AAA Green Car Guide

2017 EDITION

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

2017 EDITION

Reviews of the top fuel-efficient vehicles on the market,
including gas- and diesel-powered, hybrid, electric, and alternative-fuel cars, trucks, and SUVs

HOW TO SAVE FUEL WHEN YOU DRIVE + HOW SAFE IS YOUR VEHICLE? + BEST GREEN CARS FOR TEENS
LATEST HIGH-TECH SAFETY FEATURES + CHOOSING THE RIGHT VEHICLE + AUTONOMOUS CARS

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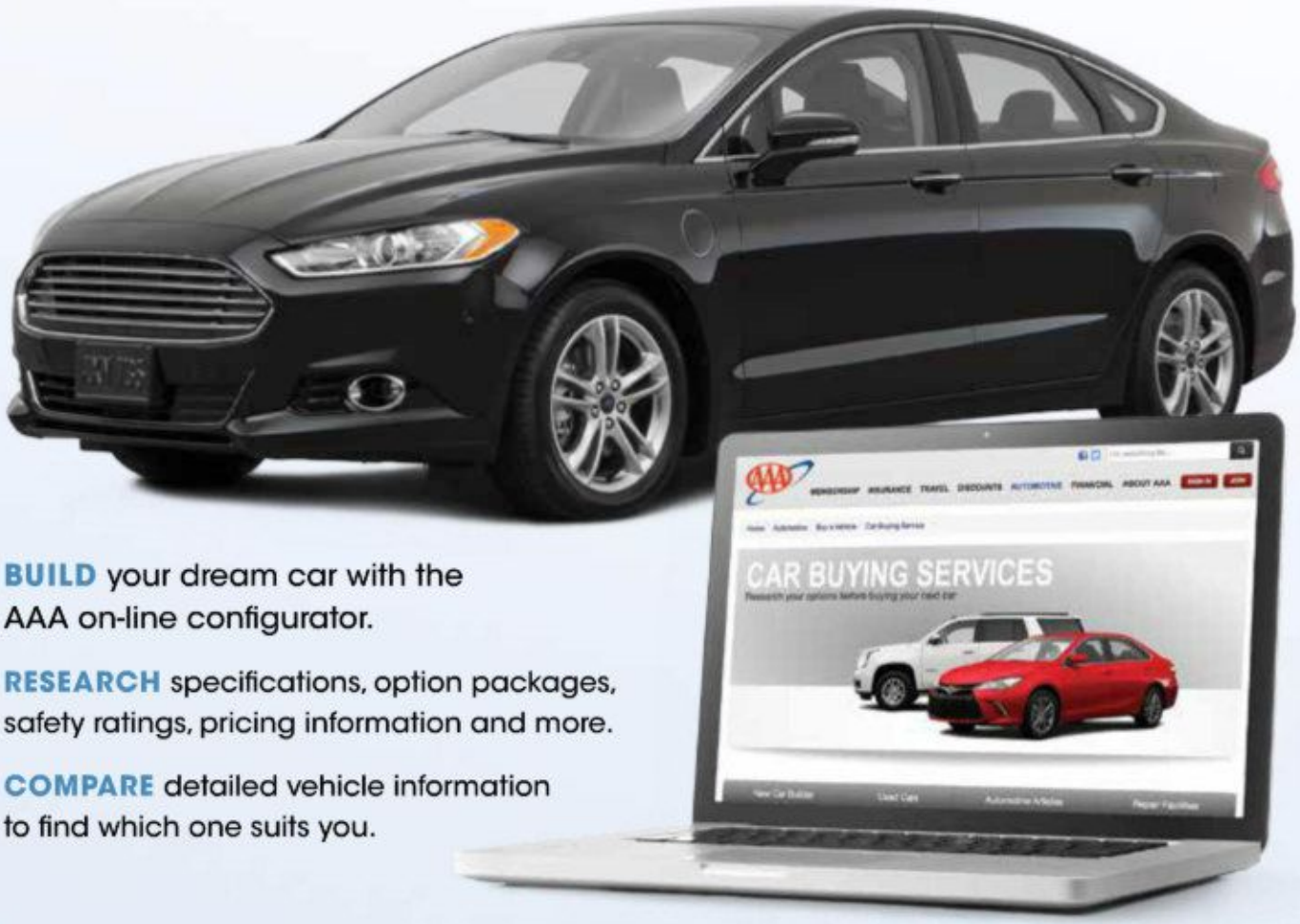

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INTRODUCTION

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 fuel-efficient, low-emitting vehicles, including gasoline- and diesel-powered cars, trucks, and SUVs, as well as vehicles with hybrid, electric, and alternative-fuel powertrains.

The ARC evaluates vehicles based on criteria such as fuel economy, ride comfort, braking, handling, interior room, and noise levels. The ARC has produced the *AAA Green Car Guide* since 2010 as part of AAA's mission to improve mobility, promote automotive safety, and keep members informed about the latest automotive technology.

Located in Los Angeles, the ARC has a premier vehicle-emission test laboratory featuring state-of-the-art facilities and equipment operated by Auto Club engineers and technicians with decades of experience. The ARC's purpose is not only to run emission and fuel-efficiency tests but also to investigate the latest vehicle technologies.

By providing AAA members with the latest information about fuel-efficient vehicles and advanced automotive technologies, the *AAA Green Car Guide* can help them make better car-buying decisions. The *AAA Green Car Guide*:

- **Defines** fuel-efficient criteria and explains why buying a car that gets good gas mileage and produces low emissions is good for both you and the planet.
- **Explains** the differences between various types of fuel-efficient cars, the advantages and disadvantages of each, and how to choose one that's best for you.
- **Previews** the fuel-efficient, low-emitting cars scheduled to come on the market in the next few years.
- **Evaluates** cars both on the road and on a 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 for 13 different attributes and specifies the top green car at different price levels. It also provides summary snapshots of the vehicles, including their strong and weak points.

The *Guide* groups the vehicles that were tested into six categories according to size or body type—subcompact, compact, midsize, large, pickup truck, and SUV—and specifies a winner and finalists in each category. For the past two years, the *Guide* has also featured a chapter on the latest automotive safety technology: standard and optional features that make driving safer and more convenient. Available advanced safety features for each vehicle tested are included in the vehicle-review section. The *Guide* also describes the results from AAA's testing of the latest automotive technologies, such as gasoline quality, headlight effectiveness, and automatic emergency braking.

In sum, the *AAA Green Car Guide* provides you with all the tools you'll need to find the car, SUV, or truck that best suits your driving needs.

THE AWARD

The Automobile Club of Southern California's Automotive Research Center (ARC) is proud to honor the top-scoring vehicles in the *AAA Green Car Guide*.

Each winner named in the *AAA Green Car Guide*, including the overall top-scoring vehicle and the top vehicles within each category, will receive a trophy produced from sustainable or recycled materials. The uprights, circle and the copy plate are all made of aluminum; the base is made from bamboo.

All vehicles must be fuel-efficient in order to qualify for review in the *AAA Green Car Guide*, but they are also rated on many other qualities, including ride comfort, visibility, acceleration, and cargo capacity.

shown actual size

What's Inside

Chevrolet
Cruze Hatchback

Test Results and Rankings

Descriptions, evaluations, and detailed test reports of 65 fuel-efficient, low-emitting cars

CHAPTER 1

Redefining Green

When many people think of green cars, they think of cars like a Toyota Prius or Tesla Model S—in other words, hybrid or electric vehicles (EVs). Those cars certainly qualify, but you may be surprised to learn that many other cars with conventional powertrains can be considered green.

The fact is, the majority of cars on the road today are equipped with internal combustion engines that burn gasoline, and this will be true for the foreseeable future. But many gasoline-powered vehicles meet the two defining requirements of a green vehicle: (1) *they use less fuel* and (2) *they produce fewer harmful emissions* than most cars on the road.

Efforts to make gasoline-powered cars more fuel-efficient and cleaner go back to the 1970s with the Clean Air Act, the Arab oil embargo, and the creation of corporate average fuel economy (CAFE) standards, decades before the development of hybrids or EVs.

Since that time, tremendous progress has been made both in raising fuel-economy standards and reducing emissions, and today most of the efforts in these areas involve making improvements to cars with conventional powertrains. In fact, 30 of the 65 cars reviewed in this year's *AAA Green Car Guide* are powered solely by internal combustion engines, most of which burn gasoline.

The *AAA Green Car Guide* focuses on all types of fuel-efficient, low-emitting vehicles, regardless of their power source. As you'll see, such vehicles are available across a range of brands, types, models, and price categories—including midsize or full-size sedans, compact hatchbacks, luxury crossovers, minivans, pickup trucks, and more.

Subaru **Crosstrek**

PZEV Vehicles
Partial-zero-emission (PZEV) vehicles are among the cleanest gasoline-burning vehicles. They produce no evaporative emissions.

BMW **X3**

Diesel Vehicles
Diesel vehicles burn low-sulfur diesel fuel. They're fuel-efficient and emit less CO_2 than cars that burn gasoline, but overall they're still among the highest-emitting vehicles sold.

Vehicles With Advanced Internal Combustion Engines (ICEs)
Most fuel-efficient, low-emitting cars run on gasoline. Automakers use a variety of sophisticated technology to make them more efficient and cleaner.

Mazda **Mazda3**

Toyota **Mirai**

Hydrogen Fuel-Cell Vehicles
Hydrogen fuel-cell vehicles have electric motors that run on electricity produced in an onboard reaction between hydrogen and oxygen.

Electric Vehicles
Electric vehicles (EVs) are propelled by powerful electric motors that run on current stored in large onboard battery packs. Those, in turn, are recharged using household current or at dedicated charging stations.

Chevrolet **Bolt**

Chevrolet **Tahoe**

Flexible-Fuel Vehicles
Flexible-fuel vehicles can run either on gasoline alone or on a blend of gasoline and ethanol, which is made mostly from corn.

Hybrid Vehicles
Hybrid vehicles have internal combustion engines and electric motors and run on a combination of gasoline and electricity. Plug-in hybrids have batteries that can be recharged from an external source.

Kia **Optima**

GOOD FUEL ECONOMY

Most motorists tend to think about getting better gas mileage—and perhaps purchasing a fuel-efficient vehicle—only when gas prices are high. Lately, that hasn't been an issue: Prices for regular gas averaged just $2.14 a gallon in 2016. Prices were consistently low in 2015, too, averaging $2.40 a gallon, according to the AAA Daily Fuel Gauge Report (gasprices.aaa.com). And the U.S. Energy Information Administration has forecast continuing low crude oil and gas prices for 2017, predicting a nationwide average price of $2.38 a gallon for the year.

Low gas prices are a major reason many car buyers switch from fuel-efficient, low-emitting cars to SUVs and light trucks. That is, they base a long-term decision—buying a car—on short-term information. Indeed, sales of SUVs and light trucks increased during the past year. (See the sidebar on page 10.) In 2016, crossovers, SUVs, and pickup trucks outsold passenger cars, 10,455,000 units to 7,105,000 units. Crossovers were the largest of all segments, with sales of 4,951,000 units. Midsize cars came in second, at 3,214,000 units.

But despite car buyers' habitually short memories, gas prices do fluctuate from year to year, often unpredictably. As recently as 2014, for instance, gas prices nationally averaged $3.34 a gallon. So it's always a good idea to keep the volatility of fuel prices in mind when you decide on a new car. Also, there are plenty of other good reasons to buy a fuel-efficient car, which we'll explore later in this chapter.

Automakers attempt to improve fuel economy in three ways:

- **Installing a more fuel-efficient powertrain.** This includes, first, improving traditional powertrains (i.e., those with internal combustion engines) and second, developing alternative powertrains, such as those found in hybrids and EVs. We'll discuss these options in more detail in Chapter 2.
- **Lightweighting.** Lighter vehicles use less fuel, so carmakers reduce vehicle weight by using materials like aluminum and carbon fiber in place of steel. Examples: Ford's F-150 pickup, which in 2015 began using aluminum rather than steel in its cab and bed, losing about 700 pounds in the process, and BMW's i3 EV, which has an upper body made of carbon-fiber composites, saving about 550 pounds.
- **Improved vehicle aerodynamics** to reduce drag and improve efficiency via elements such as specially designed underbody panels to improve airflow, air deflectors, and active grille shutters that open and close, also to control airflow.

Other fuel-saving measures include:

- **Regenerative braking systems** (found on hybrids and EVs), which convert a car's kinetic energy into electricity to recharge the battery and power a car's accessories, a task usually left to the engine.
- **"Economy" driving modes**, which adjust the 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 improve a vehicle's miles-per-gallon (mpg) rating.

REDUCING EMISSIONS

Besides getting better fuel economy, today's cars are far cleaner, producing fewer harmful emissions and pollution than cars made before the days of emission controls. This is largely due to efforts by agencies such as the U.S. Environmental Protection Agency (EPA), the National Highway Traffic Safety Administration (NHTSA, pronounced *nit*-sa), the California Air Resources Board (CARB), automakers, and organizations such as AAA.

The main pollutants in vehicle exhaust are nitrogen oxide (NOx), volatile organic compounds (VOCs), carbon monoxide (CO), and carbon dioxide (CO_2). (See the sidebar below.) In the 1960s, passenger vehicles (cars, pickups, and vans) accounted for about 50 percent of smog-producing emissions. For example, a new car in 1965 emitted 228 pounds of VOCs per year.

Principal Pollutants in vehicle exhaust

Nitrogen oxide (NO_x), caused by 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 by 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.

Now a typical new car emits less than 2 pounds of VOC annually (based on driving 15,000 miles per year)—a 97 percent improvement. And despite the increased number of cars on the road and total number of miles driven, passenger vehicles today account for less than 25 percent of smog-producing emissions.

Typically, carmakers use three types of technology to reduce harmful emissions:

- **Improved powertrain design,** including direct fuel injection and an engine control unit 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-emission systems,** which use charcoal canisters to absorb harmful vapors from a vehicle's fuel system, which might otherwise escape and pollute the atmosphere.

In addition, **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 harmful emissions.

Cars are ranked according to the levels of emissions they produce, from LEV (low-emission vehicle) up through ZEV (zero-emission vehicle). The emission-categories sidebar (right) provides more detail, and the EPA website, fueleconomy.gov, provides comparative ratings (see "EPA Ratings," page 11) to help you choose a low-emitting vehicle. The cleanest gasoline-powered cars are those with a PZEV (partial-zero-emission vehicle) rating. Currently, the only ZEV vehicles are electric vehicles and hydrogen fuel-cell vehicles.

Government Influence

Over the years, cars have continually become more fuel-efficient and cleaner, chiefly because federal and state regulations require automakers to keep improving vehicle technology in both areas.

Government efforts to improve fuel economy began after the 1973–74 Arab oil embargo, which cut off the flow of crude oil to the U.S. and led to blocks-long lines at service stations, with motorists sometimes waiting hours to buy gas. In 1975, Congress enacted corporate average fuel economy (CAFE) standards to improve the average fuel economy of cars and light trucks sold in the United States and reduce U.S. dependence on foreign oil.

Emission Terminology

The EPA and California Air Resources Board (CARB) set exhaust-emission requirements that vehicle manufacturers must meet. Over the years, the standards have become progressively more stringent. The set of standards currently in place is referred to as California LEV III/EPA Tier 3. For more detail on the actual certification standards, see the Glossary.

LEV: Low-emission vehicles are clean compared to vehicles of yesteryear. Nevertheless, these are the "dirtiest" vehicles currently on the market.

ULEV: Ultra-low-emission vehicles are cleaner than LEVs and emit less hydrocarbons (HC), oxides of nitrogen (NOx), and carbon monoxide (CO).

SULEV: Super-ultra-low-emission vehicles have the cleanest exhaust of all vehicles with internal combustion engines.

PZEV: Partial-zero-emission vehicles are SULEVs that also have zero evaporative emissions and include a 15-year/150,000-mile warranty on emission control–system components.

AT PZEV: Advanced-technology partial-zero-emission vehicles meet PZEV emission requirements but use technology deemed "advanced" by CARB—hybrids, for example. CARB is changing the AT PZEV terminology. These vehicles will be called TZEV (transitional-zero-emission vehicles).

ZEV: Zero-emission vehicles produce no harmful emissions. EVs have no tailpipes at all, and hydrogen fuel-cell vehicles (FCEV) emit only water.

2016 TRENDS IN CAR OWNERSHIP
BY VEHICLE TYPE

The trend is clear. For the second record-setting year in a row, American car buyers have shown that they're still enthusiastic about automobiles—and that they love their SUVs, crossovers, and pickups.

Record-setting? Yep, on two counts. First, low gas prices, strong incentives, rising employment, low interest rates—and a strong December—pushed 2016's total sales to 17,550,351 vehicles, beating 2015's record of 17,479,469, the highest number of vehicles sold since 2000.

Second, sales of crossovers, SUVs, and pickups continued to surge. Their sales had increased by 15 percent from 2014 to 2015, according to the *International Business Times*, and in 2016, they jumped by 7.2 percent, according to a report in the *Wall Street Journal*. They now make up about 60 percent of new-vehicle sales. Check out the numbers below. In almost all cases, the increases are SUVs, crossovers, and pickups—and the small and midsize cars are in decline.

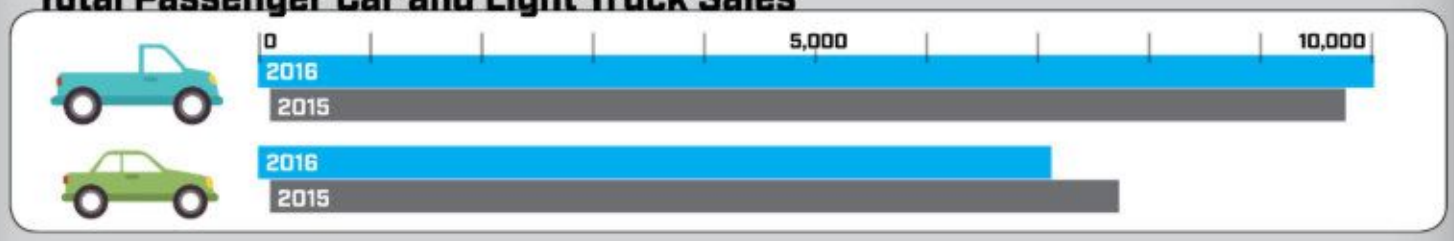
As a result of the trend, a number of well-known players have enjoyed notable success in the past two years. The top three sales leaders for both years were pickups—the Ford F-Series (the 35th year straight as No. 1 in vehicle sales), the Chevy Silverado, and the Ram pickup.

The venerable Honda CR-V, for example, was the best-selling crossover two years in a row; sales were up about 7 percent total. The Nissan Rogue's numbers surged nearly 15 percent (from 287,190 to 329,904), and the Toyota Highlander and Subaru Outback got sales bumps of just over 20 percent each (from 158,915 to 191,379 and 152,294 to 182,898 units, respectively).

Small and midsize cars may be down, but they're not out, and quality still wins the day. The Honda Civic, a perennial best seller, increased its sales a total of more than 12 percent in 2015 and 2016. And the Chevy Malibu was a midsize success story, increasing its sales by almost 17 percent from 2015 to 2016—from 194,854 cars to 227,881.

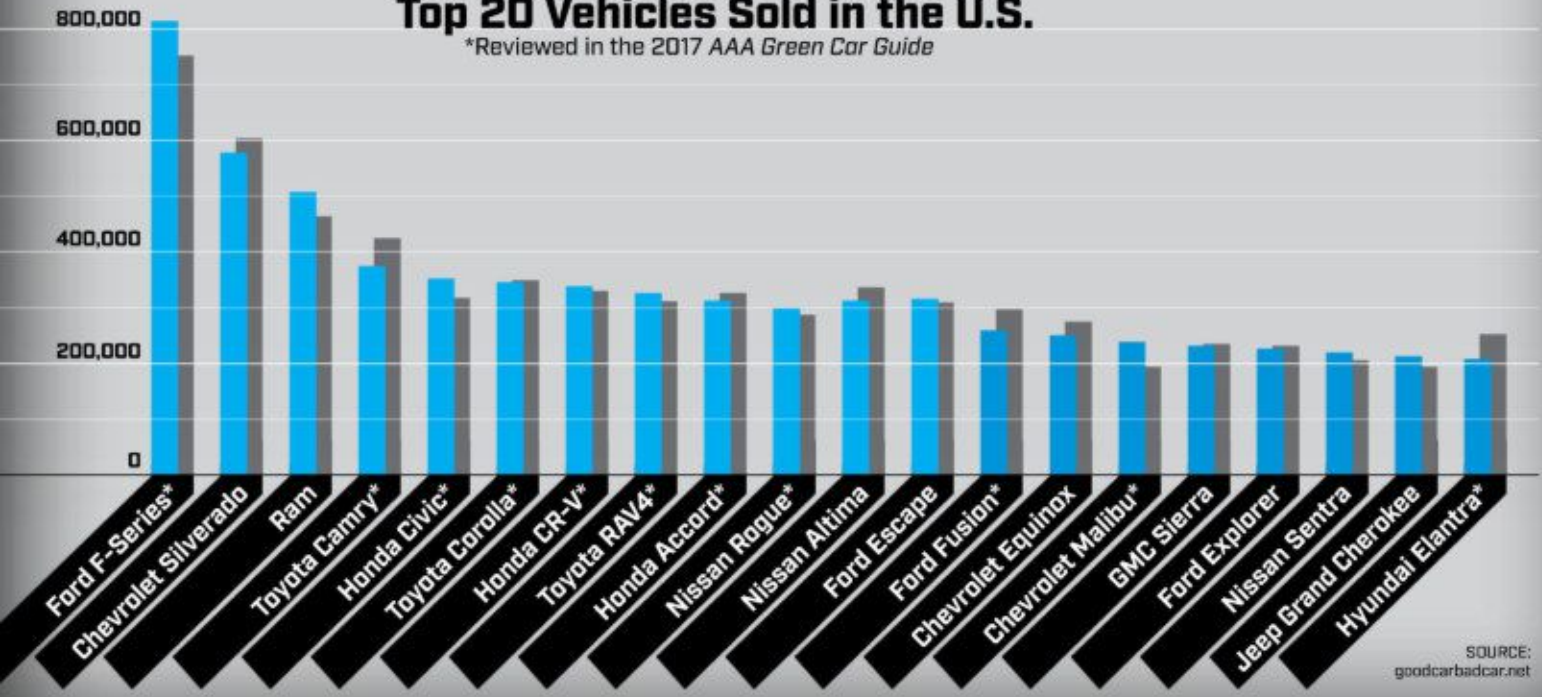
But a few stalwarts took hits, though still turning in good numbers. The Toyota Camry was the best-selling sedan both years, but its sales dropped from 429,355 in 2015 to 388,616 in 2016, a 9.5 percent decline. And the Nissan Altima went from 333,398 units sold in 2015 to sales of 307,380 in 2016, nearly an 8 percent decline. Sales of the Honda Accord, too, fell off by nearly 3 percent, from 355,557 to 345,225.

