- ⊖ Body shake on rough roads

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3480** |
| Exterior length (in): | **179.3** |
| Exterior width (in): | **72.4** |
| Exterior height (in): | **67.3** |
| Wheelbase (in): | **106.3** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Yokohama P225/65R17** |
| Towing cap. (lbs) w/wo brakes: | **2000/1000** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.5L DOHC I4** |
| Horsepower @ rpm: | **184 @ 5700** |

AAA.com/greencar

## Toyota RAV4 Hybrid Limited

BASE PRICE: **$34,510;** PRICE AS TESTED: **$35,865**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

73.95

OVERALL RANKING **33**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14.8** |
| EPA urban mpg: | **34** |
| EPA highway mpg: | **31** |
| EPA combined mpg: | **33** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0027

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

In 2016, Toyota finally gave its fans what they've waited for in the RAV4 Hybrid: a compact crossover with a hybrid drive. Our Limited model was well equipped, with a stylish brown leatherette interior, a sport steering wheel, and sport seats with big bolsters to keep the driver and front passenger in place during cornering. Unfortunately, the RAV4 Hybrid's sporty exterior and interior styling don't carry over to its vehicle dynamics. The handling is fine, but the variable-ratio steering is usually either too light (at low speeds) or too heavy. There's also some torque steer, and when accelerating hard, the steering feels too light. At an EPA-rated 33 mpg combined, fuel economy is good but not great, considering that several midsize and large hybrid sedans achieve 40 mpg.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

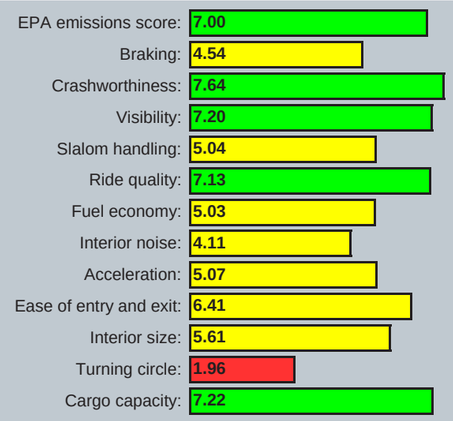
**STRONG POINTS**

- Attractive interior styling
- Good—but not great—fuel economy
- Sport seats
- Spacious rear-seating area
- Selectable driving modes (EV, Eco, and Sport)

**WEAK POINTS**

- Sport seats may be tight for larger individuals
- Variable ratio steering can be either too light or too heavy
- Some torque steer
- Steering gets light during hard acceleration
- Gasoline engine comes on with a bang during start and hard acceleration
- Navigation/entertainment touch-panel display can be overly sensitive to inputs

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)




**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4000** |
| Exterior length (in): | **181.1** |
| Exterior width (in): | **72.6** |
| Exterior height (in): | **67.1** |
| Wheelbase (in): | **104.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Bridgestone 235/55R18** |
| Towing cap. (lbs) w/wo brakes: | **1750** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.5L DOHC 16V VVT-i I4** |
| Horsepower @ rpm: | **150 @ 5700 (194 total)** |
| Electric motor horsepower: | **F: 141 (105kW) R: 67 (50kW)** |

AAA.com/greencar



## Lexus RX 450h

BASE PRICE: **$53,635;** PRICE AS TESTED: **$59,255**

### LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

72.40

OVERALL RANKING **39**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Premium** |
| Fuel capacity (gal): | **17.2** |
| EPA urban mpg: | **30** |
| EPA highway mpg: | **28** |
| EPA combined mpg: | **30** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

Introduced in 2010, the Lexus RX 450h was the first green luxury SUV on the market. Its V6 engine and two electric motors (three for AWD models) generate 308 hp, offering both performance and great fuel economy—30 mpg combined. The RX 450h is impeccably finished and provides a responsive, luxurious ride. It's loaded with the safety, comfort, and convenience features you'd expect, including LED exterior lighting, rearview camera, reclining rear seats, heated and ventilated front seats, and available blind-spot monitoring with rear cross-traffic alert. However, despite the hybrid system's power, our 0–60 mph time was only a slightly better-than-average 7.5 seconds. Also, the joystick navigation and multimedia controller remain controversial, liked by some testers and disliked by others. NHTSA has not yet crash-tested the 2016 RX 450h.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

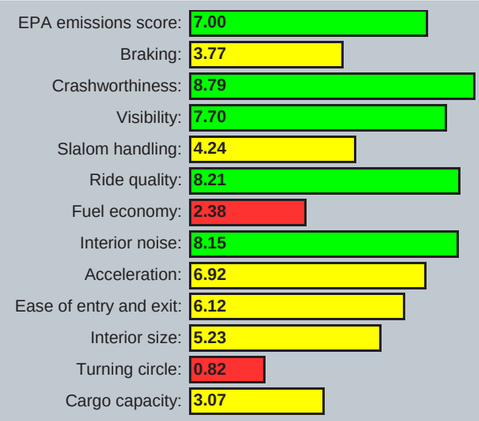
**STRONG POINTS**

- Great fuel economy for its size (30 mpg EPA combined)
- Excellent ride quality
- Very quiet cabin
- Good hybrid power

**WEAK POINTS**

- Handling is just okay for a vehicle with so many superlatives
- Getting into the vehicle is slightly difficult because of its height and lack of running boards
- High purchase price

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)




**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **4820** |
| Exterior length (in): | **192.5** |
| Exterior width (in): | **74.6** |
| Exterior height (in): | **67.7** |
| Wheelbase (in): | **109.8** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Bridgestone 235/55R20** |
| Towing cap. (lbs) w/wo brakes: | **3500** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **3.5L 24V DOHC VVT V6** |
| Horsepower @ rpm: | **259 @ 6000 (308 total)** |
| Electric motor horsepower: | **165 Front / 67 Rear** |

AAA.com/greencar

# Jeep Grand Cherokee Summit 4X4

BASE PRICE: **$52,190;** PRICE AS TESTED: **$57,190**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.98

OVERALL RANKING **43**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Diesel #2 |
| Fuel capacity (gal): | 24.6 |
| EPA urban mpg: | 21 |
| EPA highway mpg: | 28 |
| EPA combined mpg: | 24 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0023

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

## OVERALL OBSERVATIONS

The Jeep Grand Cherokee was a prototypical "tough" SUV when it disappeared from the market several years ago, but the reintroduced 2014 model turns that image around a bit: Our Summit test vehicle was tough but also plush. It came with adaptive cruise control, rearview camera, heated/ventilated front seats, heated rear seats and steering wheel, and a Harmon Kardon sound system with 19 speakers. All these amenities don't undermine the Jeep's green cred, though: Its new 3-liter, 240-hp, V6 diesel engine gets 24 mpg combined for this 5,500-pound SUV. Plus, the Grand Cherokee has plenty of room for passengers and their stuff, and it carries them with a surprisingly smooth ride. Naturally, none of this comes cheap—our test car's MSRP was more than $57,000.