Total Passenger Car and Light Truck Sales



Top 20 Vehicles Sold in the U.S.

*Reviewed in the 2017 *AAA Green Car Guide*



SOURCE: goodcarbadcar.net

CAFE standards are progressively stricter: By 2025, NHTSA, which oversees automaker adherence to the standards, will require the fuel efficiency of new cars and light trucks to average 54.5 mpg. In real-world standards, that works out to about 42 mpg. According to the EPA, the stricter standards will save consumers $1.7 trillion in fuel costs between 2012 and 2025.

CAFE regulations are complicated, but the basics are:

- Small vehicles must attain a higher mpg rating than large vehicles.
- An automaker's CAFE requirements are based on its total expected vehicle production, broken down by sales estimates for various vehicle models.
- For example, a carmaker that produces mostly SUVs and pickups has to meet a lower CAFE requirement than a carmaker that produces mostly small cars. Unfortunately, this can be an incentive for carmakers to promote and sell more SUVs and light trucks, rather than smaller, fuel-efficient cars.

Ultimately, the EPA expects that the CAFE standards will significantly reduce both passenger-vehicle CO_2 emissions and the nation's demand for petroleum. The technology needed to achieve higher fuel standards will increase new-vehicle costs by an estimated $894 to $1,017, according to the EPA, but that will be offset by fuel savings of $1,460 to $1,620.

Furthermore, by 2025, the EPA estimates that the 2017–2025 higher-mileage standards will reduce oil consumption by about 4 billion barrels of oil and greenhouse-gas (GHG) emissions by 2 billion metric tons in that time period, with net benefits to society in the range of $326 billion to $451 billion.

Regarding emissions, in 1970, Congress amended the landmark 1963 Clean Air Act and gave the EPA the authority to regulate pollution from passenger vehicles and other forms of transportation. Since then, the EPA and CARB have been leaders in the national effort to reduce vehicle pollution via increasingly stringent standards.

Over the years, achievements in pollution reduction have included:

- In the 1970s, the EPA began to phase out lead in gasoline; leaded gasoline was fully prohibited after 1995, resulting in a 94 percent decrease in atmospheric lead between 1980 and 1999.
- In 1990, Congress amended the Clean Air Act to further reduce hydrocarbons, carbon monoxide, nitrogen oxide, and particulate-matter emissions. Amendments also included: lower tailpipe standards, more stringent emission-testing procedures, and new-vehicle technologies and clean-fuel programs.
- In 2006, the EPA adjusted the test methods for calculating fuel economy, which brought mpg estimates closer to consumers' actual fuel economy; it also required manufacturers to post more effective fuel-economy labels on cars and light trucks.
- In 2011, the EPA began regulating GHG emissions from mobile sources of air pollution such as vehicles. The standards were established to go into effect in two phases, from 2012–2016 and 2017–2025.
- In 2017, the EPA's stricter Tier 3 emission standards were implemented, calling for, among other things, a two-thirds reduction of the amount of sulfur in gasoline, capping it at 10 parts per million. And by 2025, average fleetwide CO_2 levels must be reduced to 163 grams/mile, which is equivalent to 54.5 mpg.

The EPA projects that these improvements will eliminate 6 billion metric tons of GHG over the lifetimes of the vehicles sold between model years 2012 and 2025.

According to the EPA, efforts to reduce air pollution from vehicles and other forms of transportation have been cost-effective. For every dollar spent on programs to reduce emissions, the American public receives $9 of benefits to public health and the environment, according to the agency.

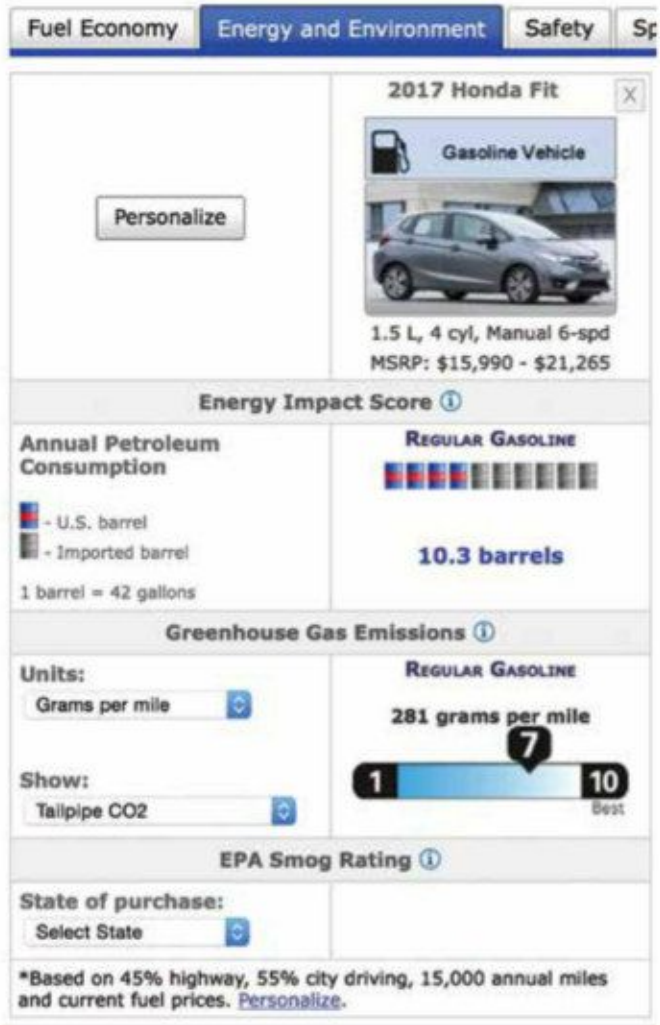
EPA Ratings

The EPA has published a great deal of information to make it easy to pick a vehicle with high fuel economy and low emission levels. Go to fueleconomy.gov/feg/findacar.shtml, choose the Browse by Model section, and select a car's year, make, and model. The website will tell you the manufacturer suggested retail price (MSRP),

what grade of gas the car requires, city/highway/combined mpg, range in miles between refills, and much more. If you click on the Energy and Environment tab near the top of the page, you'll learn a vehicle's energy-impact score, greenhouse-gas emissions, and EPA smog rating (see below).

For example, a 2017 Honda Fit with a 6-speed manual transmission has an MSRP range of $15,990–$21,165, a fuel-economy rating of 32 mpg combined, burns 3.1 gallons of gas per 100 miles, has a GHG rating of 7 out of 10 (281 grams/mile), and an energy-impact score (the amount of petroleum it uses) of 10.3 barrels of oil annually.

Another useful resource: If you're on a car dealer's lot, check out a prospective vehicle's EPA Fuel Economy and Environment label (the "new car sticker"). It's attached to the side window of all new cars and light trucks and will help you understand its green credentials. The label varies depending on the type of vehicle (gasoline, hybrid, plug-in hybrid, diesel, or electric). For more information and examples, visit fueleconomy.gov.



The EPA's Energy and Environment label provides lots of useful information: a vehicle's annual petroleum consumption, GHG emissions, MSRP, and much more.

The label provided on page 11 is for a gasoline-powered vehicle. Take note of four numbers on the label: fuel economy (upper left), fuel-economy rating 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 mileage as the most prominent. In the box below the fuel-economy score, 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 a vehicle that is less fuel-efficient.

For cars that run on gasoline (including hybrids), fuel economy is expressed as mpg. For plug-in hybrids, which run some of the time on electricity alone, the combined fuel-economy number is expressed both as mpg and MPGe (miles per gallon equivalent). For EVs and fuel-cell vehicles, the combined fuel-economy number is expressed solely as MPGe.

MPGe is defined as the estimated number of miles a vehicle can travel on the quantity of fuel with the same energy content as a gallon of gas—33.7 kWh of energy. An example of an MPGe label is on page 25.

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 a 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 than mpg, 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 traded that car in for one that gets 20 mpg, you'd 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.

This is why: 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 got 100 mpg, a 100 percent improvement over the 50-mpg car, you'd still save just one gallon of gas.

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

Why Fuel Efficiency and Emission Levels Matter

If you need reasons to buy a fuel-efficient, low-emitting car, the two main ones are *to save money* and *to save the planet*.

Saving Money

If you want to spend less on gas, buying a car that gets high gas mileage is one of the best ways to do it, and that can mean more than just saving you money at the pump. How so? Because when more people buy bigger cars and light trucks, as they've been doing recently, dealers often offer incentives and rebates to help sell fuel-efficient models.

Many gasoline-powered high-mpg cars are both affordable and fun to drive. They cost less to buy and often less to maintain than cars that use more fuel. They're easier to maneuver and park, and these days they offer plenty of convenience features and many of the latest safety features previously found only on more expensive vehicles.

Subcompact and compact cars, such as the Chevrolet Cruze, Ford Fiesta and Focus, Honda Fit and Civic, Hyundai Elantra, Mazda Mazda3, Subaru Impreza, and Toyota Corolla and Yaris, are typically the most fuel-efficient categories of cars. Despite their advantages, though, there are some trade-offs. Compacts and subcompacts aren't as roomy, not as comfortable for long trips, and are often noisy and underpowered.

Stepping up to somewhat larger vehicles addresses these concerns. For example, the Chevy Malibu, Honda Accord, Hyundai Sonata, and Mazda Mazda6 offer high fuel economy—perhaps just 2 or 3 mpg less than subcompacts—more room, higher comfort levels, and don't cost much more to buy or maintain.

Some kinds of fuel-efficient cars—hybrids, all-electric cars, and diesels—often do cost more to buy than their conventional counterparts, because they use additional or specialized powertrain components, such as electric motors, battery packs, or diesel engines.

Of course, if such cars do cost more, their fuel savings may recoup the higher purchase price—but not always, and it may take a long time. Take the Honda Accord, for example. A 2017 Accord Hybrid costs about $3,100 more than a standard Accord EX, according to the EPA's website. The Accord Hybrid gets 48 mpg combined, the nonhybrid Accord, 30 mpg.

So if regular gas is priced at $2.25 a gallon and you drive 15,000 miles a year, buying the Accord Hybrid would save you $391 a year in fuel costs and take about eight years to make up the price difference, according to the EPA's calculator (fueleconomy.gov/feg/hybridCompare.jsp).

But the catch-up time also can be relatively short. For example, with the same gas price and mileage parameters, it would take only two and a half years to make up the $700 price difference between a 2017 Toyota RAV4 AWD Limited and a 2017 Toyota RAV4 Hybrid Limited. Of course, if gas prices rise, making up the cost difference will take even less time.

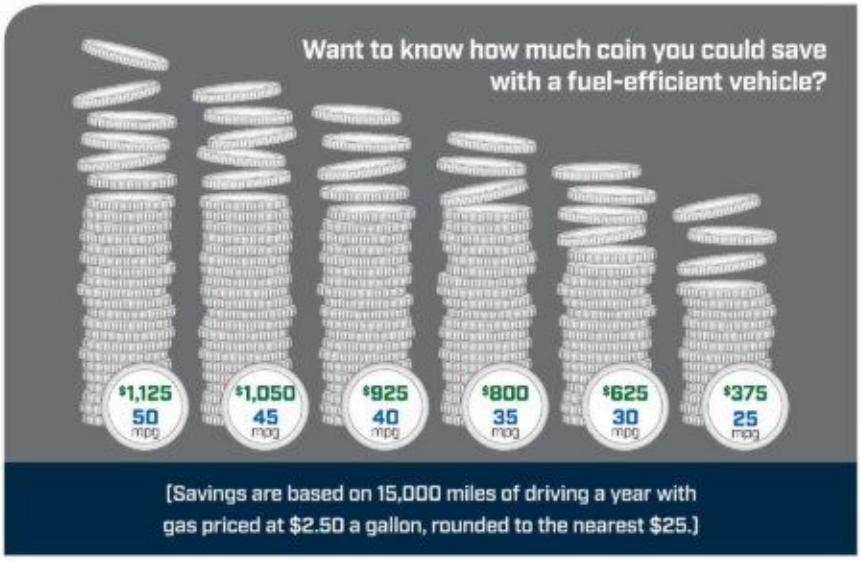
Sometimes there's no price difference between hybrids and nonhybrids. For example, the MSRP for a 2017 Lincoln MKZ Hybrid (reviewed on page 116) is the same as for a standard 2017 Lincoln MKZ. However, the hybrid version gets a combined 40 mpg versus the nonhybrid's 26 mpg, which saves $427 a year at $2.25 for a gallon of gas and 15,000 miles of driving annually. To compare gas-mileage savings on as many as four vehicles at a time, go to fueleconomy.gov/feg/findacar.shtml.

Of course, such comparisons don't matter to some car buyers, who might decide to buy a fuel-efficient car like a Toyota Prius hybrid for its other merits—it's reasonably priced, highly reliable, and has plenty of room for passengers and cargo. The fact that it gets more than 50 mpg might just be icing on the cake.

Fuel-efficient cars save their owners money in other ways. For example, new EVs and plug-in hybrids generally are eligible for a federal income tax credit of up to $7,500, depending on the capacity of the battery that powers the vehicle. (Hybrids used to qualify for tax breaks and incentives, but that's no longer the case.)

To find out which cars qualify and the amount of the tax credit, go to the U.S. Department of Energy website at 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 plug-in hybrids, go to the Alternative Fuels Data Center website at afdc.energy.gov/laws/state.

And there's more: Because electricity generally costs less than gasoline, many EVs will save their owners money in fuel costs. For example, the EPA estimates that the Kia Soul EV will save



an owner $6,000 over five years. Some workplaces provide free charging, and owners of Teslas bought before January 2017 can recharge their vehicles quickly (and for free) at nearly 800 Tesla Supercharger stations across the country (see page 26).

Finally, the price of some desirable fuel-efficient, low-emitting cars is dropping, as well. For example, before 2017, if you wanted an EV that could travel more than 200 miles on a single charge, you had to shell out in the neighborhood of $80,000 or more for a Tesla Model S or Model X. That's changed with the arrival of the 2017 Chevrolet Bolt EV, which has a base price of about $37,000 before incentives. It's EPA-rated at 119 MPGe combined, with an estimated range of 238 miles, and it produces zero emissions.

The Tesla Model 3, which won't be delivered until at least 2018, will likely have specs similar to the Bolt's. And the long wait wasn't enough to discourage about 400,000 true believers, who each put down a $1,000 deposit to reserve a Model 3.

Saving the Planet

In the larger scheme of things, saving money on gas isn't the most important reason to buy a green car. Getting more mpg and reducing noxious emissions have huge societal benefits, too. 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, methane, and nitrous oxide from vehicle emissions also contribute significantly to the concentration of greenhouse gases that cause climate change, burning less fossil-based fuel is beneficial to the planet's (and ultimately our) well-being.

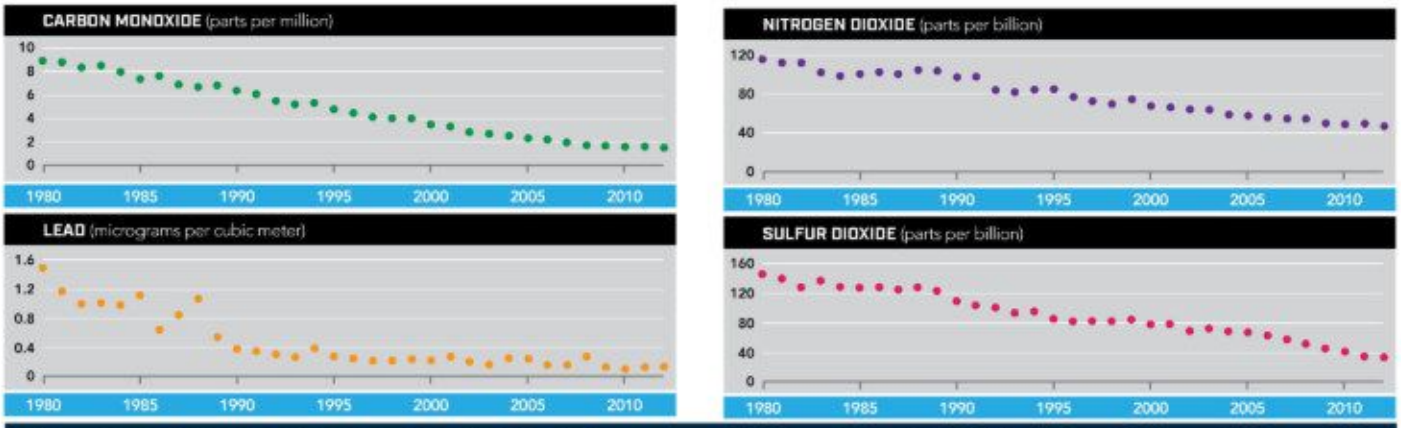
Each gallon of gas burned puts about 19 pounds of CO_2 into the atmosphere. And if you take into account the energy that goes into making and distributing the fuel, the total global-warming impact equals 25 pounds of CO_2 emissions per gallon of gas, according to greenercars.org, a part of the American Council for an Energy-Efficient Economy (ACEEE).

Is this a serious issue? In 2016, Americans consumed about 391 million gallons of gasoline every day, up from 385 million gallons in 2015, according to the U.S. Energy Information Administration. Light-duty vehicles (cars, SUVs, and small trucks) account for about 90 percent of U.S. gasoline consumption. A typical gasoline-powered passenger vehicle emits about 4.7 metric tons of CO_2 per year, assuming it gets about 21.6 mpg and is driven about 11,400 miles per year. Given this, it's easy to see that driving a vehicle with a higher mpg rating can significantly reduce your contribution to climate change.

And on a worldwide scale, matters aren't improving. The effort to increase fuel economy and lower emissions for passenger vehicles and light trucks is moving at a rate of just 2.6 percent annually in developed countries. Unfortunately, the annual improvement in developing countries, which are preparing for rapid growth in their vehicle markets, is just 0.2 percent, according to *Fuel Economy State of the World 2016: Time for Global Action*, released by the Global Fuel Economy Initiative at the Paris COP21 Climate Summit.

Both numbers are below the target rate of 3.1 percent annual improvement needed to cut fuel consumption in passenger and light-duty vehicles in half by 2030. To download the report and see a short film about the importance of improving fuel economy, go to globalfueleconomy.org.

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 began to change with the passage of the Clean Air Act in 1963, and since the 1980s, agencies such as the EPA and the California Air Resources Board have led the way in requiring automakers to produce an increasing



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.

number of low- and zero-emission vehicles.

The payoff 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.—lead, carbon monoxide, sulfur dioxide, and nitrogen dioxide—dropped more than 50 percent. [See the chart on page 14.] Ground-level ozone numbers also dropped, but not as precipitously.

Nevertheless, despite such improvements, there is still cause for concern. A recent study by the American Lung Association, *State of the Air 2016*, which ranks metropolitan areas based on ozone and particle pollution, reports that 166 million Americans—more than half the country—live in areas with unhealthful levels of these pollutants.

Energy security. Reducing dependence on foreign oil is often mentioned as a reason to buy high-mpg vehicles, but it's no longer as important as it once was because the U.S. now produces most of the oil it uses. In 2015, U.S. net imports from foreign countries equaled about 24 percent of total U.S. petroleum consumption, the lowest level since 1970, according to the U.S. Energy Information Administration.

If people focus only on short-term self-interest, whether they buy fuel-efficient cars or not depends mainly on two things: fuel prices and financial incentives. And when fuel prices are low, Americans tend to buy bigger cars and trucks—and not necessarily the ones that get the best fuel economy. Recently, American car buyers also have become infatuated with crossovers, which aren't generally as fuel-efficient as similar-sized sedans. Additionally, few motorists are willing to put public interest before perceived self-interest if buying a fuel-efficient car costs more or is inconvenient—for example, if a vehicle has a limited driving range or if refueling/recharging locations are hard to find.

Nevertheless, to meet both CAFE standards and increasingly stringent emission regulations, automakers will be required to improve the efficiency of conventional (i.e., gasoline- and diesel-fueled) powertrains, and also to introduce more cars with alternative powertrains (hybrids and EVs) in the years ahead. And if hybrids and EVs continue to improve and become more popular, they'll cost less to produce and will meet more people's needs—and more people will be likely to buy them.

EPA'S FUEL-ECONOMY TESTING

The EPA determines 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. Its testing procedures are developed by recording motorists' driving patterns and creating "drive cycles" that represent those patterns.

For many years, car buyers were justifiably skeptical of EPA mileage estimates, which were extremely optimistic, mainly because the agency's testing methods were outdated. Based in large part on scientific input it received from the Auto Club of Southern California's Automotive Research Center and AAA, in 2007, the EPA adopted new, more accurate methods for estimating mpg that took into account faster driving speeds and acceleration, air-conditioner use, and colder outside temperatures. All of these factors reduce fuel economy, so the new testing methodology, which was put into effect for 2008 and later model-year vehicles, lowered fuel-economy estimates for all vehicles.

AAA conducted a study to find out if the EPA's new testing methods produced accurate results. In general, AAA found that drivers of 1996 to 2014 model-year vehicles who reported their mileage on the EPA's website achieved an average of 12 percent better fuel economy than the EPA estimated. 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 the EPA-estimated mileage.

Virtually all of the ARC's on-road mpg measurements fell between the EPA's city and highway estimates. The ARC also conducted some of the test cycles required by the EPA for the fuel-economy ratings and found that for the vehicles tested, the fuel economy fell within the range of the sticker rating. Therefore, AAA concluded that most motorists should be able to achieve mpg numbers in the ranges the EPA now predicts—if they avoid aggressive driving. (For more on the study, see "Fuel-Economy Testing" on page 75 of Chapter 7, "AAA's Technology Initiatives."

Beginning with the 2017 model year, the EPA updated some of its calculations for estimating fuel economy, using test data from model year 2011–2016 vehicles. The agency believes that such data better reflect today's more fuel-efficient vehicles and advanced technologies (e.g., hybrids and turbocharged engines). The EPA says that ratings for most vehicles will not be affected. Some mpg estimates will decrease by 1 mpg, and a small number may be 2 mpg lower.

The Death of Private Car Ownership?

In the past two decades, two new ways of getting from place to place have taken off in the U.S.—*car sharing* and *ride hailing*, part of what's come to be called the "sharing economy." Both car sharing and ride hailing serve as alternatives or supplements to traditional private car ownership, and for some people they offer convenience or cost savings not found in owning a car. What are their implications for the future of individual car ownership?

Car Sharing

Car sharing is a form of shared transport that has two basic variations, both of which require membership: the *business-to-consumer* model, where a company owns a fleet of cars and rents them to members, and the *peer-to-peer* model, where individual owners share their cars by renting them to other members.

Zipcar, which is now owned by rental-car company Avis, is the preeminent example of the business-to-consumer model. Founded in 2000, it had more than a million members in 500 cities across nine countries by late 2016, plus a fleet of about 12,000 vehicles.

A monthly fee gives members access to vehicles at set locations, including airports and college campuses. Members book a car via an app or online, use a Zipcard to unlock and use it, and normally return it to the same location. Gas, insurance, and 180 miles of driving a day are included in the fee.

Peer-to-peer car-sharing services include Turo (formerly RelayRides) and Getaround. In this type of car sharing, members reserve a vehicle and use it for a set time period. The vehicle can be delivered to the renter, picked up from the owner's home, or even left in designated parking lots at airports for pickup.

According to Navigant Research, as reported in *Clean Fleet Report*, as a trend, car sharing:

> . . . has become a major global industry. As of 2014, car-share programs were being offered on five continents, in over 30 countries, and in hundreds of cities. These cities are at the forefront of the new model of multimodal on-demand mobility, where citizens can take advantage of a multitude of clean transportation options that meet their needs.

Navigant Research estimated that global car-sharing services revenue would grow from $1.1 billion in 2015 to $6.5 billion in 2024.

Another way to determine whether car-sharing is a leading trend is to ask whether new companies are getting into the market. The answer? Yes—lots of them. Naturally, automakers are concerned that increases in car-sharing membership will eat into future auto sales, so they're getting involved in car sharing to hedge their bets.

For example, Mercedes-Benz has its own car-sharing service, Car2Go, which rents tiny smart brand cars in—as of early 2017—seven U.S. cities. General Motors launched a car-sharing service, Maven, in early 2016. It operates in 10 U.S. cities, and ride-hailing giant Uber signed on as a partner in November.

BMW created ReachNow, a "premium car-sharing service" that's available in Portland, Oregon; Seattle; and as of late 2016, in Brooklyn, N.Y. At that time, the service had 32,000 members and about 1,000 vehicles.

Tesla has also talked about creating a "Tesla network" that would consist of a fleet of its own cars and customer cars that could be used for ride sharing.

Enterprise CarShare is another national car-sharing company,

and a host of local and regional companies also offer car-sharing services.

Once viewed as a potential long-term replacement for car ownership, car-sharing services have evolved mostly into forms of individualized car rental for users of all types, from people looking for an alternative to using traditional rental car companies to one-car families that need a temporary second car to students and recent graduates who want to postpone buying a car.

Research on the subject has yielded somewhat conflicting results: A 2014 study by AlixPartners LLP concluded that half the people who use car-sharing services regularly aren't likely to purchase new cars. On the other hand, a 2016 projection study by the Boston Consulting Group stated that:

> "Although car sharing will expand relatively quickly and widely, it will have only a minimal effect on new-car sales [in 2021], both because most drivers will not forgo car ownership entirely and because some share of lost car sales will be partially offset by sales into car-sharing fleets in large urban areas."

A more persuasive point is that new-car sales for 2015 and 2016 are at record levels, which means that private car ownership is alive and well.

Ride Hailing

An even bigger success than car sharing—if measured by sheer volume of business and worldwide availability—is *ride hailing*, aka ride sharing. Despite legal and regulatory concerns (insurance liability, conflicts with local taxi services), ride hailing has become a booming business.

Ride hailing requires no membership fees and is easily managed from a smartphone app. Typically, ride hailers type in when and where they want to be picked up, their destination, what kind of vehicle they want to ride in, and then watch on a map as their ride approaches. At the end of a trip, they pay via an on-file credit card and rate the driver, who also rates them as passengers.

The undisputed king of the ride-hailing hill is San Francisco–based Uber. Founded in 2009, Uber is available in more than 200 U.S. cities. Uber reportedly delivers 5 million rides a day. In the U.S., Uber's chief rival is Lyft, launched in 2012 and also based in San Francisco. Lyft operates in about 300 U.S. cities and, although it's growing, has delivered fewer rides than Uber.

Ride-Hailing Acceptance

Ride hailing (and to a lesser degree, car sharing) receive a lot of publicity, and the number of people using the services appears to be growing. But how popular is ride hailing, and who uses it? A study by the Pew Research Center found:

- Just 15 percent of Americans have used ride-hailing services; half (51 percent) have heard of these services but haven't used them; and 33 percent have never heard of them at all.
- For most people, ride hailing is a sporadic activity; 3 percent of Americans use it on a daily or weekly basis, while 12 percent use it once a month or less.
- Ride-hailing use varies by age: 28 percent of 18- to 29-year-olds and 19 percent of 30- to 49-year-olds have used it, but only 4 percent of those 65 and older have. The median age of ride-hailing users is 33.
- Ride-hailing awareness and use is higher among educated, relatively affluent urban dwellers—in large part because ride-hailing apps offer their services primarily in and around urban areas. As a result, both awareness and usage of these services among rural residents is extremely low. Specifically, 21 percent of urban Americans and 15 percent of suburbanites have used ride-hailing services; by comparison, just 3 percent of rural residents have used them, and more than half (54 percent) have never heard of ride-hailing apps.
- Frequent ride-hailing usage correlates with lower-than-average rates of personal vehicle ownership and use—but is not a substitute for them. And those who use ride hailing also use other forms of personal transport: walking, public transport, and cycling, for example. Two-thirds of ride hailers own a personal vehicle and drive it on a daily or weekly basis.
- The majority of ride-hailing users (86 percent) indicate that it saves them time and stress, and 83 percent view the services positively, saying they've never had a bad ride-hailing experience.

The Self-Driving Car Connection

Self-driving cars are on the horizon—or at least a couple of time zones away. (See page 60 in the chapter "How Safe Is Your Vehicle?" for more information.) Automakers, consumers, and government regulators have a strong interest in autonomous vehicles, but so do—surprise!—ride-hailing companies like Uber.

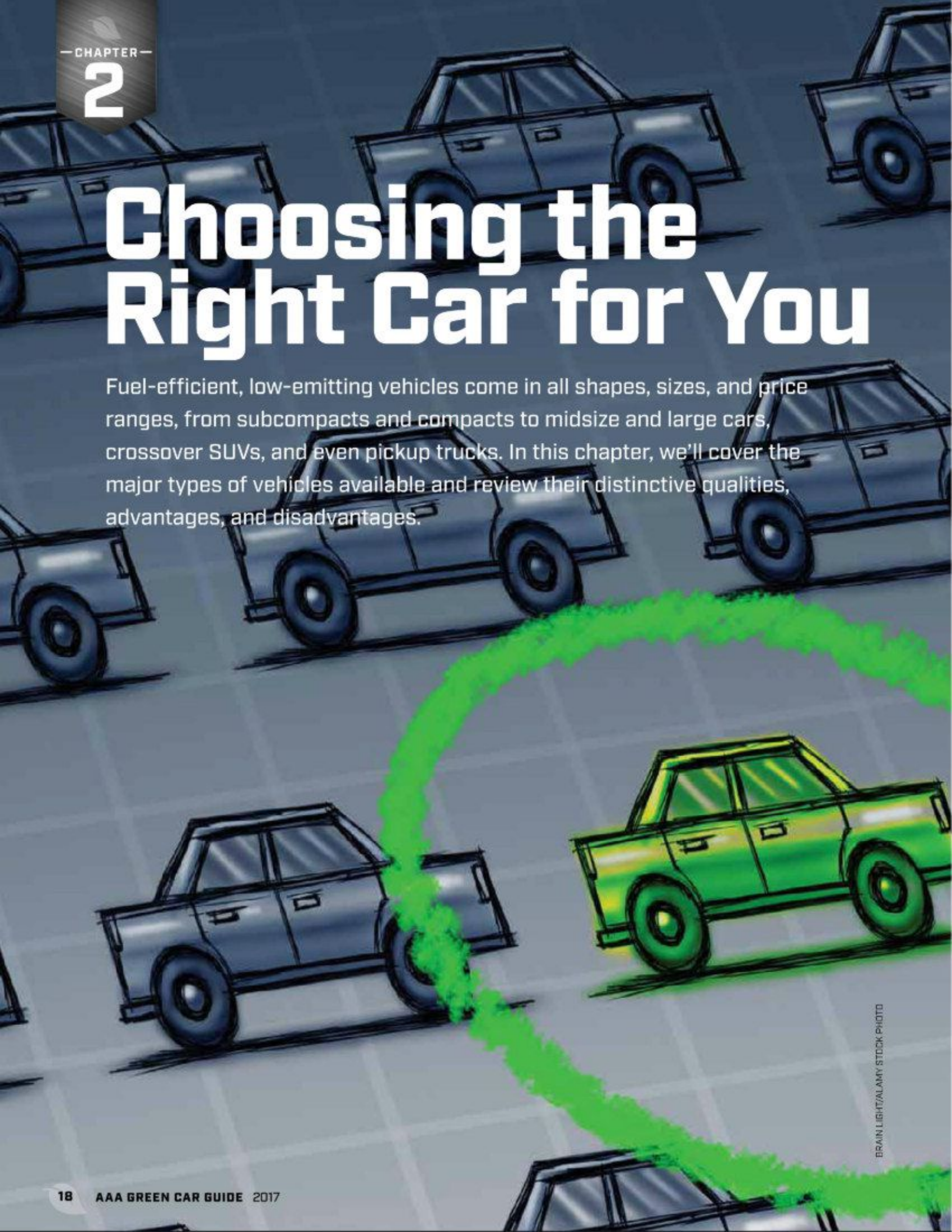
In fact, in September 2016, Uber launched a pilot program of self-driving cars in Pittsburgh. Initially, only four self-driving vehicles were available to passengers, and an Uber driver and engineer sat in the front seat to take over driving duties on occasion. Uber has also opened an Advanced Technologies Center in Pittsburgh and formed a partnership with Volvo.

Why the push? Because ultimately, Uber plans to replace many of its drivers with self-driving vehicles. And it's not alone. Fiat Chrysler, Ford, General Motors (which has invested $500 million in Lyft), Toyota (which has invested in Uber), Volkswagen, and, of course, Tesla are in a race to build autonomous vehicles and develop car-sharing or ride-hailing programs because of the changes they foresee in personal transportation. All see the potential long-term infringement of car sharing and ride hailing on new-car sales, and none wants to be behind the curve.

CHAPTER 2

Choosing the Right Car for You

Fuel-efficient, low-emitting vehicles come in all shapes, sizes, and price ranges, from subcompacts and compacts to midsize and large cars, crossover SUVs, and even pickup trucks. In this chapter, we'll cover the major types of vehicles available and review their distinctive qualities, advantages, and disadvantages.



BRAIN LIGHT/ALAMY STOCK PHOTO

Advanced Internal Combustion Engines

About 250 million vehicles currently on the road—more than 90 percent of America's legacy fleet—are equipped with engines that burn gasoline. In addition, a century-old industry and supply infrastructure—140 refineries and around 115,000 gas stations in the U.S.—support this technology, so we can expect it to continue into the foreseeable future.

One of the big surprises in the past few years has been how many improvements automakers have been able to make to the internal combustion engine. For example, since 2008, Mazda has increased the average fuel economy of its cars by approximately 25 percent and has met emission regulations without developing any electric vehicles or hybrids. Masamichi Kogai, Mazda's CEO, has said that beginning with model year 2018, the company expects to improve the fuel efficiency of its vehicles that are equipped with SkyActiv technology by an additional 30 percent.

Vehicles with internal combustion engines employ a variety of advanced drivetrain technologies to achieve high fuel economy. For example, they use:

- Smaller-displacement turbocharged engines (typically with just four cylinders), which are lighter and more efficient than V6s and V8s.
- Engines with innovative technology. For example, Infiniti has developed a variable-compression-ratio engine, which it publicized at the 2016 Paris Motor Show and in its QX50 crossover concept at the 2017 Detroit Auto Show. Called the VC-Turbo, it's a 2.0-liter turbocharged 4-cylinder engine that produces 268 hp and can switch its compression ratio from 8:1 to a 14:1 ratio for maximum fuel efficiency. The VC-Turbo is set to go into production in 2018.
- More efficient continuously variable transmissions (CVTs), or automatic transmissions with a high number of gears. An example of the latter is the Chevrolet Camaro ZL1, which offers a 10-speed automatic transmission for 2017.
- Direct fuel injection. Injecting fuel directly into an engine's combustion chamber at high pressure produces more

Vehicle	Drivetrain	Combined mpg	Greenhouse-gas rating	Smog rating
Audi A3	2.0L, 4 cyl	29	7	8
Honda Accord	2.4L, 4 cyl	30	7	8
Honda Civic	1.5L, 4 cyl	34	8	9
Hyundai Elantra	2.0L, 4 cyl	32	7	9
Hyundai Sonata	2.4L, 4 cyl	29	7	9
Kia Forte	2.0L, 4 cyl	32	7	9
Kia Optima FE	2.4L, 4 cyl	29	7	9
Mazda Mazda3	2.0L, 4 cyl	31	7	9
Mazda Mazda6	2.5L, 4 cyl	29	7	9
Subaru Crosstrek	2.0L, 4 cyl	29	7	9
Subaru Impreza	2.0L, 4 cyl	31	7	9
Subaru Legacy	2.5L, 4 cyl	29	7	9
Volkswagen Golf	1.8L, 4 cyl	29	7	9
Volkswagen Jetta	1.8L, 4 cyl	29	7	9
Volvo S60	2.0L, 4 cyl	29	7	8

WHAT'S COOL

- Proven, reliable technology
- Get better gas mileage, pollute less than conventional gasoline-powered vehicles
- Typically are less expensive than other types of fuel-efficient vehicles

WHAT'S NOT

- Sometimes not as fuel-efficient or clean as hybrid or electric vehicles

Honda **Civic**

complete combustion, a higher compression ratio, and greater efficiency and power.

- Techniques such as cylinder deactivation and stop-start engine technology, which "turn off" some engine cylinders when they're not needed or temporarily shut the engine down when the car is idling, respectively. Stop-start systems, which typically improve fuel economy by 3 to 5 percent, are becoming increasingly common to help cars meet fuel-economy mandates. A number of models from Chrysler, Ford, General Motors, and Mercedes-Benz, among others, use the technology.
- Variable valve timing and lift settings, which change according to engine speed and are more efficient than fixed settings.

Vehicles with these features not only get good gas mileage, they also produce fewer harmful emissions.

EPA's SmartWay program certifies the top 20 percent of lowest-emitting passenger vehicles for each model year, providing car buyers with an easy way to identify the cleanest, most efficient models.

Examples of 2017 vehicles with advanced internal combustion engines that can have SULEV (super-ultra-low-emission vehicle) or PZEV (partial-zero-emission vehicle) ratings can be found on page 20. (The greenhouse-gas and smog ratings are out of a possible 10 points; the higher the number, the better.)

As you can see from the list, many different kinds of fuel-efficient, low-emitting vehicles equipped with internal combustion engines are available, although not all vehicles listed are available in all states. For more information about fuel-efficient, clean SmartWay vehicles, go to fueleconomy.gov/feg/SmartWay.do.

CREATAS/THINKSTOCK

TOTAL COSTS OF OWNING A CAR

When buying a car, many people focus on the MSRP or the monthly payments. But that approach is short-sighted, because the other costs are considerable and do add up, and being aware of them might make a difference in which car you decide to buy. Sometimes one car may be cheaper to buy than another but more expensive to own.

The principal costs of owning a car beyond the purchase price are:

- Depreciation
- Fuel costs
- Interest on financing
- Insurance costs
- Maintenance and repair costs
- Taxes, fees, and registry costs

Depreciation, a car's loss in value over a given period of time, is far and away the biggest cost. Depreciation is especially high in the first couple of years. That's why, to avoid a heavy depreciation hit, many folks buy certified pre-owned cars (CPOs). Depending on the vehicle, depreciation typically can range from 30–50 percent of a vehicle's purchase price over a five-year period. Cars depreciate at different rates, of course, depending on desirability, redesigns, and other changes.

Fuel costs can also vary widely, from (over a five-year period) $4,500 for a Malibu hybrid sedan to $7,400 for a Honda CR-V to $11,000 for a BMW X5, for example. Costs are based on 15,000 miles of driving a year with gas priced at $2.85 a gallon for regular and $3 for premium. Before you buy, check to see what grade of fuel is recommended or required for any car you're considering.

Interest on financing. Interest rates vary widely—from annual rates of 0 percent to 6 percent or more. The rate you get will depend on the market, special dealer incentives, the length of the loan, and your credit score. In general, people who take shorter loans get better rates, and rates for used cars are typically higher than for new cars.

Insurance costs. This cost depends on many different things: your age, where you live, your driving record, and the cost and type of car(s) you own, to name a few. To avoid an unpleasant surprise, be sure to check with your insurance agent before you sign on the dotted line.

Maintenance and repair costs. Cars today are more reliable than ever, and many brands include routine maintenance (for a specified time) in the purchase price of the car. Still, buying an expensive car with a poor reliability record can put a big dent in your wallet after the warranty expires.

Taxes, fees, and registry costs. The more expensive the car, the greater the sales tax and (typically) the annual registration fee.

Hybrids

Hybrids have been on the market since the late 1990s and by now are considered mainstream vehicles, especially on the East and West Coasts. In some parts of the country, cars like the Toyota Prius, the world's best-selling hybrid, are among the most popular vehicles sold.

Hybrids currently on U.S. roads are all of the gasoline/electric variety, which combine a conventional gasoline engine with one or more electric motor/generators, a battery pack, and a controller. Other powertrain combinations are possible, too—diesel/electric hybrids, for example, which are available in Europe.

Hybrids use multiple powertrains to increase their 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. Not all hybrids are especially fuel-efficient, however. Some, like the Acura NSX, Porsche Cayenne Hybrid, and Lexus RX 450h, focus more on performance than on fuel economy.

Hybrids 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, which would otherwise be lost, into electricity to charge the battery pack.

Hybrids also feature stop-start technology, software that shuts the engine off when the car is idling or stopped (say, at a traffic light) and then restarts it when the driver releases the brake pedal. Stop-start technology increases fuel economy and reduces emissions. European cars with gasoline-powered internal combustion engines and diesel engines have used stop-start technology for decades and, as mentioned in the previous section, some domestic cars with internal combustion engines also use it—and more will in the future.

In 2016, U.S. hybrid sales were lower than in 2015 (347,029 versus 384,417). A little more than 28 percent of the hybrids sold, 98,863 cars, were the Toyota Prius liftback, a 23 percent decrease in sales from 2015.

Most sources blame the decline in hybrid sales on consistently low gas prices. Also, because cars with advanced internal combustion engines keep getting more efficient, they win over potential buyers from hybrid ranks. The Honda Civic, a top seller, for example, gets 36 mpg combined, which is close to the fuel-economy figures of some hybrids. Another factor negatively affecting hybrid sales is that automakers don't aggressively market or advertise them. Finally, many car buyers considering fuel-efficient cars find EVs more timely and interesting; for them, hybrids are "yesterday's news."

Still, a wide selection of hybrid models—ranging from sporty cars to SUVs to compact, midsize, and luxury sedans—is currently available, and more are coming on the market all the time. Toyota, which produces the most hybrids of any automaker, offers seven hybrid models for 2017.

As we mentioned in Chapter 1, hybrids sometimes cost more than their nonhybrid counterparts—but not always, and sometimes not much more. 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.

Another reason it makes sense to drive a hybrid, of course, is the ecological benefits, which go beyond purely financial considerations. For many people, knowing that they're burning significantly less gas and polluting less offsets the supposed penalty of paying a bit 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 function problem-free well beyond the warranty.

Toyota
Camry Hybrid

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

Plug-in Hybrids

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 a plug-in hybrid to run on electricity alone (typically for 15 to 50 miles, depending on the vehicle and driving conditions) before it starts to burn gasoline. Once its battery pack is depleted, the gasoline engine seamlessly kicks in, and drivers can continue driving until they need to stop for gas and/or recharge their battery pack. Plug-in hybrids can run solely on gasoline, but they won't achieve maximum range or fuel economy without charging.

Because plug-in hybrids can run on electricity alone, their overall fuel economy is better than that of hybrids. For example, the 2017 Prius is rated at 52 mpg combined city/highway, but the plug-in Toyota Prius Prime is rated at 54 mpg highway-city combined in gasoline-electric mode and 133 MPGe in sole electric mode. (MPGe refers to miles per gallon equivalent. It represents the estimated number of miles a vehicle can go on the quantity of fuel—i.e., electricity—that has the same energy content as a gallon of gas.)

Plug-in hybrids also save money because the cost of electricity to recharge them is usually significantly lower than the cost of gasoline, especially for utility companies that provide discounts for off-peak or nighttime charging. Typically, a plug-in hybrid's battery can be recharged overnight on a 120-volt outlet and even more quickly—usually in four or five hours—on a 240-volt charger.

Plug-in hybrid owners often buy them because they have short commutes and like the idea of driving without having to use gasoline (as well as paying less for using electricity). 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 the plug-in hybrid's gasoline engine provides.

In addition, plug-in hybrids are eligible for federal and (sometimes) state tax incentives. Go to the U.S. Department of Energy website at fueleconomy.gov/feg/taxevb.shtml and the Alternative Fuels Data Center at afdc.energy.gov/laws/state to find out more. In many states, plug-in hybrids can use carpool lanes with only the driver aboard. To find out whether a plug-in hybrid can help save you money, go to the U.S. Department of Energy's Plug-In Hybrid Calculator at fueleconomy.gov/feg/Find.do.

Total plug-in hybrid sales in 2016 were 72,935, compared with 43,143 in sales for the previous year, a 69 percent uptick. The two top-selling plug-in hybrids were the Chevrolet Volt (24,739, a 61 percent increase) and the Prius Prime (2,474; new model). Plug-in hybrids remain popular because of their convenience, range, and fuel efficiency. And Chevrolet and Toyota, which introduced the first plug-in hybrids (the Volt in 2010 and the Prius Plug-in Hybrid in 2012) aren't the only automakers offering them. Audi, BMW, Cadillac, Ford, Hyundai, Mercedes-Benz, and Porsche make plug-in hybrids—and more are on the way (see Chapter 4, "What's on the Horizon").