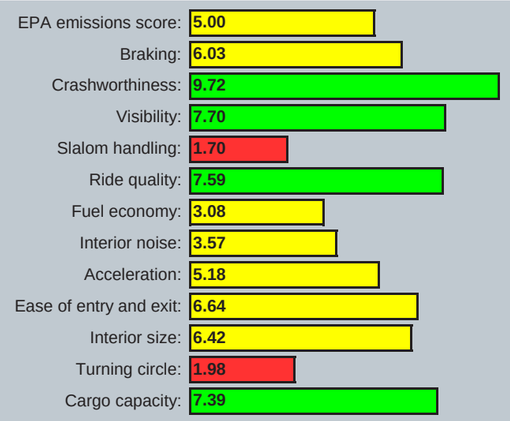
**STRONG POINTS**

- Utility and flexibility
- Good fuel economy for a vehicle of this size
- Loaded with safety and convenience features
- Plush interior
- Strong torque
- AWD traction
- Good visibility
- Rear seats recline

**WEAK POINTS**

- High purchase price
- Sloppy handling in slalom test
- High step-in
- Unusual shifter

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 5480 |
| Exterior length (in): | 189.8 |
| Exterior width (in): | 76.5 |
| Exterior height (in): | 69.3 |
| Wheelbase (in): | 114.8 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Goodyear P265/50R20 |
| Towing cap. (lbs) w/wo brakes: | 7200 Max. |
| Transmission type: | Auto 8 speed |
| Drivetrain type: | All wheel - full time |
| Engine size: | 3.0L ECO-Diesel V6 |
| Horsepower @ rpm: | 240 @ 3600 |

AAA.com/greencar





# Hyundai Tucson Fuel Cell

BASE PRICE: **$50,895;** PRICE AS TESTED: **$50,895**

## LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST — HIGHEST 92.49

71.11

OVERALL RANKING **48**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Hydrogen |
| Fuel capacity (gal): | 37 |
| EPA urban MPGe: | 49 |
| EPA highway MPGe: | 51 |
| EPA combined MPGe: | 50 |

**AVERAGE MPGe AS TESTED BY AUTO CLUB**

0047

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

## OVERALL OBSERVATIONS

Hyundai introduced the Tucson Fuel Cell in mid-2014, and this is the first fuel-cell vehicle we've reviewed in the *AAA Green Car Guide*. It's adapted from the gasoline-powered Tucson and is available—for lease only—in certain areas of California. In a fuel-cell vehicle, electricity, produced onboard by a chemical reaction of hydrogen and water, powers the vehicle. Typically, strong electric-motor torque is a benefit of electric vehicles, but the Tucson had very little low-end torque from a stop and was weak on passing power at speed. It also produced some body roll and long stopping distances at the test track, although during everyday driving, the handling, stopping, and acceleration were, for the most part, fine. Negatives include a dated-looking interior full of hard plastics, a cargo lift-over height that's high, and no spare tire—just a tire-inflator kit. Also, when you turn off the vehicle, the display asks you to wait for a full eight seconds before exiting. Neither NHTSA nor IIHS has crash-tested the Tucson Fuel Cell.

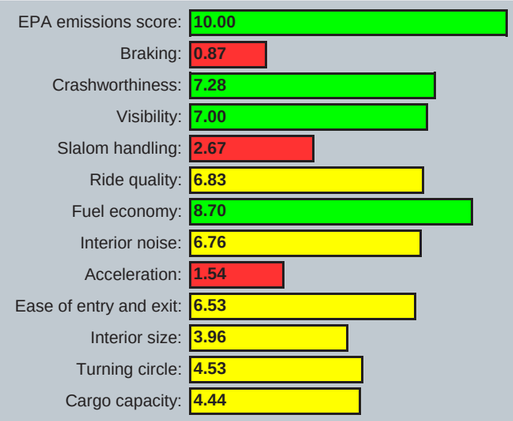
**STRONG POINTS**

- Good drivability
- High-tech fuel-cell powertrain
- Much longer range than most battery-electric vehicles
- Free hydrogen fuel (for now)

**WEAK POINTS**

- Unavailability of hydrogen fuel
- No bottom-end torque
- Weak passing power
- Long stopping distances
- Dated, plastic-filled interior

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2015 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 4100 |
| Exterior length (in): | 173.6 |
| Exterior width (in): | 71.7 |
| Exterior height (in): | 65.2 |
| Wheelbase (in): | 103.9 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | Fully covered by lease |
| Tire manufacturer and size: | Kumho 225/60R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | Auto 1 speed |
| Drivetrain type: | Front wheel |
| Engine size: | Hydrogen Fuel Cell |
| Horsepower @ rpm: | 134 @ 5000 |

AAA.com/greencar

# Subaru Crosstrek Hybrid

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

70.84

OVERALL RANKING **51**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 13.7 |
| EPA urban mpg: | 29 |
| EPA highway mpg: | 33 |
| EPA combined mpg: | 31 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0026

BASE PRICE: **$30,120;** PRICE AS TESTED: **$30,120**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Crosstrek Hybrid, Subaru's first commercially available hybrid, combines the utility and ground clearance of an SUV with the smaller exterior size and low center of gravity of a passenger car. It's rated at 31 mpg combined by EPA—only 3 mpg more than the nonhybrid version. We got 26 mpg with our test vehicle, which was equipped with a rearview camera, sunroof, Bluetooth, and heated seats. Typical of most Subarus, it had AWD, which provides improved traction in any weather. The Crosstrek Hybrid's 160-hp drivetrain could use more power, but otherwise its on-road manners are good. However, the controls for the navigation and sound system are a step backward from the excellent controls on earlier Subaru models. The Crosstrek Hybrid received an overall rating of 5 stars (out of 5) in NHTSA's crash tests. For 2016, the Hybrid gets freshened front styling and standard blind-spot monitoring, rear cross-traffic alert, and lane-keeping assist.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-keeping assist