WHAT'S COOL

- Higher fuel economy and fewer greenhouse-gas emissions than standard hybrids
- Lower fuel costs (electricity costs 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

Chrysler
Pacifica Hybrid

Electric Vehicles (EVs)

EVs are powered by an electric motor (or motors) that draws current from a rechargeable battery pack. Some EVs—the Chevrolet Bolt, Nissan Leaf, and Tesla Model X, for example—were designed from scratch as electric vehicles. Others—the Ford Focus EV, Kia Soul EV, and VW e-Golf—started life equipped with internal combustion engines but subsequently had electric drivetrains installed.

EV owners like driving their cars 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 and repair than other types of vehicles. In many states, EVs can use carpool 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. Go to the U.S. Department of Energy website at fueleconomy.gov/feg/taxevb.shtml and the Alternative Fuels Data Center at afdc.energy.gov/laws/state for more information. For example, a 2017 Fiat 500e has a base price of $31,800. Deduct the federal tax credit of $7,500, and the total is a more palatable $24,300.

Used EVs are an even better deal—largely as a result of cheap gas, which puts a crimp in the used EV (and hybrid) markets. In early January 2017, for example, a popular online car-sales site listed about 200 Nissan Leafs (2014–2015) for sale nationwide. All vehicles had been driven fewer than 15,000 miles, and prices ranged from $8,000 to $19,000.

EVs typically are cheaper to run than their gasoline-powered counterparts, too. For example, the U.S. Department of Energy (fueleconomy.gov) estimates that it would cost $1,200 a year in gasoline to drive a 2017 Kia Soul 15,000 miles, but just $600 in electricity to drive the same distance in a 2017 Kia Soul EV.

That being said, there are some downsides to EVs, most of which 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 costs and charge times are coming down, most EV batteries require a minimum of four to eight hours to recharge fully, sometimes longer. Even a "quick charge" to 80 percent capacity on a DC charger can take a half hour.

Most two-car families could own at least one EV, because 80 percent of Americans have a round-trip commute of fewer than 50 miles, much less than the range of most battery-electric

WHAT'S COOL

- Electricity costs less than gasoline
- Clean running—zero tailpipe emissions
- Strong initial acceleration
- Smooth and quiet to operate

WHAT'S NOT

- Higher vehicle cost (even with tax breaks, rebates, and other incentives)
- Limited range, typically 75–100 miles, before a recharge is needed, although this is rapidly changing
- Long recharging times, especially on a 120-volt outlet
- Not so clean to drive if your electricity source is a coal-fired power plant
- Limited places to recharge compared with gas stations—although charging stations are increasingly coming online
- Cold and hot weather reduce an EV's range
- Expensive to replace the battery

FUEL ECONOMY is estimated differently for EVs, for plug-in hybrids 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.

vehicles (typically about 75–100 miles). Nevertheless, EV batteries' limited storage capacity minimizes the cars' appeal. Potential EV owners still worry: *Suppose my plans change and I need to drive farther than I thought I would when I left the house this morning?*

That sort of concern is becoming less pressing because in late 2016, Chevrolet began delivering its long-awaited Bolt EV, with an EPA-estimated range of 238 miles, an MPGe of 119, and a price of about $37,000 before incentives. Tesla's Model 3, with similar specs, is due "mid-2018 or later," according to Tesla.

Chevy and Tesla have thrown down the gauntlet, and other EVs must either rise to the challenge and increase their range, assume the role of around-town cars, or fade into oblivion. Over the next year, we can expect to see manufacturers increase the ranges of existing EVs in an effort to stay competitive with the Chevy Bolt and forthcoming Tesla Model 3.

Would-be EV owners should be aware that several things affect an EV's range, including ambient temperature and the use of power-consuming accessories (air-conditioning, entertainment systems, and headlights). AAA and the Auto Club's Automotive Research Center conducted tests of EV battery-pack performance—using a Nissan Leaf, a Ford Focus Electric, and a Mitsubishi iMiEV—in cold, moderate, and hot conditions in a controlled lab environment to find out how EV battery range fluctuates with temperature.

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

The number of public charging stations nationwide is on the rise, so it's easier than ever to "fill up" an EV. At the beginning of 2017, there were almost

GREENER FROM START TO FINISH?

EVs are zero-emission vehicles (ZEVs). And it's been noted that the greener a car owner's sources of electricity (i.e., getting it from sources other than a coal-fired power plant), the greener the EV driving experience. To extend that line of inquiry, one might ask if EVs are cleaner compared with gasoline-powered cars if we look at their entire life cycle.

The Union of Concerned Scientists 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 produces about 8 tons of emissions.

By the end of its driving life, the gasoline-powered car will have produced 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.

In sum, the UCS concluded that 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 within a year of driving. And as sources of electricity become greener, so will driving EVs. (To watch the UCS video on this topic, go to insideevs.com/union-of-concerned-scientists-release-video-on-electric-car-global-warming-emissions/.)

As of early 2017, Tesla had set up a network of **795 Supercharger stations** across the U.S., with **5,085 Superchargers**.

15,000 electrical charging stations with some 38,000 charging outlets in the U.S.—that's up from about 11,400 and 28,400, respectively, in early 2016—and more are on the way. For example, in December 2016, Colorado, Nevada, and Utah announced they would collaborate on a DC fast-charging network along the interstate highways that connect the three states. And in the same month, the California Public Utilities Commission voted to approve Pacific Gas & Electric's Charge Smart and Save charging infrastructure program, a $130-million project that will construct 7,500 charging stations across Northern California, primarily at multifamily dwellings and workplaces.

To find a charging station near you, use the AAA App, or go to the U.S. Department of Energy's Alternative Fuels Data Center at afdc.energy.gov.

Tesla continues to expand its network of Supercharger stations, which provide quick charges for Tesla drivers. Owners of Teslas ordered after January 1, 2017, will be entitled to about 1,000 miles of free charging annually; after that, they'll be charged a "small fee," said the carmaker. Owners of Teslas purchased before January 1, 2017, will receive free charging for the life of their vehicles.

At press time, there were 795 Supercharger stations in the U.S., equipped with 5,085 chargers. Most are concentrated around large cities on the East and West Coasts, in the Midwest, and in the South. Throughout the center of the U.S., Supercharger stations are located mostly along major interstate highways. For information on current and future Supercharger locations, go to teslamotors.com and click on Supercharger.

EV sales (not including plug-in hybrids like the Chevy Volt or Toyota Prius Prime) have been strong in the U.S. over the past few years. In 2016, sales were up 18 percent over 2015 (84,246 versus 71,158).

In addition to Chevrolet, Nissan, and Tesla—currently the big names in the field—BMW, Fiat, Ford, Honda, Kia, Mercedes-Benz, Mitsubishi, Smart, Toyota, and Volkswagen have produced EVs or will bring them to market soon.

For instance, Daimler—the parent company of Mercedes-Benz and smart vehicles, among others—previewed its new EQ electric car brand via the Generation EQ concept at the 2016 Paris Motor Show this past October. (See Chapter 4.) The company expects zero-emission cars to account for 15 to 25 percent of its global sales by 2025, said Dieter Zetsche, chairman of the board at Daimler and head of Mercedes-Benz cars. Not to be outdone, rival BMW is planning EV versions of its 3 Series, X4, Mini Cooper, and perhaps its i8 sports car.

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 during driving.

Use electric seat heaters and steering-wheel heaters instead of the cabin heater 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 for iPhone and Android phones and the Alternative Fuels Data Center website (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 into 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.

Some cars (the 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 CCS (combined charging standard) adapter. Tesla EV owners can use dedicated Tesla Supercharging stations to recharge their cars' batteries.

Flexible-Fuel Vehicles

Flexible-fuel vehicles (flex-fuel or FFVs for short) have engines that can run on gasoline and on gasoline/alcohol blends in ratios of up to 85 percent alcohol. Initially, the alcohol used was methanol, but now it's ethanol. Nearly 97 percent of U.S. gasoline contains ethanol (typically 10 percent).

E85 (an ethanol-gasoline blend made with between 51 and 83 percent ethanol) is available in about 2,800 public service stations in the United States—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. The U.S. Energy Information Administration estimates that nearly 20 million flex-fuel vehicles are on the road, although many car owners don't realize they have an FFV and therefore a choice of fuels. FFVs often have a badge or some other designation, but otherwise they look the same as any other vehicle. To find a service station that sells E85 fuel, go to the Alternative Fuels Data Center at 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 (RFS) that requires blending increasing amounts of biofuels with gasoline over time.

Ethanol burns cleanly and produces 18 to 28 percent fewer greenhouse-gas emissions than gasoline. However, if coal provides the energy to produce corn-based ethanol, it may offset those lower emission levels, according to the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Additionally, ethanol has a lower energy content than gasoline, resulting in about 15 to 27 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. The big advantage to cellulosic-based ethanol is that it produces far fewer greenhouse gases than corn-based ethanol, and 90 percent fewer greenhouse-gas emissions than gasoline. But as of late 2015, alternative sources of ethanol in the U.S. simply didn't exist and weren't being developed.

At the same time, 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. Then, surprisingly, in late 2016 the EPA boosted its proposed ethanol volume for 2017, calling for 19.2 billion gallons of ethanol and other biofuels to be added to the fuel supply in 2017, an increase of 1.2 billion gallons from 2016 levels.

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

WHAT'S COOL

- Domestically produced alternative fuel reduces the need to import oil
- Higher octane means better performance

WHAT'S NOT

- Limited availability of E85
- Lower energy content and therefore worse fuel economy than gasoline

Ford
F-150

New Car–Buying Checklist

Following these steps will simplify the process of buying a new car and likely save you time, money, and hassle.

1. Narrow your initial search by asking the following kinds of questions:
   - How many people and how much stuff do I typically carry around?
   - How much can I afford to spend?
   - How important is reliability?
   - How safe are the cars I'm considering?
   - How much will fuel, maintenance, and insurance cost?
   - How much do I care about the status a car confers?
   - What vehicle type—sedan, SUV, hatchback, for example—do I prefer?
   - What other qualities—for example, ride comfort, interior space, handling, overall design, convenience features—matter to me?
2. Make sure you've done your research and have complete and accurate vehicle information (safety ratings, rebates, vehicle pricing, etc.) before you visit the dealership—preferably from a trusted source, such as AAA.
3. Before you visit the dealer, make sure you know the difference between the MSRP and the dealer's cost of the car you want to buy. Otherwise, you won't know whether the dealer is offering you a good deal.
4. Research the trade-in value or private-party value of your current vehicle before trading it in. If you know the value of your car on the open market, you might decide to sell it on your own instead of trading it in. In short, keep your trade-in options open.
5. Don't expect the salesperson to have your best interest at heart when negotiating the price of a car. If you do your research ahead of time, you'll know whether you can trust the information the salesperson provides you.
6. Get a preapproved car loan before you visit the dealer. That way, you'll know whether or not the dealer's interest rate is competitive.
7. Bring a friend along. A trusted friend can help you see the economic facts objectively and possibly keep you from making a buying decision based solely on emotion.
8. Set aside enough time to buy the car—at least two hours. If you bring all the necessary paperwork with you—your car's title, current registration, and a pre-approved loan—your buying experience will go much smoother. Still, dealers have an enormous amount of legal documentation to complete, so the entire transaction is not going to happen in an hour.
9. Don't be in a hurry to lease a car just because the lease offers lower monthly payments. A lease is like a long-term rental, and when it's over, you don't have a paid-off car with some equity to show for it. Know all the costs of a lease (or a purchase) before you sign any lease or sales agreements.
10. Be wary of buying "add-ons," such as paint sealants, service agreements, and theft-recovery systems without knowing their benefit or how much they should cost. The initial price you're offered is frequently inflated, so ask for a discount from the finance manager.
11. Consider using AAA's Car Buying Service (aaa.com/auto), which guarantees prearranged pricing, honest business transactions, and complaint resolution services for members if anything goes wrong during the car-buying process.

CULTURA CREATIVE (RF)/ALAMY STOCK PHOTO

Hydrogen Fuel-Cell Vehicles

Hydrogen fuel-cell vehicles 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 no pollutants, 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.

In 2008, Honda produced 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, Honda unveiled its new five-passenger fuel-cell sedan, the Clarity Fuel Cell, which it began leasing in Japan in March 2016 as a 2017 model. U.S. deliveries began in late 2016 to customers in Northern and Southern California.

WHAT'S COOL

- The ultimate clean vehicle—zero tailpipe emissions, and no plugging in required
- Fast refueling times, similar to a traditional gasoline vehicle

WHAT'S NOT

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

In spring 2014, Hyundai released a Tucson-based fuel-cell vehicle 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 the introduction of its Mirai fuel-cell vehicle, which became available for sale or lease in the U.S. in fall 2015. Other automakers, including Mercedes-Benz, are also pursuing fuel-cell technology. In 2016, 1,074 fuel-cell vehicles were sold in the U.S. (compared with 112 in 2015); 1,034 were the Toyota Mirai, and 40 were the Hyundai Tucson Fuel Cell.

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. At press time, about three dozen hydrogen fuel stations were open nationwide. The vast majority—about two-thirds—are located in and around San Francisco and Los Angeles. The California Air Resources Board says that 50 California stations are expected to be open by the end of 2017. A handful of stations are located on the East Coast, and virtually none exist in the center of the country.

Hyundai
Tucson Fuel Cell

Best Fuel-Efficient Cars for Teens

If you're buying a car for your teen, focusing on fuel efficiency and safety has multiple benefits. You'll save money and be kinder to the environment with a high-mpg car, and your teen will be safer driving a car with a five-star rating from NHTSA or a Top Safety Pick rating from IIHS. (Teens have the highest crash rates of any age group.) And if you buy your teen a new car or relatively new used car, you'll likely be able to choose from one or more advanced safety features that increase its protective ability. (See Chapters 5 and 7 for more information on these features.)

However, you and your teen might not agree on the best kind of vehicle for him or her. It's likely that he or she might want an SUV, something performance oriented, or a sporty car. But that's not a good idea, because sporty cars with a lot of horsepower just encourage teens to show off, and SUVs (especially larger ones) have higher centers of gravity and can roll over more easily at their handling limits.

Instead, consider a midsize sedan or a compact/midsize crossover with a 4-cylinder engine, automatic transmission, and high crash-test scores. Here's why:

- A midsize car or compact/midsize crossover is easier to drive, handles well, but still has enough mass to protect occupants better in a crash.
- A 4-cylinder engine restricts a car's acceleration and typically provides better fuel economy and releases fewer emissions.
- A car with an automatic transmission eliminates the need to shift manually, enabling teens to focus on the important elements of driving: steering, proper speed, and braking.
- Cars really have gotten a lot safer in the past few years—especially those with advanced safety features—and a car with a high crash-test score could save your teen's life or reduce the chance that he or she will be seriously injured in a crash.

Based on these criteria and the review scores, the top cars for teens in the 2017 *AAA Green Car Guide* are:

1. Honda Accord Hybrid Touring
2. Kia Optima Hybrid EX
3. Volkswagen Passat 1.8T SE
4. Lincoln MKZ HEV Reserve
5. Lexus ES 300h
6. Toyota Camry Hybrid XLE
7. Honda Accord Sport Sensing
8. Hyundai Sonata Hybrid Limited
9. Chevrolet Malibu Hybrid
10. Ford Fusion Hybrid Titanium

TOM WANG/ALAMY STOCK PHOTO

Diesel and CNG vehicles

Cars and light trucks powered by diesel fuel and compressed natural gas (CNG) have never been popular in the U.S. Just a few years ago, though, they seemed like viable alternatives to gasoline-powered vehicles, hybrids, and EVs. Unfortunately, for different reasons, their promise has diminished.

Dieselgate: The Saga Continues

Diesel passenger cars have been extremely popular for a long time in Europe, where gas prices are much higher than in the U.S., because of their high fuel efficiency, strong torque, durability, and reduced CO_2 emissions compared with gasoline-powered cars.

Diesels have been unpopular in the U.S. because, among other reasons, they cost more than their gasoline-powered counterparts and because diesel fuel typically costs more than gasoline. Also, when diesels were first imported decades ago, most were noisy, smelly, and rough running. Although that's no longer true, they've never quite shaken that reputation. And even using 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 emission standards.

Until recently, diesel sales in the U.S. had been picking up. Diesel car registrations rose from about 641,000 vehicles to almost 800,000 between 2010 and 2012, and in the first half of 2014, diesel passenger-vehicle sales increased 25 percent compared with the previous year.

These gains were due in part to an aggressive "clean diesel" campaign by Volkswagen, one of the leading producers of diesel passenger cars. The campaign, however, turned out to be a fraud, based on deception. The resulting scandal seriously damaged VW's reputation and left diesel's future in the U.S. and Europe in limbo.

With respect to VW, here's what went down: In September 2015, it was revealed that, beginning with model year 2009, VW violated U.S. diesel emission regulations by installing emission-cheating software—referred to as a "defeat device"—that turned on cars' emission controls for EPA testing and turned them off during real-world driving. This enabled cars to both "pass" the emission tests in the lab and deliver good on-road performance and high mpg for the consumer. But as a result of using the defeat device, diesel passenger cars in the U.S. emitted 10 to 40 times the permissible level of nitrogen oxide.

About half a million cars in the U.S. (and another 10.5 million worldwide) were implicated—initially, VW and Audi TDI models equipped with 2.0-liter 4-cylinder diesel engines. Later it was discovered that VW's 3.0-liter V6 TDI diesel engine also used a defeat device, which affected other Audi and Porsche vehicles (part of the VW Group) too.

VW dealers, customers, government officials, and auto-industry executives expressed shock, anger, and dismay at the deception. VW had to stop selling new diesel cars, of course, as well as some certified pre-owned diesels. Sales of all VW models dropped in the ensuing months, VW's stock value plunged, and owners of VW diesels worried about a loss in value and difficulty in selling their cars.

In October 2016, a U.S. District Court judge approved a fine of $14.7 billion against Volkswagen, after which VW began notifying owners and lessees of the affected 2.0-liter cars, letting them know about the $10 billion buyback program, which started in

Chevrolet **Colorado**

November 2016. Owners who bought their cars before September 17, 2015, could sell them back to Volkswagen for between $12,500 and $44,000, depending on model, age, etc. Lessees would receive a cash settlement of $2,600 to $4,900.

By mid-October of last year, some 340,000 TDI owners and lessees said that they wanted VW to buy back their cars. Owners who decide not to sell their cars back will receive between $5,100 and $10,000 to compensate for lowered resale value, plus a free emission fix. The same terms were offered to some owners of cars with 3.0-liter V6 diesels. Owners and lessees have until May 2018 to decide what they want to do. VW must buy back 85 percent of the cars by June 2019.

Owners in most states likely will not legally be required to have their cars fixed. In California, however, emission recalls are tied to vehicle-registration renewal, and therefore the fix will have to be performed if an owner wants to renew his or her vehicle registration.

In late 2016, VW reached a preliminary agreement with authorities regarding some 83,000 3.0-liter V6 diesel vehicles—Audis, Porsches, and VWs—with the "defeat" software. The affected cars must either be modified to meet emission standards or bought back from their owners. Estimates for the 3.0-liter settlement: $1 billion plus. VW also must contribute additional funds for environmental remediation and zero-emission-vehicle infrastructure.

On January 11, 2017, the U.S. Department of Justice announced that VW would pay $4.3 billion in criminal and civil fines; six VW executives were arrested for their alleged involvement in the scandal. An independent monitor will oversee VW for three years to ensure that it complies with U.S. regulations. Also, VW was required to plead guilty to three felony charges, stating that it broke U.S. law.

At the end of 2017, the EPA will decide whether VW will be permitted to fix the cars it has bought back, as well as those of owners who decided to keep their cars. If approved, the emission fixes will be staggered in four stages. There are several generations of cars, and all will require different fixes.

Does the VW scandal spell the death of diesel passenger cars in the U.S.? "Death" may be too strong a word, but diesels likely will be on the critical list for quite a while. On the plus side, BMW is still offering diesel passenger cars in the U.S., and pickups such as the Chevy Colorado [reviewed on page 134] are available with a diesel engine. For 2017, Chevy is offering a diesel engine in its Cruze compact sedan, and Mazda's long-awaited diesel engine will be offered in the popular CX-5.

The downside? VW has abandoned any plans to sell diesels in the U.S., and the fallout from its deceit has altered the outlook of executives at Mercedes-Benz and BMW, both formerly strong proponents of diesels. Now both companies are cutting back on the number of diesels they're bringing to the States and are seriously questioning their future commitment to diesel cars.

AAA.com/greencar

CNG-Powered Vehicles

What's happened with CNG passenger vehicles verges on tragic, because CNG has some terrific advantages as a vehicle fuel. First, the U.S. has vast reserves of it, so we're not dependent on other countries for our supply. Second, CNG is relatively clean. When burned, it produces 60 to 90 percent fewer smog-producing emissions and 30 to 40 percent fewer global-warming gases than gasoline. Third, CNG typically is less expensive than gasoline. In January 2017, for example, the average national price for CNG was about $2.11 per gallon equivalent, compared with about $2.35 for regular gasoline.

The limited availability of CNG fueling stations is one big reason CNG technology hasn't been more widely adopted for passenger vehicles—even though expanding a CNG network wouldn't be especially difficult. Only about 500 CNG fueling stations in the U.S. are open to the public, and they're concentrated mostly in urban areas. A list of CNG fueling stations can be found at cnglocator.net. Also, CNG vehicles are more costly to produce because the onboard fuel has to be stored in a high-pressure tank.

In mid-2015, after nearly two decades, Honda discontinued its Civic Natural Gas model, which cost about $6,000 more than a conventional Civic. In recent years, Honda had sold only about 700 Natural Gas models annually.

In 2013, Chevy announced it would produce a version of its Impala full-size sedan that would run on both CNG and gasoline. By late 2015, the car was in production, and about 200 vehicles were delivered by the end of the year. In May 2016, however, GM announced it was discontinuing production of the Bi-Fuel model.

Currently, no new CNG passenger vehicles are available for sale in the U.S., presumably because of lack of customer demand. Consistently lower gasoline prices have eliminated the appeal of potential fuel savings.

Cars that run on natural gas continue to be popular in other countries, but prospects for more CNG-powered cars in the U.S. are dim.

CHAPTER 3

How AAA Chooses, Tests, and Scores Vehicles

The Automobile Club of Southern California's Automotive Research Center (ARC) tests and reviews vehicles and publishes the results in the *AAA Green Car Guide*, which it has done since 2010. During that time, there has been a tremendous increase in the number of fuel-efficient makes and models, as automakers attempt to meet federal CAFE standards and increasingly stringent smog-forming-emission regulations (see Chapter 1).

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

For a vehicle to be included in the *AAA Green Car Guide*, it must be one or more of the following:

- A gas-powered vehicle with EPA category-leading fuel economy or with a fuel-economy rating within 10 percent of the leader
- A hybrid or plug-in hybrid vehicle
- A battery-electric vehicle
- A zero-emission (ZEV) or partial-zero-emission (PZEV) vehicle
- A diesel vehicle that meets California emission standards
- A vehicle that runs on CNG
- A vehicle that runs on hydrogen.

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.

Based on its research, the ARC compiles a list of potential vehicles to be tested for the current *Guide* (model years 2016 and 2017), then updates and changes the list as additional information about vehicles comes in. For this year's *Guide*, only vehicles available for sale by January 1, 2017, were tested. The *Guide* also includes models from 2016, but only if no significant changes were made to a car's powertrain for 2017. No reviews of vehicles older than model year 2016 are included in the current *Guide*.

ARC staff then asks automakers to lend it vehicles to test. Manufacturers don't always have the requested vehicles, either because they're not yet in press fleets or simply not available. If the ARC is unable to acquire a vehicle from a manufacturer, it attempts to obtain it from rental companies or other sources.

The ARC makes every attempt to acquire a vehicle or powertrain that fits within the guidelines described above. If a vehicle isn't reviewed, it's because we weren't able to acquire it by the publishing deadline. Look for capsule reviews of such vehicles in the "But Wait, There's More" section of Chapter 4, "What's on the Horizon."

SCORING

After the ARC completes vehicle testing, it ranks the scores for each test area on a 0- to 10-point basis. The best-scoring vehicle receives 10 points and the lowest receives 0 points. Then the scores from all the tests for a particular vehicle are totaled to determine its overall score. The maximum possible score is 130.

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

EMISSION SCORE. A vehicle's emission score is taken directly from the EPA's ratings. It's the equivalent of the EPA's smog rating, which is found on all new-vehicle window stickers. The rating is on a scale of 1 through 10 (with 10 being the best), determined by the vehicle's emission levels. All vehicles have a federal rating, and all vehicles sold in California must pass California exhaust-emission standards. So most vehicles will have both a federal and a California 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 emission standards) vehicles that produce lower exhaust emissions than the same vehicles sold in other states. 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.

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 0 mph.

ACCELERATION. A vehicle is given an acceleration score based on its 0-to-60 mph and 40-to-60 mph elapsed times, which are measured using an optical fifth wheel. A total of 12 acceleration tests per vehicle at each speed interval 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 5 or a 0, respectively.

All vehicles are then rated on the basis of both components on a scale from 0 to 5 each, 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 0-to-60 mph and 40-to-60 mph times.

OPTICAL FIFTH WHEEL

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 that make up the overall handling score are derived from subjective ratings of control and ease of operation.

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 5 points.

A vehicle is also awarded points based on its number of air bags, with a maximum of 5 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.

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 score of 0, 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 0 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 nine 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 for both the front and rear seats, which is factored into the overall rating for the front and rear. The average of the two overall ratings (front and rear) given by each evaluator becomes the overall score, on a scale from 0 to 10.

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 measurement are calculated. The vehicles

are then scored relative to the other vehicles in the *Guide*. Legroom and headroom can receive a maximum of 2 points, and shoulder room can receive up to 1 point.

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 0 to 60 mph. The vehicle with the noisiest interior at each measured interval receives a subscore of 0; the vehicle with the quietest interior receives a 10. All other vehicles are then scored relative to the minimum and maximum decibel values, and an overall score for interior noise is calculated.

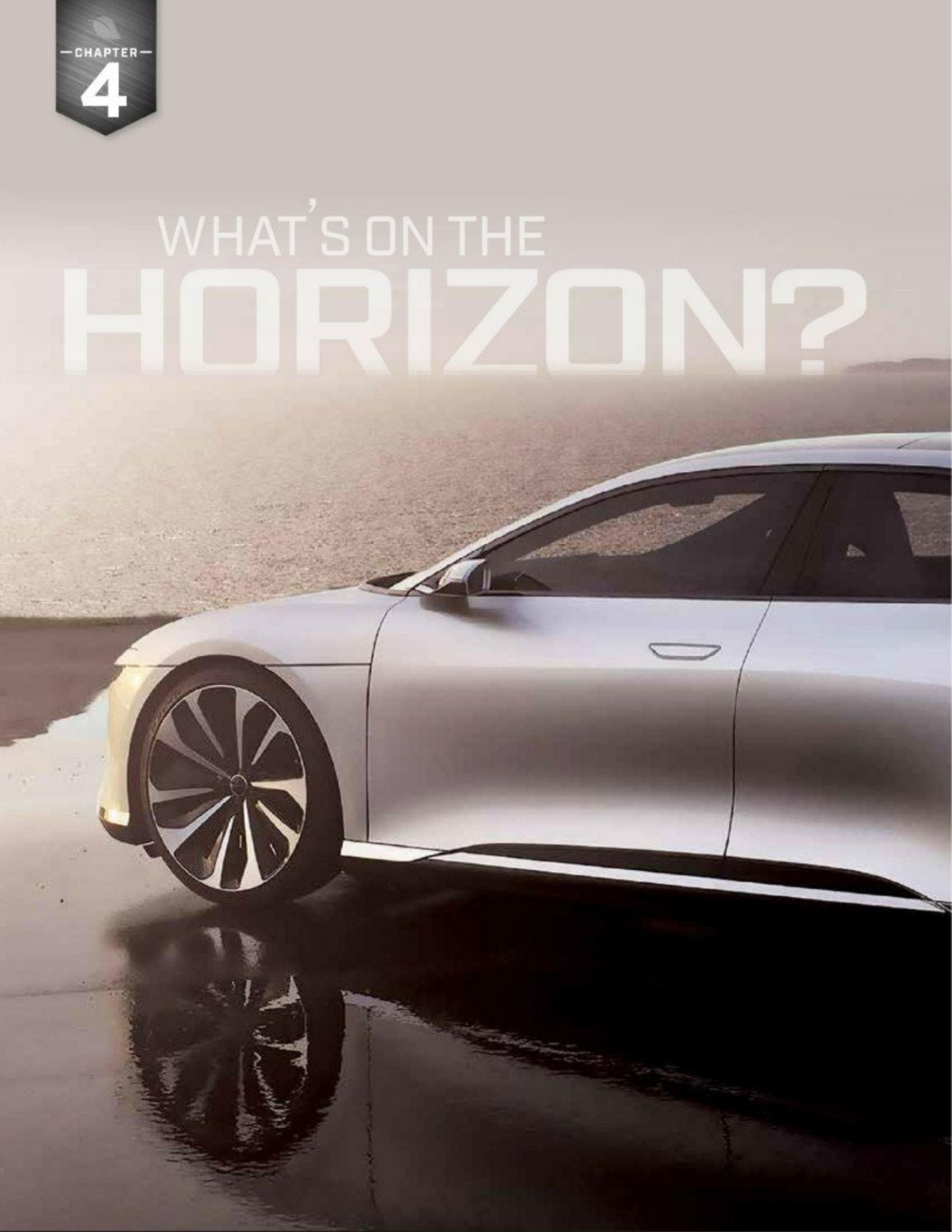
VISIBILITY. There are four subjective visibility categories that each evaluator rates: forward, rear, and side visibility, each with their own set of attributes, and the side-mirror controls. Each individual attribute (for example, forward distance visibility) is rated on a scale from 0 to 10. A vehicle 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 uses the overall average of all the scores to obtain the raw score.

FUEL ECONOMY. The ARC uses EPA estimates of combined mpg, and the ratings are ranked from highest to lowest. The vehicle with the best fuel economy gets 10 points; the vehicle with the lowest gets 0. All EVs get a score of 10. For gasoline vehicles, if a vehicle uses regular fuel, it receives 2 additional points (1 for midgrade). The high, low, and average on-the-road fuel economy for gasoline and hybrid vehicles obtained during the test vehicle's evaluation is also noted, but is not included in the fuel-economy score. Generally, at least three evaluators drive each test vehicle over a weeklong period.

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 0, and the one with the smallest circle receives a 10. All other vehicles are then scored relative to the minimum and maximum radiuses.

CHAPTER 4

WHAT'S ON THE HORIZON?




Lucid **Air**

If we've learned anything in the past decade, it's that when it comes to automotive design and development, never underestimate the range and extent of automakers' creativity and ingenuity. Ten years ago, who would have imagined the sophisticated technology that's made today's vehicles not only more fuel-efficient and cleaner but also more connected, autonomous, and safer?

Consider: affordable cars that can travel more than 200 miles on a single charge of electricity; pickup trucks with aluminum bodies and beds and 10-speed transmissions; cars with structural components made mostly from carbon fiber or aluminum; vehicles that can "talk" to each other and the driving environment; and vehicles that can accelerate, brake, turn, and stop—basically, perform all essential driving functions—with little or no human involvement.

Significant progress is being made in all these areas and will continue. Things are moving, as the saying goes, full speed ahead. That spirit—that creativity and ingenuity—is reflected in many of the vehicles on the horizon.

As carmakers look for ways to make vehicles more fuel-efficient and cleaner, the following key trends are influencing the types of vehicles coming to market over the next several years:

- **Further improvements to traditional, gasoline-fueled engines.** The vast majority of vehicles in the U.S.—including green vehicles—burn gasoline and diesel fuel. Carmakers aren't simply going to abandon this established technology nor the infrastructure that supports it. They'll keep investing time and resources to make vehicles with internal combustion engines more fuel-efficient and cleaner—if for no other reason than to meet federal and state fuel-economy and emission standards. Improvements will include greater use of direct fuel injection, cylinder deactivation, engine stop-start systems, turbocharging, and variable valve timing and lift, as well as other measures not related to powertrains, such as lightweighting and aerodynamic improvements.

- **More hybrid vehicles, especially plug-ins,** including some that use diesel fuel, hydrogen, or natural gas. For example, this year Hyundai is introducing the Ioniq, a new dedicated green car with three variations—hybrid, PHEV, and EV—and European automakers like Audi, Mercedes-Benz, Porsche, and VW have stated that they see electrification as the future of new-car development. All are developing hybrids and plug-in hybrids that will be released in significant numbers by 2020.

- **More EVs from newer car companies,** such as Lucid, as well as from more established carmakers. In addition to their interest in plug-in hybrids, European automakers are taking a greater interest in EVs. This trend will be spurred by lower battery prices, greater availability of charging stations, and improvements in battery-pack capacity.

- **The status of diesel vehicles is less certain** in the wake of the VW scandal (see page 32). A few carmakers (Ford, GM, and Mazda) have recently introduced diesel SUVs, passenger cars, and pickups, but in general, European carmakers are backing away from diesel-vehicle development. For example, Mercedes-Benz, formerly a big proponent of diesels, is not planning to offer any diesel cars in the U.S. in 2017.

- **The same seems to be true for hydrogen-powered vehicles** but for different reasons. Hyundai introduced the Tucson Fuel Cell in 2014, Toyota released the Mirai in late 2015, and Honda began delivering the Clarity Fuel Cell in late 2016. The Tucson Fuel Cell and Mirai have had limited success, for the same reasons hydrogen fuel-cell vehicles generally haven't taken off: Gas is cheap, fuel-cell vehicles are expensive, and, most important, there's hardly any place to refuel them. Some automakers are entering into partnerships to offset the high expense of developing fuel-cell vehicles; for example, the Honda and GM partnership, created in 2013.

The mid- to long-term picture isn't as clear. U.S. cars with alternative powertrains (i.e., hybrids, PHEVs, EVs) still make up only about 5 percent of the U.S. fleet. The vast majority of the U.S. vehicle fleet for the foreseeable future will be traditional gasoline vehicles, because Americans keep their cars for 11–12 years on average, and gasoline and diesel fuel are cheap and readily available.

Government policies in other countries—especially in Europe—also remain committed to high fuel economy and reduced emissions, which means that, because the auto industry is a world market, automakers will continue producing cars that are cleaner and burn less fossil fuel.

The first part of this chapter describes fuel-efficient, low-emitting vehicles that are likely to come on the market in early to mid-2017 or 2018 but that weren't available for sale as of February 1, 2017. The second part of the chapter, "But Wait, There's More," provides capsule reviews of vehicles that are available now but that weren't tested in this year's *AAA Green Car Guide*.

HYBRIDS

Hyundai **Ioniq**

Early in 2017, Hyundai is releasing hybrid and EV versions of its Ioniq hatchback. The hybrid (shown) has a 1.6-liter 4-cylinder engine that produces 104 hp, a 43-hp electric motor (139 hp total), a 6-speed automatic transmission, and a 1.6-kWh lithium-ion battery pack. The EV has a 120-hp electric motor and a 28-kWh lithium-ion battery pack. EPA-estimated combined fuel economy is 55 mpg for the hybrid and 136 MPGe for the EV. The estimated range for the EV is 124 miles; Hyundai plans to increase that to closer to 200 miles by 2018. An Ioniq plug-in hybrid, with a more powerful electric motor, a larger battery pack, and an estimated all-electric range of 25 miles, is scheduled to go on sale in summer 2017.

Kia **Niro**

Korean carmaker Kia will release its first dedicated hybrid, the compact Niro crossover, in spring 2017. (Kia calls it a crossover, but the Niro doesn't offer AWD or elevated ground clearance.) Sharing a platform with parent company Hyundai's Ioniq vehicles, the Niro is equipped with a 1.6-liter 4-cylinder engine that produces 104 hp, a 43-hp electric motor (139 hp total), a 6-speed automatic transmission (with Sport mode), and a 1.56-kWh lithium-ion battery pack. Numerous advanced safety features are available. EPA-estimated combined fuel economy is between 43 and 50 mpg, depending on the trim level.

PLUG-IN HYBRIDS

Audi **Q8 concept**

At the 2017 Detroit auto show, Audi introduced its "coupe-design" plug-in SUV, the full-size Q8 concept; a production model based on it will launch sometime in 2018, the company said. The Q8 is powered by a turbocharged 3.0-liter engine that delivers 333 hp and 369 lb-ft of torque; the Q8 also has a 100-kW electric motor and an 8-speed automatic transmission with three driving modes. Its top speed is 155 mph. The Q8's battery pack can be recharged in 2.5 hours at 240 volts. Its claimed all-electric range (European test cycle) is 37 miles, which in real-world terms probably translates to somewhere in the 20s.

PLUG-IN HYBRIDS (CONT.)

BMW **530e iPerformance**

BMW completely redesigned its 5 Series sport sedan for 2017, and the lineup includes the company's fifth plug-in hybrid, the 530e iPerformance. Its twin-turbo 2.0-liter 4-cylinder engine (180 hp) and 95-hp electric motor combine for a total output of 248 hp and 310 lb-ft of torque, which can propel it to 60 mph in about 6 seconds. The 530e has an 8-speed automatic transmission with three driving modes: Auto eDrive, Max eDrive, and Battery Control. A 9.2-kWh lithium-ion battery resides beneath the backseat; it can be fully charged in under three hours on 240 volts or in about seven hours on 120 volts. Offered in both RWD and AWD, the 530e is scheduled to go on sale in spring 2017.

Cadillac **CT6**

The all-new CT6, Cadillac's standard-bearer, has a plug-in hybrid version that combines a turbocharged 2.0-liter 4-cylinder engine, two 100-hp electric motors, an electric variable transmission with three operating modes, and an 18.4-kWh battery pack located above the rear axle. The powertrain's total output is 335 hp and 432 lb-ft of torque. The CT6 PHEV will have RWD 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. (At press time, the EPA hadn't provided an estimate.) Recharge time is approximately five hours at 240 volts. The CT6 PHEV should be in dealer showrooms in spring 2017.

Karma **Revero**

In 2012, Fisker Automotive produced the Karma, a sleek plug-in hybrid four-seat sport sedan, but the company went out of business in 2013. A multinational Chinese auto-parts maker bought Fisker's assets, renamed the company Karma Automotive, and reintroduced an updated version of the car as the Revero in September 2016. GM supplies the 260-hp turbocharged 4-cylinder engine; the battery's capacity has been upgraded to 21.4 kWh, good for about 50 miles of all-electric driving. The Revero has three drive modes and regenerative braking. The car will be built in Southern California. The company has eight "retail associates" in North America, and deliveries should start in early 2017. Fuel-economy figures weren't available at press time.

PLUG-IN HYBRIDS (CONT.)

Kia **Optima Plug-In Hybrid**

The 2017 Optima Plug-In Hybrid, based on the redesigned 2016 Optima sedan, had been scheduled to arrive in late in 2016; at press time, Kia's consumer website only said "coming soon." It's equipped with a 2.0-liter direct-injection 4-cylinder engine (154 hp), a 66-hp electric motor, a 6-speed automatic transmission, and a 9.8-kWh lithium-ion polymer battery pack. Total power output is 202 hp; the all-electric range is expected to be about 27 miles, with EPA-estimated fuel-economy ratings of 40 mpg in combined city/highway driving and 103 MPGe. The Optima PHEV can fully charge in less than three hours at 240 volts or in nearly nine hours on a 120-volt power outlet.

Mercedes-Benz **E350e**

The E350e, a plug-in version of Mercedes-Benz's redesigned E Class, may be hitting dealer showrooms in late 2017. It will be powered by a turbocharged 2.0-liter inline 4 that produces 208 hp, plus juice from an 87-hp electric motor, for a total of 282 hp. Top speed is 130 mph. The estimated 0–60 time is 6.1 seconds, and the estimated all-electric range is 20 miles. No fuel-economy figures were available at press time.

Mercedes-Benz **GLC350e**

A few years back, Mercedes' compact GLK SUVs got a new designation: GLC. Its PHEV variant, the GLC350e, will be powered by a turbocharged 4-cylinder engine and a 112-hp electric motor that produce a combined 320 hp and 413 lb-ft of torque. Additional features include a 7-speed transmission and an 8.7-kWh lithium-ion battery pack. AWD is standard. The electric-only range is estimated at 20 miles, and charging should take about four hours at 240 volts. Fuel-economy numbers hadn't been released at press time. Look for the GLC350e in dealer showrooms in mid-2017.

PLUG-IN HYBRIDS (CONT.)

Mitsubishi **Outlander Plug-in Hybrid**

Talk about late to the party! The Outlander PHEV went on sale in Asia and Europe in 2013, where it's been quite popular. It's even been through a redesign since then. But entry into the U.S. has repeatedly been delayed; currently, the SUV's performance is being retweaked for the U.S. market, and new safety and convenience features are being added. The basic driveline components will likely stay the same: a 2.0-liter 4-cylinder gasoline engine and two 80-hp electric motors—one at the front and another at the rear—that provide it with full-time AWD. It will be powered by a 12-kWh lithium-ion battery and have an all-electric range of about 25 miles. The most optimistic estimate for arrival on U.S. shores? Fall 2017.

Porsche **Panamera 4 e-Hybrid**

Porsche redesigned the Panamera completely for 2017; the hybrid version will hit the U.S. in summer 2017 as a 2018 model. It will have a 2.9-liter twin-turbo V6 that puts out 330 horsepower, a 136-hp electric motor, a 14.1-kWh lithium-ion battery, and an 8-speed automatic transmission. Total power output will be 462 hp and 516 lb-ft of torque. The claimed 0–60 mph time is 4.4 seconds, with a 31-mile electric-only range. AWD is standard.

Volvo **S90 T8 Twin Engine**

Volvo pulled the wraps off its new luxury flagship sedan, the S90, to widespread acclaim at the 2016 Detroit auto show. Volvo's largest sedan also has a hybrid powertrain option, which it shares with the recently redesigned XC90 T8: 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, and the claimed all-electric range is up to 25 miles. The S90 will be offered only in AWD. At press time, the EPA hadn't posted fuel-economy numbers. (The XC90 is reviewed on page 138.)

ELECTRIC VEHICLES

Audi **e-tron Quattro concept**

Audi, like other German automakers, is taking a big role in electrified vehicles these days. One example is the e-tron Quattro concept, which debuted at the 2015 Frankfurt auto show. Like the Q8 plug-in hybrid concept, the e-tron is sleek and muscular, with a sloping roof and large wheels. Designed from the ground up as an EV, the e-tron has a 95-kWh battery pack and three electric motors—one in the front and two in the rear—providing a total of 496 hp and 590 lb-ft of torque. Audi claims a top speed of 130 mph. Look for a production e-tron in 2018.

Faraday Future **FF 91**

Faraday Future, a start-up headquartered in California, revealed its first production vehicle, the FF 91, at the 2017 Consumer Electronics Show in Las Vegas. Faraday plans to produce the car at a $1 billion factory it's building north of Las Vegas—although construction had been halted at press time. The FF 91 will be powered by three electric motors—one front, two rear—and a 130-kWh battery pack. Total horsepower is a claimed 1,050; range is estimated at 378 miles. Faraday has taken more than 64,000 deposits of $5,000 for the FF 91; neither pricing nor a release date has yet been set.

Jaguar **I-Pace**

Jaguar, which only recently released its F-Pace SUV, plans on releasing yet another before long. But this one—based on the I-Pace concept revealed last fall at the L.A. auto show—will be an EV. An I-Pace production version, which will seat five, is expected in late 2017 and will go on sale in 2018. The I-Pace will be powered by a pair of electric motors—one for each axle—that produce a total of 400 hp and 516 ft-lb of torque. A 90-kWh lithium-ion battery pack underneath the floor will provide a 220-mile range and propel the I-Pace from 0–60 mph in about 4 seconds.

ELECTRIC VEHICLES (CONT.)

Lucid **Air**

Lucid Motors, another newcomer (formerly known as Atieva), is entering the electric-car field with its Air "executive class" midsize sedan. The Air will feature an all-aluminum body structure and produce 1,000 hp from its two electric motors (mounted front and rear). Lucid claims the Air will accelerate from 0–60 mph in 2.5 seconds. Its floor-mounted 100-kWh battery pack will provide more than 300 miles of range; later, Lucid plans to install a larger battery good for about 400 miles. The Air will feature steeply reclining rear seats, several touch screens, air suspension, and an autonomous driving system. Lucid says it plans to start producing the Air in 2018 in a $700 million factory located in Casa Grande, Arizona.