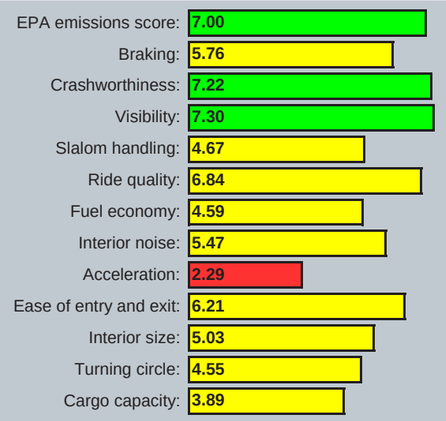
**STRONG POINTS**

- AWD traction
- Good fuel economy
- Certified AT PZEV
- Well equipped, including navigation, Bluetooth, and satellite radio
- Good forward visibility

**WEAK POINTS**

- Underpowered
- Engine stop-start system isn't smooth
- Touch-screen radio controls distract from driving
- Front seat has to be moved forward to fold down the backseat
- Lack of traditional instrumentation

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2014 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 3700 |
| Exterior length (in): | 175.2 |
| Exterior width (in): | 70.1 |
| Exterior height (in): | 63.6 |
| Wheelbase (in): | 103.7 |
| Restraint type: | 9 air bags or more |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Yokohama P225/55R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | All wheel - full time |
| Engine size: | 2.0L DOHC Flat 4 |
| Horsepower @ rpm: | 148 @ 6000 (160 total) |
| Electric motor horsepower: | 13 hp |

AAA.com/greencar





# Honda HR-V EX-L NAVI

LEAF RATING:

**OVERALL SCORE**

58.89 LOWEST HIGHEST 92.49

69.01

OVERALL RANKING **57**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | Regular |
| Fuel capacity (gal): | 13.2 |
| EPA urban mpg: | 28 |
| EPA highway mpg: | 35 |
| EPA combined mpg: | 31 |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0028

BASE PRICE: **$24,590;** PRICE AS TESTED: **$25,470**

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

For 2016, Honda released its entry in the increasingly popular compact-crossover market, the HR-V, which is based on the Honda Fit. It's equipped with a 1.8-liter, 4-cylinder, 141-hp engine and a CVT transmission. We averaged almost 28 mpg during our testing. The HR-V is priced in the neighborhood of $25,000, but it's surprisingly well-equipped, including satellite radio, moonroof, navigation, fog lights, and Bluetooth. Even though it's relatively small, the HR-V has a sporty driving demeanor and a flexible Magic Seat interior that can be configured to haul passengers or a wide variety of cargo. On the downside, it feels underpowered at anything but around-town speeds, and the cabin is noisy under even moderate acceleration. The HR-V received a 5 star (out of 5) overall crash-test rating from NHTSA.

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera

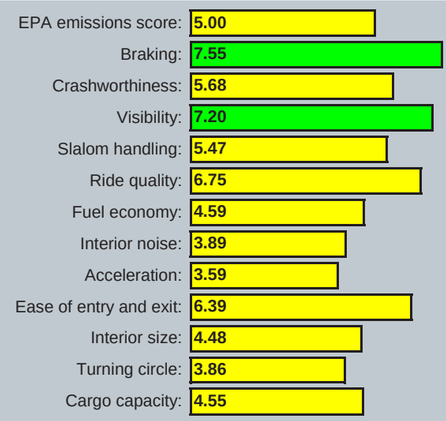
**STRONG POINTS**

- Well equipped for $25,000
- Good fuel economy
- Easy to drive
- Lots of interior space for a small vehicle
- Side-view camera
- Rear seats fold flat

**WEAK POINTS**

- Underpowered, with lots of engine noise
- A/C and radio controls have no knobs
- The rear seat is difficult to enter and exit
- Car lacks rear center armrest
- Electric parking brake

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)




## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | 2016 |
| Number of passengers (F/R): | 2/3 |
| Curb weight (lbs): | 2960 |
| Exterior length (in): | 169.1 |
| Exterior width (in): | 69.8 |
| Exterior height (in): | 63.2 |
| Wheelbase (in): | 102.8 |
| Restraint type: | 8 air bags |
| Warranty (months/miles): | 36/36,000 |
| Tire manufacturer and size: | Michelin 215/55R17 |
| Towing cap. (lbs) w/wo brakes: | Not recommended |
| Transmission type: | CVT |
| Drivetrain type: | Front wheel |
| Engine size: | 1.8L SOHC 16V i-VTEC I4 |
| Horsepower @ rpm: | 141 @ 6500 |

AAA.com/greencar

# Mazda CX-3 Grand Touring

BASE PRICE: **$24,990;** PRICE AS TESTED: **$28,340**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

66.52

OVERALL RANKING **66**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **12.7** |
| EPA urban mpg: | **29** |
| EPA highway mpg: | **35** |
| EPA combined mpg: | **31** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0027

NHTSA SAFETY RATINGS (2016 MODEL): **N/A**

## OVERALL OBSERVATIONS

For 2016, Mazda released the CX-3, its entry in the crowded compact crossover market. It's equipped with a 2.0-liter, 4-cylinder, 146-hp engine and a 6-speed automatic transmission; EPA combined fuel economy is rated 31 mpg. Our test vehicle was the top-of-the-line Grand Touring version, which sells for about $28,000. It came well equipped, sporting a list of features befitting a luxury car, such as 18-inch alloy wheels, adaptive LED headlights, a sunroof, navigation, and a satellite radio. Mazda prides itself on creating drivers' cars, and the CX-3 is no exception. It provides responsive handling, with precise steering and a comfortable (if firm) ride—although some engine and road noise invade the cabin. The front seats are roomy and comfortable, but the backseat is another story. It's hard to get in and out of and useless for adult passengers. At press time, neither NHTSA nor IIHS had crash-tested the CX-3.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

### STRONG POINTS

- ⊕ Easy and enjoyable to drive, in part due to the high seating position
- ⊕ Good value: well equipped for $28,000, including automatic climate control, LED headlights, and some safety features
- ⊕ Good fuel economy
- ⊕ Roomy and comfortable heated front seats

### WEAK POINTS

- ⊖ Noisy powertrain
- ⊖ Clumsy, nonintuitive infotainment controls
- ⊖ Cramped rear seat with no center armrest or cup holders
- ⊖ Entry and exit difficult, especially in the rear
- ⊖ Lack of instrumentation
- ⊖ Armrest is over the cup holders, so tall drinks won't fit

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.87 |
| Crashworthiness: | 5.57 |
| Visibility: | 6.90 |
| Slalom handling: | 6.77 |
| Ride quality: | 6.38 |
| Fuel economy: | 4.59 |
| Interior noise: | 4.34 |
| Acceleration: | 5.01 |
| Ease of entry and exit: | 5.92 |
| Interior size: | 4.09 |
| Turning circle: | 3.49 |
| Cargo capacity: | 2.60 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2880** |
| Exterior length (in): | **168.3** |
| Exterior width (in): | **69.6** |
| Exterior height (in): | **60.7** |
| Wheelbase (in): | **101.2** |
| Restraint type: | **8 air bags** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Yokohama P215/50R18** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.0L I4 Skyactiv** |
| Horsepower @ rpm: | **146 @ 6000** |

AAA.com/greencar



# Chevrolet Trax LT FWD

BASE PRICE: **$22,445;** PRICE AS TESTED: **$23,815**

## LEAF RATING:

### OVERALL SCORE

**58.89** LOWEST HIGHEST **92.49**

66.34

OVERALL RANKING **68**

### FUEL INFORMATION

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14** |
| EPA urban mpg: | **26** |
| EPA highway mpg: | **34** |
| EPA combined mpg: | **29** |

### AVERAGE MPG AS TESTED BY AUTO CLUB

0028

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★★

## OVERALL OBSERVATIONS

The Trax crossover is equipped with a turbocharged, 1.4-liter, 4-cylinder engine, good for 138 hp, and a 6-speed automatic transmission. We averaged over 28 mpg during our testing. Our test vehicle was priced below $24,000, so we didn't expect too many creature comforts. But, as it turned out, it came equipped with the necessities and more. A rearview camera is standard—which is a good thing because of the limited rear visibility. And even though it's small, the Trax's flexible interior can be configured to haul passengers or a wide variety of cargo. The Trax received 5 stars (out of 5) overall from NHTSA in its crash tests. For 2016, the Trax is essentially unchanged.

### AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

### STRONG POINTS

- ⊕ Good fuel economy
- ⊕ Utility—even the front passenger seat folds down for hauling long objects
- ⊕ Well equipped for the price, including Bluetooth, satellite radio, and 10 air bags
- ⊕ Lots of cup holders

### WEAK POINTS

- ⊖ Lots of road and tire noise
- ⊖ Sloppy handling
- ⊖ Rear seat cramped; difficult to enter and exit
- ⊖ Large rear headrests limit visibility
- ⊖ Front end scrapes when exiting a driveway

## TEST DATA TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 6.56 |
| Crashworthiness: | 5.96 |
| Visibility: | 6.80 |
| Slalom handling: | 3.98 |
| Ride quality: | 6.75 |
| Fuel economy: | 4.16 |
| Interior noise: | 3.61 |
| Acceleration: | 3.88 |
| Ease of entry and exit: | 6.70 |
| Interior size: | 4.95 |
| Turning circle: | 3.75 |
| Cargo capacity: | 3.23 |

## VEHICLE SPECIFICATIONS

| | |
|---|---|
| Model year tested: | **2015** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **2805** |
| Exterior length (in): | **168.4** |
| Exterior width (in): | **69.9** |
| Exterior height (in): | **65.2** |
| Wheelbase (in): | **100.6** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Continental P205/70R16** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **1.4L VVT DOHC Turbo I4** |
| Horsepower @ rpm: | **138 @ 4900** |

AAA.com/greencar

## **Subaru** Crosstrek 2.0i Premium

BASE PRICE: **$22,395;** PRICE AS TESTED: **$26,240**

**LEAF RATING:**

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

64.39

**OVERALL RANKING** 74

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **15.9** |
| EPA urban mpg: | **26** |
| EPA highway mpg: | **34** |
| EPA combined mpg: | **29** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

### OVERALL OBSERVATIONS

The Crosstrek, Subaru's small crossover, has many typical Subaru attributes: AWD, a boxer engine with some of the sportiest sounds of any 4-cylinder out there, and the rugged Subaru styling that targets adventurous drivers. The Crosstrek's handling, however, isn't especially sharp; there's a slight delay from the steering input to the vehicle taking a set and turning. The ride, too, is a bit choppy. Subaru's EyeSight safety system, which includes automatic braking, adaptive cruise control, and lane-departure warning, is available, as is blind-spot monitoring. Given all this available technology, you'd think Subaru would make keyless entry and push-button starting easily available. But even our Premium model came with an old-fashioned metal key. On some trim levels, you can get these features as part of a $2,100 package that includes a moonroof and navigation. NHTSA awarded the Crosstrek 5 stars (out of 5) overall in its crash tests. IIHS rated it a Top Safety Pick+ (with optional front-crash prevention).

**NHTSA SAFETY RATINGS (2016 MODEL):** ★★★★★

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Good all-wheel-drive traction
- ⊕ Boxer engine intake and exhaust sounds are sporty
- ⊕ EyeSight safety system
- ⊕ Instantly recognizable Subaru styling

**WEAK POINTS**

- ⊖ Choppy ride
- ⊖ Handling isn't sporty
- ⊖ No proximity-key option
- ⊖ Bluetooth phone conversations are fuzzy
- ⊖ Lacks interior storage

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 3.94 |
| Crashworthiness: | 6.54 |
| Visibility: | 7.20 |
| Slalom handling: | 4.87 |
| Ride quality: | 6.75 |
| Fuel economy: | 4.16 |
| Interior noise: | 4.80 |
| Acceleration: | 1.50 |
| Ease of entry and exit: | 6.48 |
| Interior size: | 3.49 |
| Turning circle: | 4.57 |
| Cargo capacity: | 4.08 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2016** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3220** |
| Exterior length (in): | **175.2** |
| Exterior width (in): | **70.1** |
| Exterior height (in): | **63.6** |
| Wheelbase (in): | **103.7** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **36/36,000** |
| Tire manufacturer and size: | **Yokohama P225/55R17** |
| Towing cap. (lbs) w/wo brakes: | **1500/1000** |
| Transmission type: | **CVT** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **2.0L DOHC 16V I4** |
| Horsepower @ rpm: | **148 @ 6200** |

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## **Buick** Encore AWD Premium

BASE PRICE: **$29,690;** PRICE AS TESTED: **$32,425**

**LEAF RATING:**

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

64.02

**OVERALL RANKING** 75

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **14** |
| EPA urban mpg: | **23** |
| EPA highway mpg: | **30** |
| EPA combined mpg: | **26** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0024

### OVERALL OBSERVATIONS

The upscale Encore, new to the Buick lineup in 2013, is equipped with standard luxury features other compact crossovers often lack, like a power driver's seat on the base trim level. The Encore has a quiet, comfortable ride, optional AWD traction, and decent cargo space with the backseat folded down. However, its turbocharged, 138-hp engine could use more power at lower speeds, and backseat room is tight for larger passengers. The Encore handled pretty well on our slalom course, and we averaged 24 mpg overall. The rearview camera is necessary because of the Encore's limited rear visibility. Optional forward-collision alert, lane-departure warning, blind-spot monitoring, and rear cross-traffic alert systems are great safety items. All these features are available for a base MSRP right around $30,000. The 2016 Encore has a 5-star (out of 5) overall NHTSA crash-test rating, and, with optional front-crash prevention, it earns a Top Safety Pick rating from IIHS.