Mercedes-Benz **Generation EQ Concept**

Daimler AG, parent company of Mercedes-Benz, previewed its new EQ electric-car brand via the Generation EQ concept at the 2016 Paris Motor Show. EQ stands for "electric intelligence," and the Generation EQ is said to be a close-to-production concept. A small crossover that resembles the Mercedes GLC line, the EQ will be built on a platform developed for EVs. It has two motors—one front, one rear—that produce about 400 hp, AWD, and a 70-kWh lithium-ion battery pack in the floor. Mercedes claims it will travel from 0 to 60 mph in under 5 seconds and will have a range of about 310 miles (likely based on optimistic European standards). Generation EQ will be Daimler's first long-range EV; the company said it will produce at least 10 EVs under the EQ brand by 2025.

smart **Electric Drive**

The latest version of the diminutive two-seater Electric Drive coupe should be in dealer showrooms in the late spring or early summer of 2017. The most obvious change is the adoption of the 2016 gas version's redesigned body style. An 80-hp motor propels the car from a standing stop to 60 mph in about 11 seconds; top speed is limited to 81 mph. A 17.6-kWh lithium-ion battery pack provides a range of 70 to 80 miles per full charge, according to smart. Using 240-volt current, the recharge time is just under three hours; with 120-volt household current, a full recharge takes more than 13 hours.

ELECTRIC VEHICLES (CONT.)

Tesla **Model 3**

The Model 3 is an important EV for several reasons. Although it won't be delivered to customers until at least early 2018, the Model 3's reputed affordability (an estimated $35,000 before incentives), power (0–60 mph in about 6 seconds), and range (estimated 215 miles) got enough people excited about the idea of an affordable EV that more than 340,000 customers put down a $1,000 deposit on the car in a few weeks' time.

Volkswagen **e-Golf**

Winner of the compact category in the 2016 and 2017 *AAA Green Car Guide*, the e-Golf has been completely redesigned for 2017. The new e-Golf has a 134-hp electric motor (up from 115) and a new lithium-ion battery (35.8 kWh, up from 24.2 kWh). VW estimates the new battery will increase the e-Golf's range from 83 miles to 125 miles. Advanced safety and infotainment packages have also been upgraded, as well as redesigned front and rear ends. The 2017 e-Golf goes on sale in the second quarter of 2017.

DIESEL VEHICLES

Chevrolet **Cruze**

For 2017, the compact Cruze is available as a sedan and, for the first time, as a hatchback. Both versions can be ordered with a 1.6-liter 4-cylinder turbodiesel engine that makes 136 hp; the last time the Cruze had a diesel option was 2015. It will be mated to a 6-speed automatic transmission. Chevy expects the diesel Cruze to get about 40 mpg in highway driving; the EPA hadn't weighed in at press time. (See reviews of the gasoline-powered Cruze on pages 100 and 103.)

DIESEL VEHICLES (CONT.)

Chevrolet **Equinox**

A completely redesigned 2018 Equinox comes out in early 2017 with a choice of three turbocharged engines, one of which is the 136-hp turbodiesel with a 6-speed automatic transmission that's also an option on the Chevy Cruze. The compact Equinox crossover, one of Chevy's best sellers, has shed some 400 pounds for 2018. Additional changes include an on-demand AWD system and available advanced safety features.

Ford **F-150 Diesel**

The 2018 F-150 pickup will hit dealer showrooms this fall, and in summer 2018, the nation's best-selling vehicle will get a 3.0-liter V6 turbodiesel option, paired with a 10-speed automatic transmission. The automaker hasn't released details yet, but the engine is likely to be similar to a Range Rover unit that produces 245 hp and 443 lb-ft of torque and has a 25-mpg EPA combined rating. Ford's F-150 diesel will also have standard engine stop-start technology.

Mazda **CX-5**

The refreshed 2017 CX-5 comes to dealer showrooms this spring, and this fall, after four years of delays, Mazda is slated to offer a diesel engine in its compact crossover, which is Mazda's best-selling vehicle. It will be a version of the Skyactiv-D 2.2-liter two-stage turbodiesel already in use in Japan and Europe. Reportedly, a diesel-powered Mazda6 midsize sedan will follow. Diesels account for just under 40 percent of Mazda's sales in Japan, where the carmaker also offers diesel versions of the Mazda2, Mazda3, and CX-3.

BUT WAIT, THERE'S MORE ...

The 2017 *AAA Green Car Guide* provides detailed data and reviews of 65 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.

HIGH-MPG/PZEV

Chevrolet **Malibu**

The Malibu, redesigned for 2016, is perennially one of the most popular midsize sedans. Apart from its good looks, accommodating interior, and comfortable ride, it's also fuel-efficient. For the best gas mileage, go for either the L, LS, or LT trim levels, which have a turbocharged 1.5-liter 4-cylinder engine (160 hp, 184 lb-ft of torque) and a 6-speed automatic transmission. EPA-estimated fuel-economy numbers are 27 city/36 highway/30 combined. For a review of the Malibu Hybrid, turn to page 123.

Chevrolet **Trax**

Based on Chevy's Sonic platform, the Trax, a compact crossover, is equipped with a turbocharged 1.4-liter 4-cylinder engine (138 hp) and a 6-speed automatic transmission. The diminutive Trax may be small on the outside, but its flexible interior can be configured to comfortably carry passengers or haul quite a bit of cargo. It's been refreshed for 2017, with redesigned front and rear fascias, new headlights and taillights, and more available safety features. A rearview camera is standard. The FWD Trax gets the best fuel economy: 25 city/33 highway/28 combined.

Ford **Focus**

The Ford Focus is a functional, no-nonsense compact car available as a sedan or hatchback. It's a relatively comfortable small car with sporty handling, and Ford has kept it fresh with regular updates. The Focus comes with a choice of two engines; the most fuel-miserly is the turbocharged 1.0-liter 3-cylinder Ecoboost engine (123 hp). With a 6-speed manual transmission, it gets 30 city/40 highway/34 combined. With a 6-speed automatic transmission, its mpg is 27 city/38 highway/31 combined.

Kia **Optima**

Redesigned for model year 2016, the Kia Optima offers car buyers a solid combination of style, features, performance, comfort, value, and, with the right engine choice, improved fuel economy. That engine would be the 1.6-liter turbocharged 4-cylinder, which produces 178 hp and 195 lb-ft of torque. It's mated to a 7-speed automatic transmission. EPA-estimated fuel economy is 28 city/37 highway/31 combined.

HIGH-MPG/PZEV (CONT.)

Mercedes-Benz **GLA250**

The GLA is Mercedes' compact luxury crossover. The most fuel-efficient version is equipped with a turbocharged 2.0-liter 4-cylinder engine that produces 208 hp and 258 lb-ft of torque and is matched with a 7-speed automatic transmission. An engine stop-start feature is standard. EPA-estimated fuel economy is 24 city/33 highway/27 combined for the FWD version; the AWD version achieves 23/31/26. The GLA250 is relatively quick for its class, with a 0–60 mph time of about 7 seconds.

Nissan **Quest**

The Nissan Quest is equipped with a 3.5-liter V6 engine that produces 260 hp and 240 lb-ft of torque. Only one transmission is available, a CVT, and AWD is not an option—all Quests have FWD. EPA-estimated fuel economy for the Quest is 20 city/27 highway/23 combined.

HYBRIDS

Ford **C-Max Hybrid**

Released in 2013, the C-Max Hybrid remains Ford's only dedicated hybrid vehicle. It's powered by a 2.0-liter 4-cylinder engine and an electric motor, good for 188 hp total. The C-Max Hybrid is also equipped with a 1.4-kWh lithium-ion battery pack, a CVT, and comes with FWD. EPA-estimated fuel economy is 42 city/37 highway/40 combined. The C-Max's wagon body style provides a good-sized cargo compartment (25 cu. ft. with the backseat up, 53 cu. ft. with it down). For a review of the C-Max Energi plug-in hybrid, turn to page 121.

Infiniti **Q50 Hybrid, Q70 Hybrid**

The midsize Infiniti Q50 Hybrid (pictured) and full-size Q70 Hybrid sedans are both equipped with a 3.5-liter V6 engine, a 67-hp electric motor (360 hp total), a 7-speed automatic transmission, and a lithium-ion battery. The Q50 Hybrid is available with both RWD and AWD; the Q70 Hybrid comes only with RWD. EPA-estimated combined city/highway fuel economy for the Q50 Hybrid is 29 mpg (28 mpg for AWD); for the Q70 Hybrid, 30 mpg. Both the Q50 Hybrid and Q70 Hybrid carry over into 2017 unchanged.

HYBRIDS (CONT.)

Infiniti **QX60 Hybrid**

Full-size hybrid SUVs are few and far between. An exception is the Infiniti QX60 Hybrid, which has a 2.5-liter supercharged 4-cylinder engine, a 20-hp electric motor (good for 250 hp total), and is equipped with a CVT. The QX60 Hybrid is available with FWD or AWD. EPA fuel-economy estimates for both the FWD and AWD versions are 25 city/27 highway/26 in combined driving.

PLUG-IN HYBRIDS

BMW **330e iPerformance**

BMW's 3 Series plug-in, the 330e, features a 180-hp, 2.0-liter twin-turbo 4-cylinder engine, an 87-hp electric motor, a 7.6-kW 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 and an all-electric range of 22 miles. EPA-estimated combined fuel economy is 30 mpg and 73 MPGe.

BMW **740e xDrive iPerformance, X5**

BMW's plug-in hybrid variants, the flagship 7 Series sedan (shown) and its X5 SUV, share drivetrain components: a twin-turbo 2.0-liter 4-cylinder engine that makes 245 hp and a 95-hp electric motor, good for 320 hp combined; a 9.9-kWh lithium-ion battery; AWD; and an 8-speed automatic transmission. The EPA-estimated combined fuel economy is 27 mpg and 64 MPGe for the 740e and 24 mpg and 56 MPGe for the X5. The EPA estimates the electric-only range at 14 miles for each.

Chrysler **Pacifica Hybrid**

The Pacifica is Chrysler's replacement for its iconic Town & Country minivan. A gas version went on sale in 2016, and an industry-first plug-in hybrid version followed in early 2017. It features a 3.6-liter V6 and two electric motors—good for 260 total horsepower—coupled to a 16-kWh battery pack. The combined EPA fuel-economy rating in electric mode is 84 MPGe and 32 mpg as a gas-electric hybrid. It can be recharged in two hours on 240 volts and has an electric-only range of 33 miles. Down the road, a Pacifica EV will likely be released.

PLUG-IN HYBRIDS (CONT.)

Mercedes-Benz **C350e**

The Mercedes-Benz C350e plug-in hybrid takes the C300's turbocharged 208-hp 4-cylinder engine and adds an 80-hp electric motor for a total power output of 275 hp. A 7-speed automatic transmission and a water-cooled 6.2-kWh lithium-ion battery round out the drivetrain. The C350e can be driven for up to 19 miles solely on electric power; the 0–60 mph time is 5.9 seconds.

Mercedes-Benz **GLE550e**

The GLE550e is powered by a 3.0-liter twin-turbo V6, good for 329 hp, and a 114-hp electric motor (436 hp total); a 7-speed automatic transmission; and an 8.8-kWh lithium-ion battery pack. M-B's AWD system, 4MATIC, is standard. All-electric driving is estimated at about 12 miles, and the recharging time is expected to be two hours on 240 volts or four to five hours on 120 volts. Fuel-economy figures are 21 mpg combined when running as a hybrid and 43 MPGe in all-electric mode.

Mercedes-Benz **S550e**

The S Class is Mercedes' flagship; its S550e plug-in hybrid's drivetrain consists of a 3.0-liter 329-hp twin-turbo V6 engine, a 114-hp electric motor (442 hp total), a 7-speed automatic transmission, and a water-cooled 8.7-kWh battery pack. The S550e can run solely on electricity for up to 12 miles. Charging on 240 volts takes under three hours; on 120 volts, about seven. Fuel-economy numbers are 26 mpg combined in hybrid mode and 58 MPGe running on electricity.

Porsche **Cayenne S E-Hybrid**

The Cayenne S E-Hybrid's drivetrain combines a supercharged 333-hp V6 and a 95-hp electric motor to produce 416 hp; they're mated to an 8-speed automatic transmission. The all-electric range is about 15 miles, and the EPA-estimated combined fuel-economy numbers are 47 MPGe on electric power and 22 mpg as a hybrid.

BMW **i3**

The i3, BMW's first EV, has a powertrain with a 170-hp electric motor and—this is the big news—an optional, 33-kWh battery that extends the i3's range to 114 miles. The smaller battery, providing a range of 81 miles, is still available, as is the optional gasoline range-extender engine (big battery only), which gives the i3 a 180-mile range. Last year, a 2015 model year i3 placed first among the subcompacts tested in the *AAA Green Car Guide*, but we weren't able to obtain a test vehicle for this year's *Guide*.

Fiat **500e**

The Fiat 500e is an EV version of the gasoline-powered Fiat 500. Equipped with a 111-hp motor, it's highly maneuverable and fun to drive, but its limited range (84 miles) restricts it to around-town trips and short commutes. The EPA rates the 500e at 112 MPGe combined. The battery pack can be completely recharged in about four hours with a 240-volt charger, but it takes as long as 24 hours at 120 volts. The 500e is available only in California and Oregon.

Ford **Focus Electric**

The Ford Focus Electric is equipped with a 143-hp electric motor and a 23-kWh lithium-ion battery pack. Like the regular Focus, it's comfortable and fun to drive, but like many EVs, it's somewhat impractical for longer trips because of its limited range (115 miles). The EPA-estimated combined MPGe is 107. With a 240-volt charger, the battery pack can be charged in 5.5 hours; using a 120-volt system, recharging can take up to 30 hours.

Mercedes-Benz **B250e**

Mercedes-Benz's B250e EV is a compact but roomy five-person hatchback. Its powertrain combines a 177-hp electric motor with a 28-kWh lithium-ion battery housed under the vehicle's floor. The B250e's range is low for EVs these days, estimated at just 87 miles; a two-hour recharge is good for another 60 miles. The EPA-estimated MPGe is 84 in combined city/highway driving. The B250e is available in all 50 states, although most are sold in California.

DIESEL VEHICLES

BMW **328d, 535d, X3 xDrive28d, X5 xDrive35d**

The BMW compact and midsize diesel sedans and SUVs share powertrain elements. The 328d and X3 xDrive28d are equipped with a 2.0-liter turbocharged 4-cylinder diesel engine that produces 180 hp and 280 lb-ft of torque. The 535d (pictured) and X5 xDrive35d have a 3.0-liter turbocharged 6-cylinder diesel engine that produces 255 hp and 413 lb-ft of torque. An 8-speed automatic transmission delivers power to all four wheels on the xDrive models and to the rear wheels only on the 328d and 535d.

Jaguar **XE 20d, XF 20d**

Jaguar is offering a diesel option for both its new luxury compact sedan and recently redesigned midsize luxury sedan, the XE (pictured) and XF, respectively. The two sedans share the same powertrain: a 2.0-liter 4-cylinder turbodiesel rated at 180 hp and 318 lb-ft of torque, matched with an 8-speed automatic transmission. EPA-estimated fuel economy for the XE 20d is 32 city/42 highway/36 combined with RWD and 30 city/40 highway/34 combined with AWD. For the XF, the numbers are 31 city/42 highway/35 combined (separate RWD/AWD numbers aren't specified).

HYDROGEN FUEL-CELL VEHICLES

Honda **Clarity Fuel Cell**

The Honda Clarity Fuel Cell's powertrain fits entirely under the car's hood, allowing for five-passenger seating. Its driving range is an EPA-estimated 366 miles, along with 68 MPGe combined. Honda began delivering the Clarity Fuel Cell to select California dealers in mid-December 2016. The lease price is $369 per month for 36 months, with $2,868 due at signing; $15,000 worth of hydrogen fuel is included. Honda is planning to produce hybrid and EV versions of the Clarity in the near future.

Hyundai **Tucson Fuel Cell EV**

Hyundai delivered its first Tucson Fuel Cell SUV in June 2014. Its powertrain and major components—a 134-hp electric motor, single-speed transmission, and lithium-ion battery pack—remain the same. It gets an EPA-estimated 50 MPGe combined and has a range of 265 miles. Currently, it's available only on a three-year lease (which includes fuel and maintenance) for $499 per month (with $2,999 down) at a total of five dealers in Northern and Southern California.

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CHAPTER 5

How Safe is Your Vehicle?

About 6 million car crashes happen in the U.S. every year, so it should be no surprise that they're one of the leading causes of death, especially among young people, according to the AAA Foundation for Traffic Safety.

The number of fatalities had been declining over the past five decades. However, 35,092 people were killed in 2015, a 7.2 percent increase from the 32,744 killed in 2014—the highest percentage increase in fatalities since 1966.

In January 2017, NHTSA released early figures for fatal crashes in 2016—and the upward trend continued. In the first nine months of 2016, an estimated 27,875 people died in motor vehicle crashes, an 8 percent increase as compared to the 25,808 fatalities reported to have occurred in the first nine months of 2015.

Further, NHTSA said, the third quarter was the eighth consecutive quarter with increases in fatalities, as compared to the corresponding quarters in previous years.

To reduce the number of injuries and deaths from car crashes, NHTSA requires automakers to make cars progressively safer. Over the years, some significant safety features have included seat belts, padded dashboards, air bags, crumple zones, and antilock brakes/electronic stability control. Recently, the agency ruled that as of May 2018, all new cars sold in the U.S. must have a standard rearview camera. And virtually all automakers have agreed to make automatic emergency braking standard on all cars as of 2022, although this was not a NHTSA requirement.

All vehicles sold in the U.S. must also meet certain crash-test standards developed by NHTSA. The Insurance Institute for Highway Safety (IIHS), an independent safety-research group funded by auto insurers, performs similar crash testing on new cars. New cars are not legally obligated to meet IIHS standards, but automakers take IIHS results seriously and typically fix defects on cars that do poorly on IIHS tests.

FSTOP IMAGES GMBH/ALAMY STOCK PHOTO

Both organizations conduct tests under controlled conditions that simulate real-world car crashes, including:

- front, rear, and side-impact crashes
- the propensity to roll over
- roof-strength tests

Using the test results, NHTSA and IIHS determine a vehicle's structural integrity and how well it protects its occupants in various types of crashes.

NHTSA uses star ratings (1 through 5, with 5 being the best) to rate a vehicle's frontal crash, side crash, rollover, and overall safety. The more stars a vehicle receives for a given test, the smaller the chance of occupant injury in that type of collision. As the agency says, "more stars mean safer cars." Vehicles with advanced safety features get extra credit. The agency recommends that consumers strongly consider purchasing vehicles with forward-collision warning, lane-departure warning, a rearview camera, and automatic emergency braking.

Results of some of NHTSA's tests can be compared across various classes of cars; others cannot. For example, side-crash rating results can be compared because all cars are hit with the same force by the same pole or moving barrier; the same is true of rollover results. But frontal crash ratings (into a fixed barrier at 35 mph) can be compared only to vehicles of the same class and roughly the same weight, because the results represent a crash between two similar vehicles.

IIHS runs five kinds of tests: small overlap front, moderate overlap front, side, roof strength, and head restraints and seats. It also rates a vehicle's front-crash prevention features, if any (for example, forward-collision warning). Instead of stars, IIHS scores vehicles using the terms *good, acceptable, marginal*, or *poor*. It also rates vehicles as a Top Safety Pick or Top Safety Pick+ if they score well enough.

To qualify for a Top Safety Pick rating, a vehicle must earn good ratings in five crashworthiness tests: small overlap front, moderate overlap front, side, roof strength, and head restraints, as well as a basic rating for front-crash prevention. To qualify for a Top Safety Pick + rating, a vehicle must earn good ratings in the five crashworthiness tests and an advanced or superior rating in front-crash prevention.

NHTSA and IIHS are continually refining their testing procedures and raising their standards. To learn more about crash testing and view videos about how crash tests are carried out, go to nhtsa.gov and iihs.org. Crash-test ratings from one or both organizations are included in the *AAA Green Car Guide*'s individual car reviews.

Making Driving Easier—and Safer

Increasing the number of safety devices in vehicles, making structural changes, and testing these innovations have been effective ways to reduce deaths and injuries on U.S. roads. However, these features, it should be noted, are passive in nature. They help protect a vehicle's occupants during or following a collision, but they take no role in preventing or mitigating the severity of collisions. Other recent safety features, which are becoming available on an increasing number of cars, include:

- **Head-up displays** project data such as speed, distance from the car in front, etc., on a panel or the windshield in front of drivers at eye level, so they don't have to glance away from the road.
- **LED headlights** let drivers see farther down the road than halogen or HID headlights.
- **Adaptive headlights** follow a curve as a car turns, allowing better visibility when cornering.
- **Self-dimming rearview mirrors** prevent glare that often blinds drivers, allowing them to better judge how close they are to cars around them and to pass or change lanes more safely.
- **Automatic high/low beams** detect the presence of headlights or taillights of vehicles in front of a car and generally result in greater usage of high-beam headlights. The system automatically switches between high beams and low beams to improve a driver's visibility.
- **Driver-alert systems** monitor driver behavior, such as eye and head movements, that might indicate a driver isn't fully alert. If the system senses a potential problem, it issues a visual and/or audible alert.

Advanced Driver-Assist Systems

In recent years, safety technology has taken a more active role; that is, features have been included in vehicles that help prevent collisions from occurring in the first place or reduce their severity. These electronic systems are known collectively as advanced driver-assist systems (ADAS); they started out as optional equipment but are becoming standard equipment on more and more cars today.

ADAS act as a safety net; for example, blind-spot monitoring alerts drivers to cars in adjacent lanes on either side that may be in their blind spot. In other cases, ADAS reduce the effects of mistakes drivers have already made—such as drifting out of their lane or not noticing that they're about to crash into a vehicle in front of them—by taking temporary control of the vehicle.

It's hard to overstate the importance of ADAS. NHTSA estimates that more than 90 percent of vehicle crashes involve human error; therefore, because ADAS are able to mitigate driver errors to some extent, they have tremendous potential to improve driving safety. And because they take over various driving functions, they're also foundational to the development of self-driving or autonomous vehicles.

ADAS appeared first on high-end vehicles, but they soon migrated down to midpriced and even to lower-priced vehicles. Many are now available on almost every model in manufacturers' lineups. For example, the Toyota Yaris iA, which has a base price under $18,000, comes with a low-speed collision-avoidance system as standard equipment. Blind-spot monitoring with rear cross-traffic alert is available on a 2017 Mazda Mazda3 for less than $23,000, and blind-spot monitoring with rear cross-traffic alert plus Subaru's well-regarded EyeSight collision-avoidance system are available on a 2017 Impreza costing about $24,000. Each of these vehicles is priced well below the $34,000 price of the average new car.