**NHTSA SAFETY RATINGS (2016 MODEL):** ★★★★★

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning
- Forward-collision warning

**STRONG POINTS**

- ⊕ Comfortable ride, good handling
- ⊕ Navigation and Bluetooth connectivity
- ⊕ Lots of standard comfort and convenience features

**WEAK POINTS**

- ⊖ Limited cargo space
- ⊖ Cramped backseat
- ⊖ Lacks low-end power
- ⊖ Large rear headrests limit visibility

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 6.00 |
| Braking: | 5.33 |
| Crashworthiness: | 6.59 |
| Visibility: | 7.40 |
| Slalom handling: | 5.75 |
| Ride quality: | 7.13 |
| Fuel economy: | 3.51 |
| Interior noise: | 2.57 |
| Acceleration: | 2.23 |
| Ease of entry and exit: | 6.14 |
| Interior size: | 5.17 |
| Turning circle: | 2.95 |
| Cargo capacity: | 3.26 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2013** |
| Number of passengers (F/R): | **2/3** |
| Curb weight (lbs): | **3250** |
| Exterior length (in): | **168.5** |
| Exterior width (in): | **69.9** |
| Exterior height (in): | **65.2** |
| Wheelbase (in): | **100.6** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **48/50,000** |
| Tire manufacturer and size: | **Continental P215/55R18** |
| Towing cap. (lbs) w/wo brakes: | **Not recommended** |
| Transmission type: | **Auto 6 speed** |
| Drivetrain type: | **All wheel - full time** |
| Engine size: | **1.4L DOHC I4 Turbo** |
| Horsepower @ rpm: | **138 @ 4900** |

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## **Mitsubishi** Outlander ES

BASE PRICE: **$23,820;** PRICE AS TESTED: **$23,820**

### LEAF RATING:

**OVERALL SCORE**

**58.89** LOWEST HIGHEST **92.49**

63.10

OVERALL RANKING **79**

**FUEL INFORMATION**

| | |
|---|---|
| Fuel type: | **Regular** |
| Fuel capacity (gal): | **16.6** |
| EPA urban mpg: | **25** |
| EPA highway mpg: | **31** |
| EPA combined mpg: | **27** |

**AVERAGE MPG AS TESTED BY AUTO CLUB**

0025

NHTSA SAFETY RATINGS (2016 MODEL): ★★★★☆

**AVAILABLE ADVANCED SAFETY FEATURES**

- Rearview camera
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Forward-collision avoidance

**STRONG POINTS**

- ⊕ Good fuel economy for a 7-passenger SUV
- ⊕ Large, flexible interior
- ⊕ Good forward visibility
- ⊕ Ample storage with third-row seats down

**WEAK POINTS**

- ⊖ Sluggish acceleration, especially in Eco mode
- ⊖ Buzzy engine during acceleration
- ⊖ Lack of instrumentation
- ⊖ Poor rear visibility with the backseat up

## OVERALL OBSERVATIONS

The Outlander, which was extensively redesigned for 2014, can seat seven—if those riding in the third row are kids. If you use only the first two rows for passengers, there's plenty of room in the back to store stuff. Our ES version, a preproduction prototype, showed good fit and finish. It was equipped with a 2.4-liter, 4-cylinder engine good for 166 hp and a CVT transmission. We averaged over 25 mpg with reasonable acceleration scores, although the engine is buzzy when pushed and feels weak in Eco mode. Handling in the slalom course was poor but would be acceptable in normal driving. The Outlander lacks many of the niceties that much of the competition comes with, but with an MSRP under $24,000, it's also less costly than most. The 2016 Outlander with FWD got 4 stars (out of 5) overall in NHTSA's crash testing. The IIHS awarded it a Top Safety Pick+ rating (with optional front-crash prevention).

**TEST DATA** TEST VEHICLE SCORES (0 TO 10 POINTS)

| | |
|---|---|
| EPA emissions score: | 5.00 |
| Braking: | 5.21 |
| Crashworthiness: | 6.63 |
| Visibility: | 7.20 |
| Slalom handling: | 2.42 |
| Ride quality: | 6.81 |
| Fuel economy: | 3.73 |
| Interior noise: | 4.17 |
| Acceleration: | 4.54 |
| Ease of entry and exit: | 6.36 |
| Interior size: | 6.01 |
| Turning circle: | 3.84 |
| Cargo capacity: | 1.18 |

**VEHICLE SPECIFICATIONS**

| | |
|---|---|
| Model year tested: | **2014** |
| Number of passengers (F/R): | **2/3/2** |
| Curb weight (lbs): | **3280** |
| Exterior length (in): | **183.3** |
| Exterior width (in): | **70.9** |
| Exterior height (in): | **66.1** |
| Wheelbase (in): | **105.1** |
| Restraint type: | **9 air bags or more** |
| Warranty (months/miles): | **60/60,000** |
| Tire manufacturer and size: | **Yokohama P215/70R16** |
| Towing cap. (lbs) w/wo brakes: | **1500** |
| Transmission type: | **CVT** |
| Drivetrain type: | **Front wheel** |
| Engine size: | **2.4L MIVEC SOHC 16V I4** |
| Horsepower @ rpm: | **166 @ 6000** |

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# APPENDIX

## A

**ABS.** *Antilock brake systems* use speed sensors at each wheel to let a vehicle's computer know how much brake force to apply in order to prevent the wheel from locking up under hard braking, which could result in the vehicle skidding out of control. ABS brakes enable a driver to maintain control and steer around obstacles while applying the brakes as hard as possible. The proper technique for using ABS brakes is to keep a hard, constant pressure on the brake pedal rather than pumping it. As of September 1, 2011, all passenger vehicles sold in the United States are required to have ABS, in conjunction with electronic stability control (ESC).

**ACC.** *Adaptive cruise control* uses radar, cameras, or other onboard sensors to automatically adjust a car's speed by braking or accelerating to maintain a safe following distance from the car in front of it. With most systems, the driver can adjust the following distance from the vehicle in front (within limits).

**ADAS.** *Advanced driver-assist systems* take an active role in helping to keep car crashes from happening, or at least in reducing their severity. These systems act as a kind of safety net, alerting drivers to potential problems that might lead to a crash, and in some instances performing functions such as emergency braking to prevent or mitigate crashes. Examples of ADAS include adaptive cruise control, blind-spot monitoring, and forward-collision warning. Currently, these features generally are optional rather than standard equipment, but they're becoming more prevalent on a wide variety of vehicles.

**AWD.** *All-wheel drive* provides better traction on slippery or uneven terrain than front-wheel drive (FWD) or rear-wheel drive (RWD). As the name indicates, AWD delivers power to all four wheels and can provide traction where FWD or RWD might fail: in wet or snowy conditions or when driving through mud, sand, or loose dirt. Most AWD systems deliver power primarily (or sometimes entirely) to one set of wheels, the front or the rear. If the system detects slippage at one, it diverts power to the other, where the wheels might get more traction. One downside to AWD is that it adds weight to a vehicle, which compromises fuel economy.

## B

**BSM.** *Blind-spot monitoring* uses radar to detect vehicles in potential blind spots on either side of a car. Typically, the system illuminates a light, usually in the right or left side-view mirror, indicating that it's unsafe to make a lane change. If a driver puts on a turn signal when another vehicle is alongside, the light flashes, and sometimes a warning tone sounds as an added alert.

## C

**CAFE.** *Corporate average fuel economy* refers to federal regulations or standards designed to improve the country's overall fuel economy for passenger vehicles. Passenger cars and light trucks sold in the U.S. must meet a specified minimum mpg figure, based on a weighted average of how many of the various types of vehicles automakers sell (e.g., compacts, SUVs, midsize cars). If they don't meet the standard, automakers must pay a penalty. Periodically, the government raises CAFE standards. By 2025, cars and light trucks will have to achieve a real-world average of about 42 mpg.

**CNG, LNG, NGV.** *CNG* is compressed natural gas, mostly methane, the same substance that's piped into homes. Natural gas is compressed to either 3,000 pounds per square inch (psi) or 3,600 psi when used in motor vehicles. *LNG* is liquefied natural gas, which is cryogenically chilled to temperatures as low as -275° F to liquefy it, at which point it occupies 1/600 of its volume as a gas, making efficient storage and transportation possible. *NGV* stands for natural gas vehicle, one that has been designed or converted to use CNG or, less often, LNG for its fuel source.

**CPO.** A *certified preowned* car is a late-model used car that's been thoroughly inspected and refurbished mechanically and cosmetically to look and drive like new, and then given an extended warranty backed by the automaker.

**CVT.** Using pulleys connected by a belt or chain instead of conventional gears, a *continuously variable transmission* is a smoother-operating and more fuel-efficient type of automatic transmission.

## D

**DFI.** *Direct fuel injection* (also known as gasoline direct injection, or GDI) squirts atomized fuel into the engine's cylinders rather than into the manifold.

**DOD.** To reduce fuel use, a computer deactivates some of the cylinders in a *displacement-on-demand* engine when it's cruising along and not working hard.

**DRL.** Many new-model vehicles have *daytime running lights*, which are reduced-intensity headlights that make cars more visible to oncoming traffic, making daytime driving safer.

## E

**E85, M85, FFV.** E85 is *85 percent ethanol* or grain-alcohol fuel; M85 is *85 percent methanol* or wood alcohol. E85 and M85 fuel use 15 percent gasoline, rather than 100 percent alcohol, for two reasons: Gasoline enables the vehicle to start more easily in cold temperatures. Also, alcohol burns with an invisible flame; adding gasoline provides a bright orange flame and thick black smoke, which, in case of a collision or accident, alerts drivers, passengers, and emergency responders to the presence of fire. FFV refers to a *flexible-fuel vehicle*, which is capable of running on regular gasoline or E85.

**EBD.** *Electronic brake-force distribution* improves brake performance by varying brake pressure between the front and rear wheels according to the car's load and speed.

**EFI.** *Electronic fuel injection* supplies fuel to a vehicle's engine with greater efficiency than a carburetor, the technology it replaced. EFI atomizes fuel by pumping it through a small nozzle under high pressure. It monitors airflow and density, which enables it to more precisely control the fuel supply, eliminating or reducing problems such as incomplete combustion, pollution, difficulties with cold-weather starting, and rough running. All new cars sold in the U.S. since 1995 have had EFI.

**ESC.** *Electronic stability control* refers to a variety of systems designed to improve a vehicle's handling or to regain driver control. ESC uses antilock brake sensors, braking capability, and other sensors to help the driver maintain directional control of the vehicle. Sensors monitor individual wheel speed, the driver's intended path, and cornering force, among other things. From these inputs, ESC determines if the car is going in the direction the driver intends. If the car begins to slide or spin, ESC temporarily applies brake pressure at one or more wheels and/or reduces engine power to help restore the car to the driver's intended path. Some advanced ESC systems detect possible rollovers and operate to help prevent them from happening.

**EV.** An *electric vehicle* is powered solely by electricity. It's sometimes referred to as a BEV, or battery electric vehicle. Its distinctive components include one or more electric motors, a battery pack, and a controller. Currently, the biggest drawback of most EVs is their limited range (typically 85–100 miles).





## F

**FCEV, FCV.** A *fuel-cell electric vehicle* or *fuel-cell vehicle* uses hydrogen fuel cells to create electricity via a chemical process in which hydrogen fuel reacts with oxygen from the air to power its onboard electric motor. FCEVs are zero-emissions vehicles (ZEVs). Examples include the Hyundai Tucson Fuel Cell, the Toyota Mirai, and the upcoming Honda Clarity Fuel Cell.

**FCW, FCM, FCA.** *Forward-collision–warning*, *forward-collision–mitigation*, and *forward-collision–avoidance* systems use cameras and/or radar to help drivers respond safely to traffic in front of them. An FCW system provides audible and visual alerts to warn drivers of a possible crash, but it doesn't intervene to prevent a crash. An FCM system lets drivers know a collision is imminent; if the driver doesn't take action, the system applies the brakes to try to minimize the damage. An FCA system alerts drivers to a possible crash and automatically applies the vehicle's brakes to either prevent the crash or at least reduce its severity; it also may increase seatbelt tension.

**FWD.** Most passenger vehicles are equipped with *front-wheel drive*, in which the engine's power is routed to the front wheels. FWD gives better traction for climbing hills because the engine's weight is over the drive wheels.

## G

**GGE.** The *gasoline gallon equivalent* is the amount of an alternative fuel (e.g., hydrogen) it takes to equal the energy content of a gallon of gasoline.