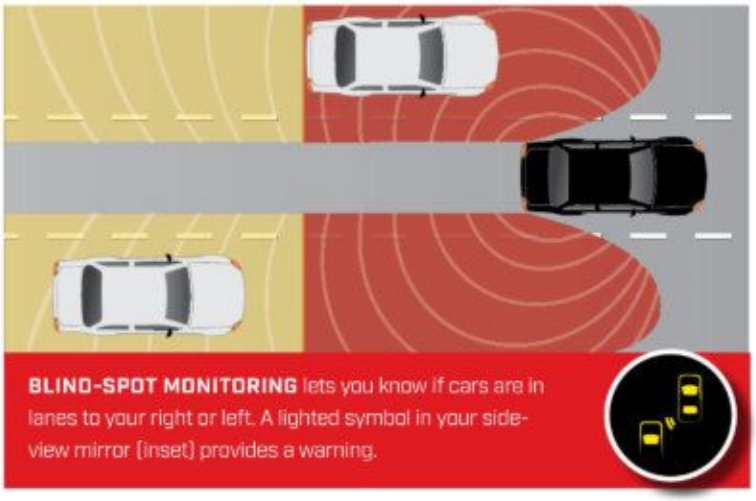
In the coming years, advanced driver-assist systems will become more widespread, and will become standard equipment on an increasing number of vehicles. For instance, in 2016, a blind-spot–monitoring system with cross-traffic alert was optional on the high-end Ford Escape Titanium and unavailable on lower trim levels. But in 2017, the feature became standard on the Titanium trim level and optional on the midlevel SE.

The following are some advanced driver-assist systems that are either standard equipment or can be ordered on today's new cars. These listings are general categories; individual automakers' systems will vary and may use slightly different nomenclature. The car-review section of the *Guide* lists available safety features on each car model.

Rearview Camera

Rearview cameras, although not a new technology, remain 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, Mercedes-Benz GLC300, and other vehicles now offer the option of cameras that give a 360-degree view of what's happening all around a vehicle.

The latest cameras provide drivers with views all around a vehicle, as with the Ford F-150's **MULTIPLE-CAMERA DISPLAY.**



BLIND-SPOT MONITORING lets you know if cars are in lanes to your right or left. 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 a car's rear quarter panels to detect cars that are immediately beside and behind your vehicle. The system alerts you if you start to make an unsafe lane change that could result in a collision 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, and sometimes a warning tone sounds as an added alert.

Some BSM 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 touch screen on the dashboard displays an image of what's happening on the right side of your car.

Blind-spot–monitoring and rearview-camera systems are often paired with a rear cross-traffic alert (RCTA) function, which is useful when you're backing out of a head-in parking spot. When you're backing up, the system typically flashes a warning signal in the side mirror, A-pillar, or the rearview-camera display on the touch-screen display and sounds an audible warning tone to alert you if a vehicle is approaching from the left or right.

Lane-Departure Warning/Lane-Keeping Assist

Typically using cameras or sensors mounted on the windshield near the rearview mirror, lane-departure warning (LDW) and lane-keeping–assist (LKA) systems read road markings such as painted lines and raised pavement 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 actually want to change lanes, you won't want to see or hear an alert.

If you have an LKA system on your vehicle, you can't just take your hands off the wheel and expect the car to do the steering for you. On some 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

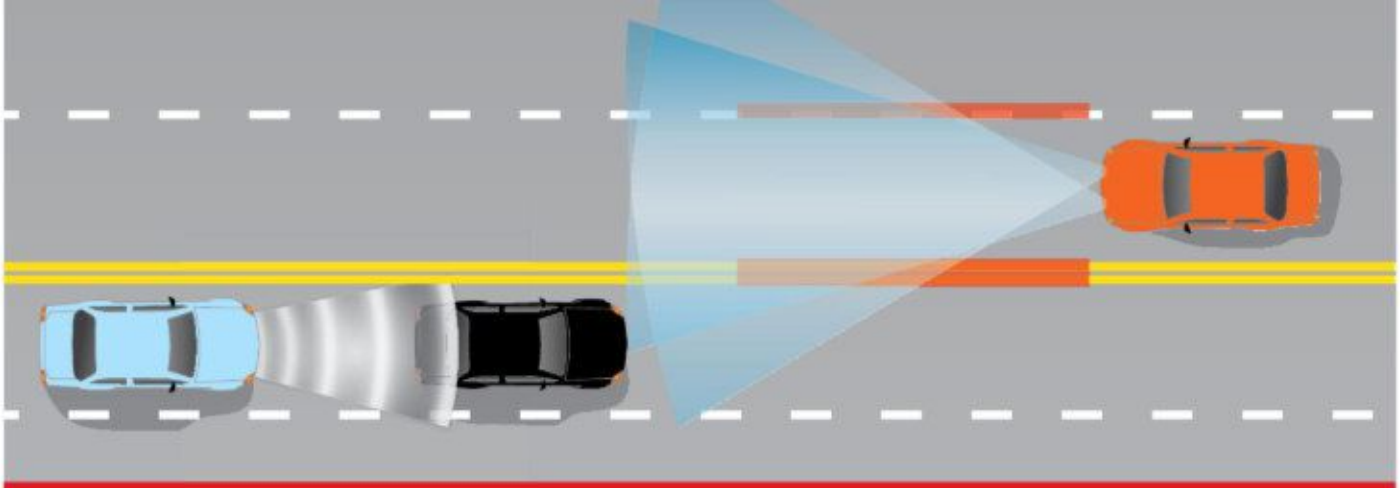
With conventional cruise control, you must reset the system once you've sped up and passed a vehicle or hit the brakes to keep a certain distance from the vehicle in front of you. Not so with adaptive cruise control (ACC), which typically uses a combination of camera and radar technology to detect vehicles 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, ACC 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/ Automatic Emergency Braking

Several types of forward-collision systems use cameras and/or radar to help drivers respond safely to traffic in front of them. The following is a general description of the different types of 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 not apply the brakes to prevent a crash from occurring. There are also two types of automatic emergency braking (AEB) systems. The difference between such systems is mostly one of degree:
- **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 the tension of the occupants' seatbelts.



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

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

As of September 1, 2022, virtually all new cars will feature automatic emergency braking (AEB) systems like those described above. In 2016, AAA tested five different vehicles equipped with AEB. In all cases, the AEB systems worked, but there was considerable variation in performance among different systems. If you buy a vehicle with AEB, it's really important that you understand how the braking system functions. Not all systems are created equal. You can read about those differences on page 70 in Chapter 7, "AAA's Technology Initiatives."

Limitations of ADAS

Good driver-assist systems have controls, displays, and touch screens that are easy to understand and operate. As a fail-safe measure, many systems won't activate until drivers go through two or more steps. That way, they won't turn the systems on accidentally and will be fully aware when 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 many ADAS can be switched off if drivers don't want to use them. You can read more about the effectiveness of ADAS in Chapter 7, "AAA's Technology Initiatives."

Also, it's critical to understand what any driver-assistance system is designed to do—and not do—before you leave the dealership. In fact, it could be a matter of life and death. 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 must be 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.

Autonomous Vehicles

The ADAS features discussed in this chapter, such as adaptive cruise control and automatic emergency braking, are foundational elements of autonomous vehicles. However, the bigger question is: When will autonomous vehicles become mainstream?

Exactly what is an autonomous vehicle? The National Highway Transportation Safety Administration (NHTSA) defines autonomous vehicles as "those in which at least some aspects of a safety-critical control function (e.g., steering, throttle, or braking) occur without direct driver input." The agency is interested in autonomous cars mainly from a regulatory and safety standpoint; it has stated that automated vehicles could save tens of thousands of lives every year.

Levels of Automation

In the fall of 2016, NHTSA issued a Federal Automated Vehicles Policy, with voluntary guidelines for automakers intending to produce automated vehicles. In the agency's words, the policy sets out a proactive safety approach "that will bring lifesaving technologies to the roads safely, while providing innovators the space they need to develop new solutions." NHTSA believes that automated vehicles have tremendous potential to improve safety, mobility, productivity, and sustainability.

The policy has four components or sections:

1. Vehicle performance guidance for automated vehicles outlines a 15-point "safety assessment" for manufacturers, developers, and other organizations to safely design, develop, test, and deploy automated vehicles. Some of these points include data recording (and the ability to share data), privacy safeguards, consumer education and training, redundancy and system safety, and cybersecurity.

2. Model state policy is intended to clarify federal and state responsibilities for regulation of highly automated vehicles and suggests recommended policy areas for states to consider. Its goal is to generate a consistent national framework for testing and deploying highly automated vehicles.

3. Current regulatory tools describes the existing regulations and

policies that NHTSA can use to accelerate the safe development of automated vehicles, such as interpreting current rules to allow for greater flexibility in design and providing limited exemptions to allow for testing nontraditional vehicle designs in a more timely fashion.

4. Modern regulatory tools identifies potential new ways that NHTSA could seek in the future to aid the safe and efficient deployment of new automated technologies.

In addition, NHTSA adopted the terminology created by the Society of Automotive Engineers (SAE) specifying six levels, or degrees, of vehicle automation:

Level 0 (no automation): The human driver performs all tasks associated with driving and monitoring the environment. Warning systems, such as blind-spot monitoring, may assist the driver.

Level 1 (driver assistance): An automated system on the vehicle can sometimes assist the human driver conduct some parts of the driving task, such as controls for either forward (speed) or lateral (side-to-side) movements—but not at the same time. Examples would include adaptive cruise control or electronic stability control.

Level 2 (partial automation): Automated systems on the vehicle assist some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving tasks. At this level, two primary functions work in unison—for example, the combination of adaptive cruise control with lane-keeping assist.

Level 3 (conditional automation): An automated system can both actually conduct some parts of the driving task and monitor the driving environment in some instances, but the human driver must be ready to take back control when the automated system requests. For example, if the vehicle determines a collision is imminent, the system will warn the human driver to take control of the vehicle in an effort to prevent a collision or reduce the severity of impact. This level of vehicle automation is potentially difficult because it requires drivers to reengage the driving task when they have been performing other functions.

Level 4 (high automation): An automated system can conduct the driving task and monitor the driving environment, and the human driver need not take back control. It would also have redundant systems as backup for any system failures. However, there may be limitations on where or how far the car can be driven without driver control—for example, an autonomous vehicle that does not require the driver's attention at all but is limited to a specific city or driving mode.

Level 5 (full automation): The automated system performs all driving tasks under all conditions that a human driver could perform them, with redundancy and without limitations on where, when, or how it can be driven. This is a fully autonomous car.

In Levels 0–3, the human driver stills needs to monitor the driving environment; in Levels 4 and 5, the automated driving system takes on that function.

In September 2016, Uber launched a pilot program of **SELF-DRIVING CARS** in Pittsburgh. The ride-hailing company also opened an Advanced Technologies Center in the city and formed a partnership with Volvo. Ultimately, Uber's plan is to replace many of its drivers with autonomous vehicles.

REUTERS/ALAMY STOCK PHOTO

Luxury car companies are putting considerable effort into vehicle automation. BMW's 7 Series, shown here, can **AUTOMATICALLY RESET THE CAR'S SPEED** in response to changes in posted speed limits. Mercedes-Benz has equipped its latest E Class and S Class vehicles with numerous automated features. If the car detects that a collision is imminent but unavoidable, its automatic braking system will engage the braking function earlier.

The Public's Response

U.S. drivers have mixed feelings about self-driving cars. For example, three out of four U.S. drivers report feeling "afraid" to ride in a self-driving car, according to a 2016 AAA survey. Nevertheless, AAA also found that drivers who own vehicles equipped with semi-autonomous features are, on average, 75 percent more likely to trust the technology; this suggests that increasing experience with advanced features can ease consumer fears.

"With the rapid advancement toward autonomous vehicles, American drivers may be hesitant to give up full control," said John Nielsen, AAA's managing director of automotive engineering and repair. "What Americans may not realize is that the building blocks toward self-driving cars are already in today's vehicles, and the technology is constantly improving and well trusted by those who have experienced it."

Indeed, the AAA survey revealed that 61 percent of American drivers said they want at least one of the following technologies on their next vehicle: automatic emergency braking, adaptive cruise control, self-parking technology, or lane-keeping assist. Their primary motivations were safety (84 percent), convenience (64 percent), reducing stress (46 percent), and wanting the latest technology (30 percent).

A vast majority of those who don't want semi-autonomous technology (84 percent) feel that way because they trust their driving skills more than the technology (84 percent); they feel the technology is too new and unproven (60 percent); they don't want to pay extra for it (57 percent); they don't know enough about it (50 percent); or they find it annoying (45 percent).

Sixty percent of drivers want semi-autonomous technology in their next vehicle, Nielsen said, but 40 percent are either undecided or reluctant to purchase these features. "Education is the key to addressing consumer hesitation toward these features," he continued, "and AAA's ongoing effort to evaluate vehicle technologies—highlighting both their benefits and limitations—will help drivers make informed choices."

A 2014 University of Michigan Transportation Research Institute survey found that most people had heard of self-driving cars and had positive initial feelings about them. Not surprisingly, those whose cars already had autonomous features, such as automatic emergency braking, responded more positively to the idea of self-driving cars and expected more benefits from them.

However, the majority of those surveyed expressed high levels of concern about the safety of riding in self-driving cars (especially those with high levels of automation), and most were highly reluctant to allow their children to ride in them. Other concerns included 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.

Nonetheless, car companies, tech firms, and government agencies are forging ahead with the development of self-driving cars. Luxury car manufacturers, such as BMW and Mercedes-Benz, are putting considerable time and money into vehicle automation. BMW's latest 7 Series, for example, can automatically reset the car's speed in response to changes in posted speed limits, and a lane-keeping feature is more aggressive: If you ignore its warning and attempt to change lanes, the steering wheel will resist your efforts.

Mercedes-Benz has equipped its latest E Class and S Class vehicles with a plethora of automated features. For example, if the car senses that a collision is imminent but unavoidable, its automatic braking system will engage the braking function earlier.

Finally, in October 2016, Tesla, one of the leaders in the autonomous vehicle revolution, announced that "all Tesla vehicles produced in our factory—including Model 3—will have the hardware needed for full self-driving capability at a safety level substantially greater than that of a human driver." Tesla CEO Elon Musk predicted that in less than two years, all Tesla models should be capable of full Level-5 autonomy—driving themselves without human input.

Clearly, these are exciting times for automotive technology, but there is still a long way to go to get to the fully autonomous vehicle that is fail-safe and operates ubiquitously. As then-U.S. Department of Transportation Secretary Anthony Foxx said when NHTSA issued its Federal Automated Vehicles Policy this past fall, "The self-driving car raises more possibilities and more questions than perhaps any other transportation innovation under present discussion."

Distracted Driving

According to NHTSA, the majority of car crashes—upward of 90 percent—are caused by human error. And one of the most prevalent causes of human error is driver distraction. NHTSA studies have found that up to 78 percent of car crashes involve some sort of inattention or distraction, including 10 percent of fatal crashes.

Distracted driving, as defined by NHTSA, is "any activity that could divert a person's attention away from the primary task of driving" and that, therefore, puts the driver, his or her passengers, and other drivers and pedestrians at risk.

We typically think of texting and talking on a cell phone as driving distractions, but a lot of other activities count, too. Examples include talking/interacting with passengers, daydreaming, being in a hurry, feeling frustrated, multitasking, inattentiveness (these mental states are more significant than most people realize), grooming, smoking, eating or drinking, looking at a map or navigation system, looking at objects or people outside the vehicle, and adjusting an infotainment system or heating/air-conditioning controls—again, anything that can divert attention away from driving.

Distractions are of three main types:

- **Manual**—those in which you move your hands away from the wheel.
- **Visual**—those where you take your eyes off the road, such as looking at a billboard by the side of the road or the car's touch screen.
- **Cognitive**—when your mind drifts away from the task of driving. Some distractions are riskier than others because they involve more than one of the above elements. In fact, that's why texting is so dangerous: It involves manual, visual, and cognitive forms of distraction.

Today's cars and life itself provide more sources of distraction than previous generations of drivers had to face: smartphones, tablets, and other electronic devices people bring into cars; the increased level of connectivity in cars themselves (Android Auto, Apple CarPlay, etc.); to say nothing of the increase in the number of cars on the road and a more frantic, data-filled pace of life generally.

How dangerous is distracted driving, and are people aware of its dangers? As was mentioned above, distractions play a role in up to 10 percent of fatal crashes—that's about 3,500 deaths annually. Driving is the riskiest task we engage in on a daily basis, yet most people aren't aware how risky it is—let alone how dangerous distracted driving is.

For example, many drivers think using a hands-free cell phone is safer than a hand-held one. (It isn't, because cognitive distraction is still present.) They don't know that the risk of getting in an accident while talking on a cell phone is about the same as while driving drunk, according to studies by David Strayer, PhD, an expert in the field at the University of Utah.

Many drivers don't know what laws regulate distracted driving—that talking on a hand-held cell phone while driving is banned in 14 states and the District of Columbia; that the use of all cell phones by novice drivers is restricted in 37 states and D.C.; and that text messaging is banned for all drivers in 46 states and D.C. A new California law, which went into effect in January 2017, goes a step further: It bars drivers from even holding mobile devices while driving.

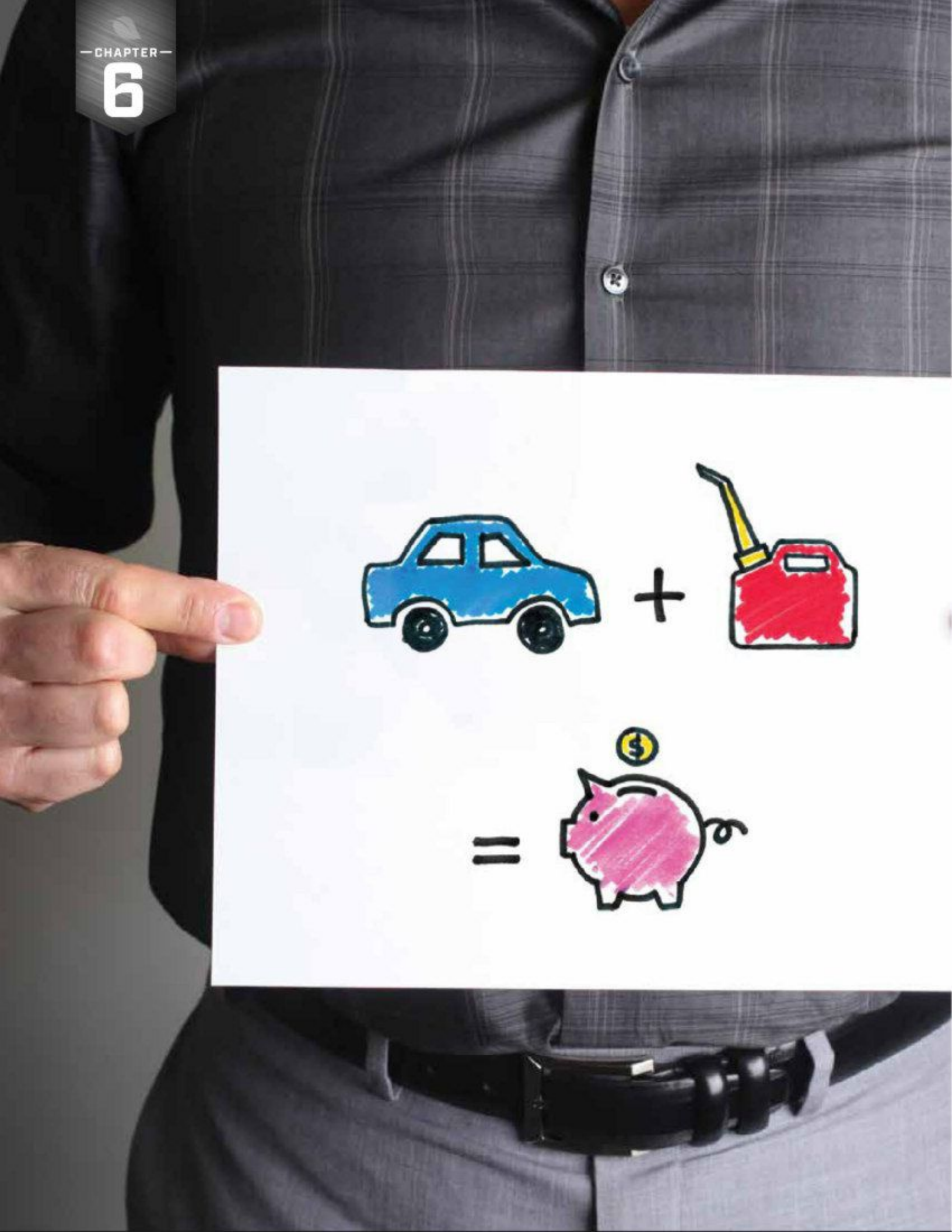
The 2015 Traffic Safety Culture Index, put out by the AAA Foundation for Traffic Safety (aaafoundation.org), uncovered yet another problem: a discrepancy between what drivers say they believe and how they behave. For example, 80 percent of those surveyed said that texting while driving is "unacceptable," but 42 percent had read a text or e-mail while driving in the previous month. In other words, many American drivers practice a "do as I say, not as I do" approach. Parenthetically, NHTSA has estimated that at any given time, approximately 660,000 drivers are using cell phones or manipulating electronic devices.

Other studies for AAA by Dr. Strayer revealed the surprising result that the effects of distraction last longer than people previously thought. "Just because a driver terminates a call or music selection doesn't mean they are no longer impaired," the study stated. "Impairment lingered for up to 27 seconds after a task was completed."

Two other factors play an important role in drivers' willingness to engage in distractions: complacency and misplaced confidence in their driving abilities. In other words, after you've driven for a number of years, it's easy to forget just how demanding and dangerous driving can be—you become complacent to its risks. Perhaps worse, every time you safely engage in a distraction—making a phone call, reading a text—you become more convinced that you can "get away with it" the next time.

PHOTOALTO/ALAMY STOCK PHOTO

CHAPTER 6



PHOTOGRAPH BY LORI ANDERSON. ILLUSTRATIONS BY HERNANDO MARÍN

Saving Fuel When You Drive

You might think you need to buy a new, fuel-efficient car to save gas and lower your emissions. But nothing could be further from the truth. The fact is, you can take significant steps every day to drive more efficiently, regardless of the vehicle you own.

The truth of this statement has been proven by fuel-economy research carried out by Auto Club of Southern California's Automotive Research Center (ARC). It calculated the mileage motorists normally achieved with their typical driving habits or sometimes when they drove more aggressively. The ARC compared those results to the mileage motorists obtained when they used the driving, maintenance, and lifestyle techniques described below. The results? In all cases, gas mileage improved—from as little as 25 percent to as much as 100 percent (from 10 mpg to 20 mpg).