**GVWR.** *Gross vehicle weight rating* is the maximum allowable total weight, including the weight of the vehicle, fuel, passengers, and cargo. The GVWR is usually found on the driver's door or the lower door pillar.

## H

**HID.** *High-intensity-discharge* headlights send a high-voltage discharge through a mix of gases, including xenon, in a microdischarge bulb to produce an extra-white (or bluish) light three times brighter than a conventional halogen headlight. HID headlights enable drivers to see objects more clearly and at greater distances. They're becoming increasingly available as expanded demand and production drives prices down.

**Hybrid.** *Hybrids* (sometimes called hybrid-electric vehicles, or HEVs) are vehicles with more than one type of powertrain. Currently, all hybrids sold in the U.S. have gasoline-electric powertrains consisting of an internal combustion engine, a battery pack, and a controller. In a series hybrid, only energy from the electric motor directly turns the car's wheels. This energy is supplied either from a battery pack, from a generator that's powered by the internal-combustion engine, or both. The battery pack is recharged from regenerative braking and from the engine and generator. In a parallel hybrid, the gasoline engine and electric motor work together to provide power to the vehicle's wheels, either individually or together. An electronic controller automatically determines whether the electric motor, the gasoline engine, or a combination of both provide the power. Most hybrid and plug-in hybrid vehicles have combination series-parallel drivetrains, in which both the engine and electric motor are connected separately to the transmission. This enables the vehicle to operate via either the gas engine alone or the electric motor alone.

## I

**ICE.** *Internal combustion engines* are powered by gasoline, diesel, compressed natural gas, propane, hydrogen, flex-fuel, ethanol, or biodiesel. In recent years, automakers have used a variety of techniques (e.g., turbocharging, direct injection) to make ICEs more efficient.

**IIHS.** The *Insurance Institute for Highway Safety* is an independent, nonprofit scientific and educational organization dedicated to reducing the losses—deaths, injuries, and property damage—from car crashes on the nation's roads. One of its principal activities is evaluating the safety of passenger vehicles, based on the results of a variety of crash tests that simulate real-world collisions. Based in Arlington, Virginia, the IIHS is wholly supported by auto insurers and insurance associations.

## L

**LDW.** Using cameras or sensors mounted near the rearview mirror, a *lane-departure–warning system* reads road markings such as painted lines and raised pavement markers to help a car stay in its lane. If a vehicle starts to drift out of its lane, lane-departure warning alerts the driver with a sound, a flashing icon on the instrument panel, a pulsing or vibration in the steering wheel or driver's seat, or a combination of the three.

**LED.** *Light-emitting diodes* are semiconductor chips arranged to produce a desired light pattern when electricity is passed through them via a process called electroluminescence. LEDs have no moving parts, no filament, and they are much more durable than halogen or high-intensity-discharge (HID) headlights. Automakers used them first as day-running lights and in taillight assemblies, then as headlights in high-end vehicles. Advances in semiconductors have made LEDs cheaper and brighter than in the past. As a result, they're being used as headlights in an increasing number of cars. LEDs are equally as bright, and in some applications brighter, than HIDs.

**LKA.** When a car starts to drift out of its lane, a *lane-keeping–assist system* can nudge the steering wheel to direct the car toward the center of the lane, or it selectively brakes a single wheel to guide the car back into the lane. Such corrections are subtle, and drivers can override them by turning the wheel themselves. However, LKA systems don't steer the cars themselves. On most vehicles, if the car doesn't sense any steering input from drivers for a brief period (about 10 seconds), it alerts them to grip the wheel.

## M

**MPG, MPGe.** *Miles per gallon* is a number that indicates the estimated distance traveled by a vehicle per gallon of gasoline used, typically categorized as city, highway, or combined driving. A related term, MPGe, means *miles per gallon equivalent*, and is used by the EPA to compare the energy consumption of alternative-fuel vehicles, such as EVs, with the fuel economy of vehicles powered by conventional internal-combustion engines. The MPGe is the estimated number of miles a vehicle can travel on the quantity of fuel (e.g., compressed natural gas, electricity, etc.) with the same energy content as a gallon of gasoline. The website fueleconomy.gov reports the EPA-estimated mpg and MPGe of recent car models.

**MSRP.** *Manufacturer suggested retail price*—the key word being *suggested*, since a dealer can sell a car at a lower or higher price.

## N

**NHTSA.** Pronounced "*nit*-sa," the *National Highway Traffic Safety Administration* is a federal agency that sets car safety standards, issues recalls, and performs crash tests.

## O

**OBD.** *Onboard diagnostics* refers to a diagnostic system that monitors whether a

vehicle's emissions-control system is operating correctly. In general, OBD systems illuminate a malfunction indicator light on the dashboard if it detects a problem, often using the terms *service engine soon* or *check engine soon*. OBD2 is a computer-based system built into all 1996 and later passenger vehicles and light-duty trucks that enables a technician to diagnose problems with a vehicle's engine or emissions-control system. It provides a standardized way to locate problems by reading diagnostic trouble codes and operating data.

**OEM.** *Original equipment manufacturer*, the manufacturer of record for a fully assembled vehicle. Many vehicle parts are built by external suppliers, but the OEM is responsible for the final production of the vehicle.

## P

**P285/35VR20.** This is an example of a series of letters and numbers found on a tire's sidewall, which refers to the following tire characteristics: The first letter indicates the tire's intended use or vehicle class (in this case, passenger); the next three numbers are the tire's width in millimeters; the numbers following the slash are the ratio of the tire sidewall height to the width, expressed as a percent; the next two letters refer to the tire's maximum speed capability (in this case, V = 149 mph) and tire fabric construction (bias, diagonal, or, in this case, radial); the final two digits refer to the wheel diameter.

**PCM.** A *powertrain-control module* is a computer that manages the vehicle's engine, transmission, and other components for good drivability, maximum fuel economy, and performance, with minimum emissions.

**PHEV.** A *plug-in hybrid electric vehicle* is a type of hybrid with batteries that can be recharged by connecting the vehicle to an external electric power source. These vehicles can operate on battery power for a portion of their driving range before they must switch over to conventional hybrid mode (i.e., using both electricity and gasoline). This configuration overcomes motorist concerns about the limited driving range of pure battery-electric vehicles. A PHEV's overall fuel economy can be much higher than that of a conventional hybrid.

## R

**RAP.** *Retained accessory power* lets you operate the radio or power windows for a short time after you shut off the engine.

**RCTA.** Blind-spot monitoring (defined above) may be paired with a *rear cross-traffic alert* function, which is useful when drivers back out of a parking spot. When the car is in reverse, the RCTA system flashes a warning signal in the side mirror and sounds a warning tone to alert drivers if a vehicle is approaching from the left or right.

**Regenerative braking.** Hybrids, plug-in hybrids, hydrogen fuel cell, and battery-electric vehicles are typically equipped with regenerative braking, which means that when the car coasts or brakes, its electric motor helps to slow the car down and functions as a generator to convert the vehicle's kinetic energy into electricity and charge the battery pack.

**RPM.** Engine speed is measured in *revolutions per minute*; that is, how many times per minute the crankshaft rotates.

**RWD.** *Rear-wheel drive* is commonly found on pickups, truck-based SUVs, sports cars, and high-performance and luxury sedans. RWD enables trucks to use heavy-duty components, and because loads in their beds are over the rear wheels, RWD provides better traction. On a sports or performance car, RWD improves handling by more evenly distributing the car's weight front to rear. However, RWD provides less traction on slippery roads.

## S

**SAE.** The *Society of Automotive Engineers* is an international, nonprofit, educational and scientific organization dedicated to advancing mobility technology. It is made up of more than 90,000 engineers and scientists who develop technical information on self-propelled vehicles, including automobiles, trucks, buses, off-highway equipment, aircraft, aerospace vehicles, and marine, rail, and transit systems. SAE disseminates this information via meetings, technical papers, and other reports.

**SRS.** A car's *supplemental restraint system* refers to air bags that supplement seatbelts as safety devices. During a frontal crash, the air bags inflate rapidly; when passengers are thrown forward, they're met by a fully inflated air bag, which absorbs energy and helps keep them from colliding with the vehicle's interior. First-generation air bags used sensors to "decide" when to activate; they deployed at a single level of force, sometimes causing injuries or fatalities to older, smaller, or frail occupants. These shortcomings led to the development of second-generation air bags, which use additional sensors to take into account an occupant's size, weight, and the severity of the impact to adjust the speed and force of deployment. Side-impact air bags inflate for side impacts, and side curtain air bags above the side windows help protect an occupant's head. In the case of a rollover, they stay inflated. Some vehicles also have an air bag under the steering column to protect the driver's legs and help to keep the driver in a normal driving position so that they can maintain some level of control over the vehicle.

**Stop-start.** In the U.S., this term mainly refers to software in hybrids that shuts the engine off when a car is motionless (for example, when idling or stopped at a traffic light), then restarts it with the electric motor when the driver releases the brake pedal. Stop-start technology increases fuel economy and reduces emissions. Some American nonhybrid vehicles feature stop-start, and it's likely that more will in the future to meet strict fuel-economy mandates. These systems require a stronger battery and starter motor to deal with the increased loads.

## T

**10W-30.** These numbers refer to oil grade and viscosity (thickness or resistance to flow). The manufacturer's recommendation for the type of oil to use in your vehicle is listed in your car's owner's manual. Multigrade oil designations include two numbers—in this case, 10W–30. The first number (10) means that an engine can pump this grade of oil as easily as it can a single-grade SAE 10 oil. (W means winter, not weight.) It's easier for an engine to pump a "thinner" oil, e.g., 5W, at a given temperature than it is to pump 10W. The second number (30) means that the viscosity of this multigrade oil at a 100°C (212°F) operating temperature is equivalent to the viscosity of a single-grade SAE 30 oil at the same temperature.

**TCS.** A *traction-control system* uses the same wheel-speed sensors as antilock brakes, with additional electronic controls to sense the speed of each drive wheel. It then applies braking force and/or reduces power to the drive wheel(s) to prevent spin and the loss of traction. Some sophisticated AWD vehicles have advanced systems that supply power to only one wheel and simultaneously apply braking force to the others in an attempt to maintain traction. Traction control does not give a vehicle more traction; it simply prevents the drive wheels from spinning.

## V

**V8, V6, I4.** These terms refer to a vehicle's engine configuration and number of cylinders. A V engine has two banks of cylinders (typically three or four cylinders per bank) offset by 60 or 90 degrees from each other. An I engine configuration has the individual cylinders in a vertical line, referred to as *inline*.

**VIN.** This 17-digit designation is a car's unique *vehicle identification number*. The VIN is broken down into groups of numbers and letters: the first three are the manufacturer identifier; the next five are vehicle attributes (body style, model, etc.); the next three are the check digit, model year, and assembly plant; and the remaining six characters identify a specific vehicle that came off the assembly line.

**VSS.** *Variable-suspension system* refers to a suspension system (springs, shock absorbers, and linkages) that varies in stiffness and ride height. Fully active suspensions electronically monitor road and vehicle conditions and modify suspension settings in real time to control the motion of the car.

**VVT.** *Variable valve timing* refers to an enhanced engine valve-train configuration used in many of today's automobiles. VVT allows the lift, duration, or timing (any or all of these) of the intake and/or exhaust valves to be changed during engine operation to improve fuel economy and engine power and to lower emissions.

## Z

**ZEV, PZEV, AT PZEV, SULEV, ULEV, LEV.** Emissions certification levels for California and other states that have adopted California's emissions standards.

**ZEV.** A *zero-emissions vehicle* produces no harmful emissions at the tailpipe. Currently the only technologies that can meet this standard are battery-electric vehicles (EVs) and vehicles powered by hydrogen fuel cells (HFCVs).

**PZEV.** *Partial-zero-emissions vehicles* produce only miniscule amounts of harmful (i.e., smog-forming) pollutants from the tailpipe and are certified to produce no emissions from fuel evaporation. The tailpipe standards have been set by the California Air Resources Board (CARB) to be equivalent to the emissions caused by electricity generation needed to charge a battery-electric car. This level is based on the relatively clean mix of electricity-generation sources (natural gas, hydro, nuclear, and renewable) in California. For other regions, where electricity is not as clean because it is generated from burning coal or oil, operating a PZEV may be cleaner than operating a battery-electric vehicle, especially when considering smog precursor emissions. PZEVs also have a 15-year/150,000-mile emissions warranty.

**AT PZEV.** *Advanced-technology partial-zero-emissions vehicles* meet the same emissions standards as a PZEV but use technologies that CARB deems to be "advanced," thus earning the manufacturer additional zero-emissions-vehicle credits. This terminology is being changed, and in the future such vehicles will be called TZEV (transitional-zero-emissions vehicles).

**SULEV.** *Super-ultra-low-emissions vehicle*s have the same tailpipe standards as a PZEV but with some evaporative emissions.

**ULEV.** *Ultra-low-emissions vehicle*.

**LEV.** *Low-emissions vehicle*.

# INDEX

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