Drive Smart

Easy does it. Accelerate slowly and smoothly instead of racing away from a stop sign or traffic light. Accelerating uses more fuel than any other type of driving, wastes gas, 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.

No need for a warm-up. 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 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.

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; aggressive driving also 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 moving to one of the slower freeway lanes—doing so is also less stressful. You won't lose much time by slowing down, either. A 60-mile trip driven at an average speed of 50 mph will take only 12 minutes longer than the same trip driven at an average speed of 60 mph.

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 fuel-cell electric vehicle with regenerative brakes, coasting typically 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.

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: (1) It changes the shift points so the transmission shifts earlier, keeping engine revs down. (2) 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 features 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 15–50 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 whenever possible. Stop-and-go driving burns more gas, increases pollution, and is generally more stressful than driving during off-peak hours.

Steady as she goes. Studies have shown that 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 needless idling. When you get out of your car, turn it off rather than leaving it idling. Letting your car idle for more than a minute uses more gas than turning it off and starting it again, according to the Union of Concerned Scientists. Park and walk into a fast-food restaurant or bank instead of using the drive-through.

Use your air conditioner wisely. Driving with the windows open increases aerodynamic drag, which increases the faster you drive. Air-conditioning use in newer cars can reduce gas mileage by about 5 percent (even more on older cars). To cool off on warm days, open your windows when you're driving slowly (under 45 mph); close them and turn on the air conditioner at higher speeds.

Maintain Your Vehicle

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 emission-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 strict AAA quality standards.

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 items such as golf clubs or other sporting equipment, tools, clothing, coolers, etc., out of your car's trunk when you're not using them.

Ditch the rack. Carry bulky items in the trunk whenever possible instead of on a roof rack. If you do use a roof rack, take it off when you're not using it. Roof racks increase aerodynamic drag and can reduce fuel economy even when not being used.

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. A University of Michigan study showed that using low-rolling-resistance tires could save 1–2 mpg, or about 32 gallons of fuel a year, based on about 11,000 miles of driving. That equates to about $72 in annual savings, with gas priced at $2.25 a gallon. 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 unleaded; 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 unleaded, although you may experience reduced power or slightly reduced fuel economy.

AAA's study of gasoline use determined that although 70 percent of cars on the road require only regular gas, 16.5 million U.S. drivers who didn't need to do so filled their tanks with premium fuel at least once a month, wasting $2.1 billion annually. [For more details on the AAA study, see page 70 in Chapter 7, "AAA's Technology Initiatives."]

Fill up with care. Gasoline is a hazardous substance. It's extremely flammable; its fumes are toxic and carcinogenic; it can pollute water and poison wildlife; and 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.

Keep a log. Track your fuel economy; many new cars display current mpg on their instrument panel, or download an app [type in "fuel economy calculator" to the search function]. If your mpg drops suddenly, find out why and fix the problem.

Lifestyle Choices

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. 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. So don't automatically jump into your big SUV if the more fuel-efficient sedan will do.

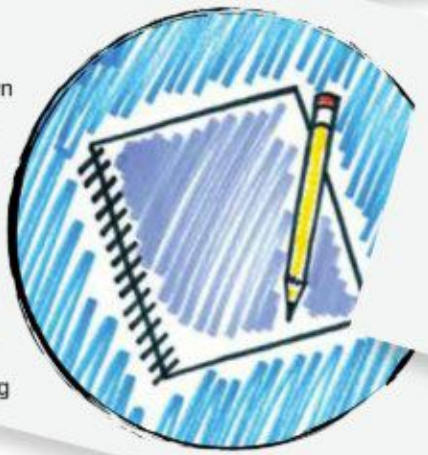
Check out a rental. Consider renting a fuel-efficient car for vacations and long trips, putting the wear on a rental car instead of your daily driver. Similarly, consider renting a pickup truck instead of buying one if you need a truck to haul things only occasionally. For more information on car sharing, check out page 16 in Chapter 1, "Redefining Green."

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 vanpool a day or two a week? How about telecommuting one or more days a week? And before you start your drive, check the traffic app on your smartphone to determine the quickest route. All four measures save fuel and reduce vehicle wear.

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

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

With the addition of more technology and safety features, today's passenger vehicles are becoming more complicated each year. That means it's more important than ever for AAA members to understand current automotive technology so they can make wise decisions when purchasing and maintaining their vehicles.

AAA and the Auto Club of Southern California's Automotive Research Center (ARC) conduct unbiased, objective research, provide in-depth information on the latest technology to help members better understand their own vehicles, and work with governmental agencies and carmakers to establish policies and pass legislation that benefits all motorists. For example, AAA research was instrumental in persuading the EPA to modify its methods for estimating fuel economy, resulting in more accurate estimates in real-world driving. (For details, see page 15 in the sidebar, "EPA's Fuel-Economy Testing," in Chapter 1.) Other research projects and studies include such subjects as evaluating the relative quality of gasoline, assessments of advanced driver-assistance systems (ADAS), and the effectiveness of different types of headlights.

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

Two Fuel Studies

AAA recently completed two landmark gasoline studies that can help drivers save money and prevent engine deposits. They also conclusively answer the questions: **"Is premium fuel better for my car?"** and **"Are Top Tier brands of gasoline the same as non-Top Tier?"**

The short answers are: for most cars, no, and definitely not. The complete explanations are:

Regarding premium fuel, it's important to understand that all gasoline has an *octane rating*, which is related to compression ratio but *not* to quality. The octane ratings of gasoline in the U.S. are 85 or 87 (regular), 89 (midgrade), and 91 or 93 (premium). Cars with high-performance engines, which tend to have high compression ratios, require high-octane gas to perform well.

But according to automakers, the vast majority of cars in the U.S.—70 percent—require only regular gas. Midgrade is recommended for 10 percent, and premium gas is required by 15 percent. (Four percent of cars use an alternative energy source.)

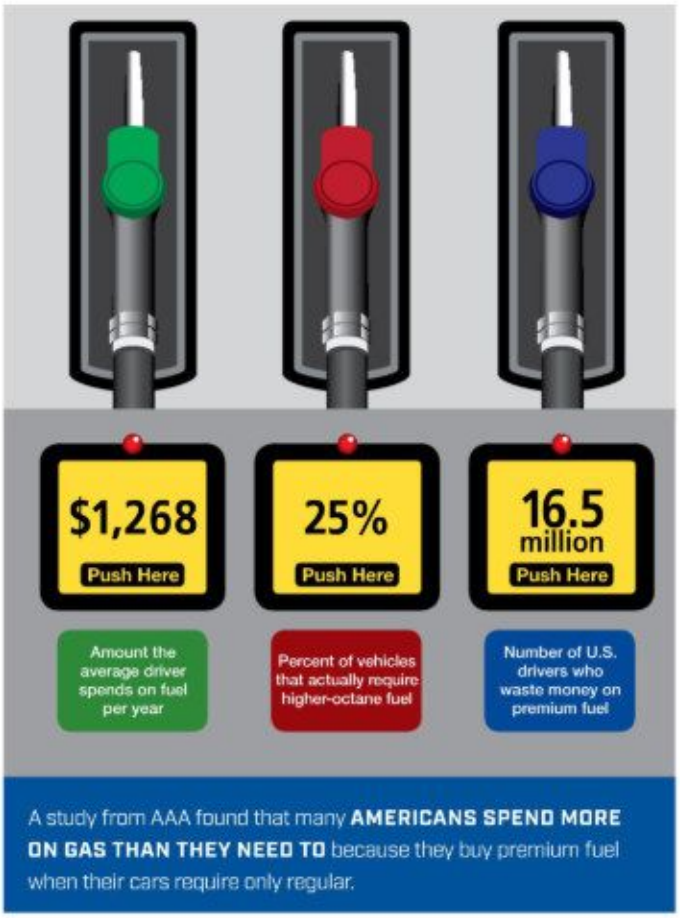
"But," some car owners say, "wouldn't my car run better—perform better, get better gas mileage—on higher-octane gas?" To find out, AAA and the ARC ran tests on vehicles that only require regular octane, using both premium and regular gasoline. They analyzed horsepower, fuel economy, and tailpipe emissions—all tested under a variety of driving conditions. The results? There were no significant differences—indicating that using premium gas when it's not required offers vehicle owners no benefits.

Is this a big deal? Yep. The average car owner spends about $1,300 a year on gasoline, the second-biggest expense of owning a car. Nationally, 16.5 million drivers who didn't need to do so filled their tanks with premium fuel at least once a month, wasting $2.1 billion annually. The lesson? Check your car's owner manual or manufacturer's website, and use the grade of fuel recommended. Doing anything else is a waste of money.

However, pay careful attention when you see the words "recommended" and "required." Some manufacturers *recommend* using midgrade or premium fuel, which means that you might be able to use regular fuel. Although your performance may suffer slightly, you won't damage your engine. But if the manufacturer says midgrade or premium fuel is *required*, it's best to use it.

A second study by AAA investigated gasoline *quality*: Top Tier gas versus non-Top Tier. All refiners are required to add a certain amount of detergent to their gasoline to prevent the buildup of carbon deposits in the engine. However, some auto manufacturers decided that the minimum standards weren't sufficient, and they increased the amount of detergent, calling their fuel Top Tier gasoline.

But is Top Tier gas really better, or is it just advertising hype? AAA found out by testing Top Tier gas and ordinary gas in laboratory procedures that simulated 4,000 miles of driving. The results were pretty amazing. Researchers discovered that using Top Tier gas left engines much cleaner—there were 19 times fewer deposits on the valves of engines using Top Tier gas.



A study from AAA found that many **AMERICANS SPEND MORE ON GAS THAN THEY NEED TO** because they buy premium fuel when their cars require only regular.

What's more, using Top Tier gas not only prevents deposits from occurring, it helps remove existing deposits from dirty engines. The final bit of good news: Top Tier gas averages only about 3 cents more per gallon than ordinary gas. That difference can easily be made up through better performance and improved fuel economy. To read the AAA study in its entirety, go to newsroom.aaa.com/2016/07/aaa-not-gasoline-created-equal/. To find brands of Top Tier gas, go to toptiergas.com/licensedbrands/.

Automatic Emergency Braking (AEB)

In March 2016, virtually every automaker committed to making automatic emergency braking (AEB) a standard feature on new cars by September 1, 2022. AEB systems, already standard or optional on some vehicles, use in-vehicle sensors such as radar, cameras, or lasers to detect an imminent forward collision with another vehicle. They use sounds, images, or vibration to warn a driver of a potential crash. If a driver doesn't act quickly enough, AEB automatically activates the brakes to help prevent or reduce the severity of a crash by slowing the vehicle or bringing it to a complete stop. Some AEB systems also can detect the presence of pedestrians.

Make no mistake about it—AEB systems are a big deal. According to NHTSA, rear-end collisions, which automatic emergency braking

systems are designed to mitigate or prevent, result in nearly 2,000 fatalities and more than 500,000 injuries annually.

In 2016, AAA and the ARC tested five different cars equipped with AEB systems both to determine performance quality within the systems' limitations and in real-world driving scenarios that intended to push the technology's limits. The various systems were tested and compared based on their capabilities and limitations as stated in the owners' manuals, and using scenarios designed to mirror and build upon those used by NHTSA and IIHS.

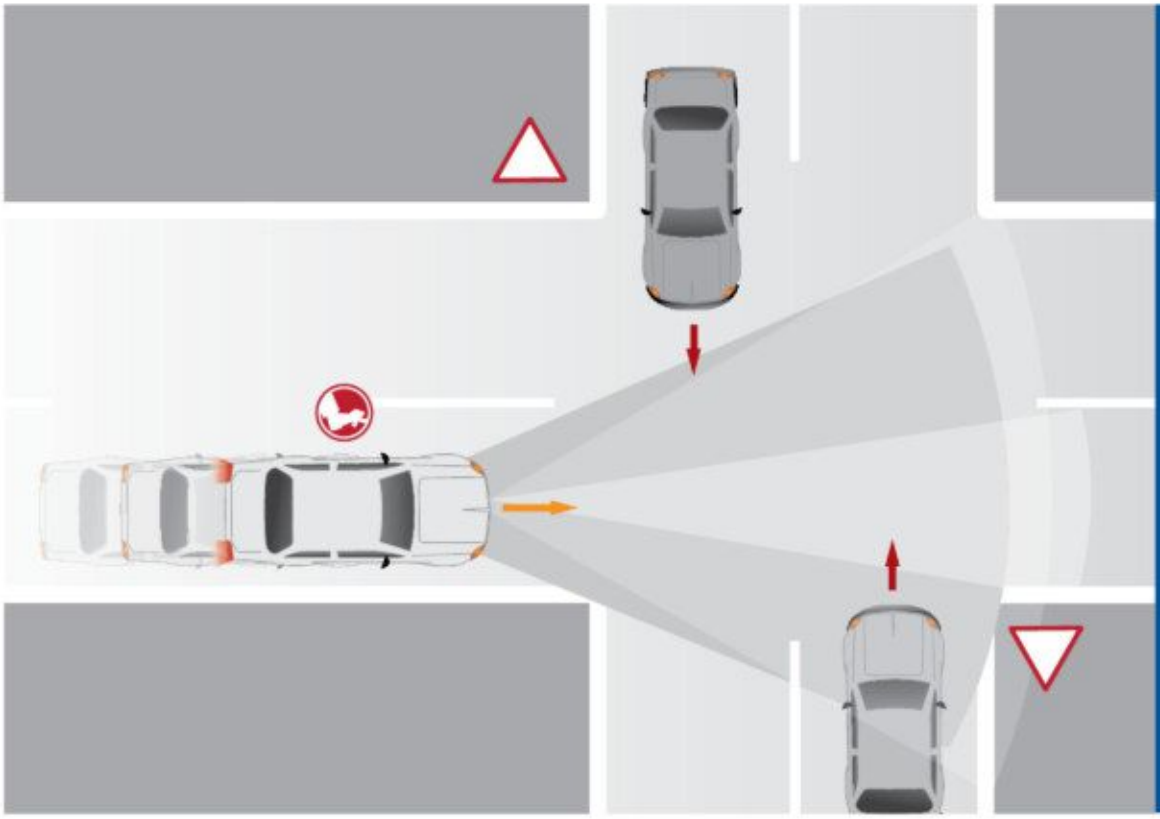
All of the vehicles tested automatically applied some level of braking and, in some cases, vehicles were able to come to a complete stop without hitting the target, a "soft car" designed by Dynamic Research specifically for this kind of testing. After more than 70 trials, the tests revealed:

- When the difference in speed between two vehicles was less than 30 mph, the vehicles were able to avoid collisions nearly 50 percent of the time.
- When the difference in speed between two vehicles was less than 30 mph, the average reduction in speed across all vehicles was 63 percent.
- The systems reduced vehicle speed in scenarios where the soft car was stopped, as well as when the soft car was slowing down directly in front of a fast-approaching test car.
- When AEB systems were pushed beyond their stated limitations and proposed federal requirements, the variation among systems became more pronounced.
- When a vehicle approached the soft car at 45 mph, the systems reduced speeds by an average of 48 percent and avoided crashes 24 percent of the time.
- Emergency braking systems are effective in mitigating crash severity. Drivers should consider purchasing this technology when they buy a new vehicle.
- Not all AEB systems are created equal. Drivers should know the capabilities and limitations of all vehicle technology before getting behind the wheel.

In addition to independent testing, AAA surveyed U.S. drivers to better understand their purchasing habits and the degree of trust they have in AEB systems. The results reveal:

- Nine percent of U.S. drivers currently have AEB on their vehicle.
- Nearly 40 percent of U.S. drivers want AEB on their next vehicle.
- Male drivers are more likely to want AEB on their next vehicle (42 percent) than are female drivers (35 percent).
- Two out of five U.S. drivers trust AEB to work.
- Drivers who own a vehicle equipped with AEB are more likely to trust it to work (71 percent) than drivers who haven't experienced the technology (41 percent).

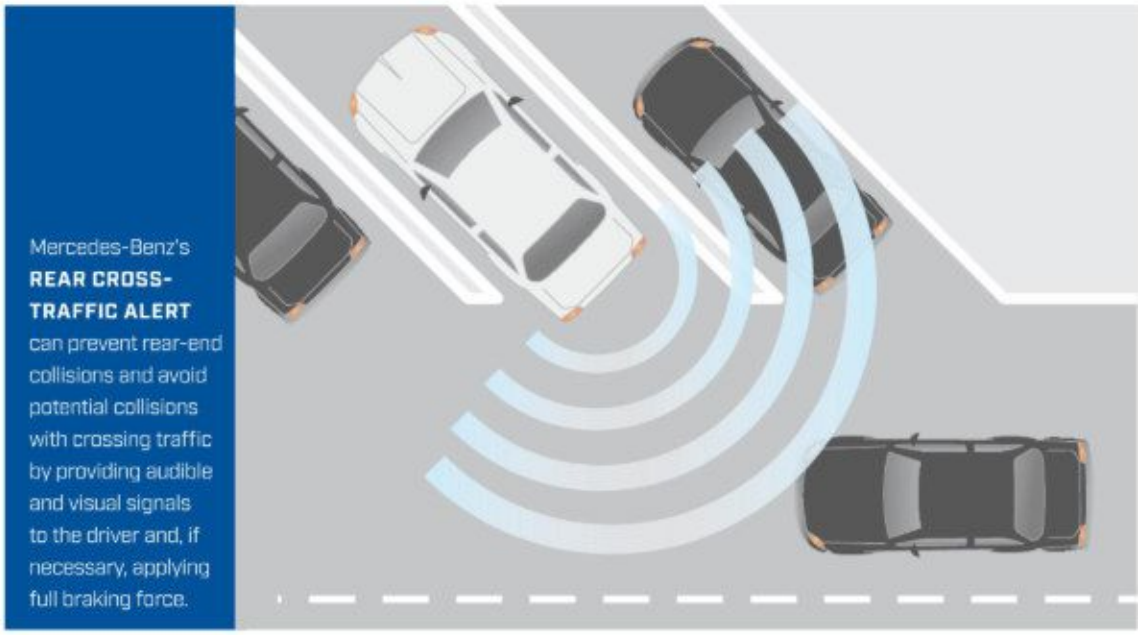
But simply having (or wanting) an AEB system isn't enough: Drivers have to understand the systems. "Two-thirds of Americans familiar with the technology believe that AEB systems are designed to avoid crashes without driver intervention," said John Nielsen, AAA's managing director of automotive engineering and repair. "The



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.

reality is that today's systems vary greatly in performance, and many are not designed to stop a moving car. AAA recommends that people consider buying a vehicle equipped with an AEB system. However, it's more important than ever for drivers to fully understand their vehicle's capabilities and limitations before they drive off the dealer lot."

"Based on our testing, we found that overall, AEB systems work well," said Megan McKernan, manager of the ARC. "However, not all AEB systems are the same. Some only slow a vehicle down to minimize damage, while others are designed to stop a vehicle completely to avoid a collision. Some systems perform better than others—and none work 100 percent of the time. Drivers should never rely on AEB to prevent a crash. It should be considered a driver-support system, not a substitute for safe, alert driving."



Mercedes-Benz's **REAR 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-Assistance Systems (ADAS)

We described advanced driver-assistance systems in detail in Chapter 5, "How Safe is Your Vehicle?" The purpose of ADAS is to make driving safer by warning drivers of a possible collision (for example, blind-spot monitoring) or temporarily assuming some driver functions like braking or steering (for example, forward-collision avoidance). Drivers should use ADAS to assist their driving, not as a substitute for responsible driving. Most ADAS systems can be overridden by driver input and/or turned off.

AAA Automotive Engineering and the ARC have evaluated the effectiveness of five ADAS technologies:

- Adaptive cruise control/autonomous braking
- Forward-collision avoidance
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-departure warning/lane-keeping assist

Adaptive Cruise Control/Forward-Collision Avoidance

To test *adaptive cruise control*, including an *autonomous-braking* function, AAA replicated typical commuting scenarios, and concluded that, overall, adaptive-cruise-control systems tested did a good job of maintaining a specified following distance when traveling behind slower-moving vehicles on a highway.

Some systems even brought vehicles to a complete stop in congested traffic and resumed a safe speed when traffic began moving again. 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 vehicles.

Vehicles also were driven on a test track at varying speeds toward different obstructions (traffic cones, a weather balloon, and a Mylar "space blanket") to test *forward-collision-avoidance* systems. This test replicated conditions motorists might encounter in real-world driving. Technicians found that the systems didn't always recognize obstacles, provide a warning signal, or engage the brakes early enough to slow or stop the vehicle in time to avoid hitting the obstacle.

Also, a system's ability to recognize obstacles varied among vehicles. Although owner's manuals warn that systems might not recognize or react to motorcycles, a stopped vehicle, traffic cones, or other obstructions, people who own automobiles equipped with these systems might not be aware of the systems' limitations.

Blind-Spot Monitoring

In the research on *blind-spot-monitoring systems*, vehicles were driven at varying speeds on the oval track at the Auto Club Speedway and evaluated for their ability to spot another vehicle or a motorcycle in their blind spot. The results: Blind-spot-monitoring systems detected target vehicles under most—but not all—conditions. Also, the detection distance varied considerably depending on the system being tested and the speed of the approaching vehicle.

Detection of a passing motorcycle was, on average, 26 percent later than detection of other vehicles. In every evaluation, there were times when a driver needed to take corrective action to compensate for a system's shortcomings. AAA concluded that drivers should not become overly reliant on this technology.

Rear Cross-Traffic Alert

Sometimes, a blind-spot-monitoring system has a *rear cross-traffic*

alert (RCTA) system; various examples have been evaluated by AAA. These systems let you know if traffic is about to cross at right angles from either direction behind your vehicle. This feature is especially useful if you're about to back out of a parking spot where your ability to see clearly is restricted or completely blocked by other vehicles. RCTA systems are designed only to detect other cars. However, the ARC tested whether the systems worked for motorcycles, bicycles, and pedestrians on the assumption that motorists might assume they would.

The systems on 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 of the test vehicle. 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 their systems' limitations.

Lane-Departure Warning/Lane-Keeping Assist

Three different vehicles were driven on the road for an evaluation of *lane-departure-warning* and *lane-keeping-assist 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 types of lane markings better than others, but there was no consistent marker recognition among vehicles. Worn pavement markers, construction zones, and intersections sometimes caused the LDW system to lose track of lane location.

Similarly, lane-keeping-assist 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 disconcerting to test drivers.

In conclusion, AAA recommends (1) that automakers make concerted efforts to let car owners know the benefits and limitations of ADAS, and (2) that motorists become thoroughly familiar with the performance of ADAS before operating their vehicles.

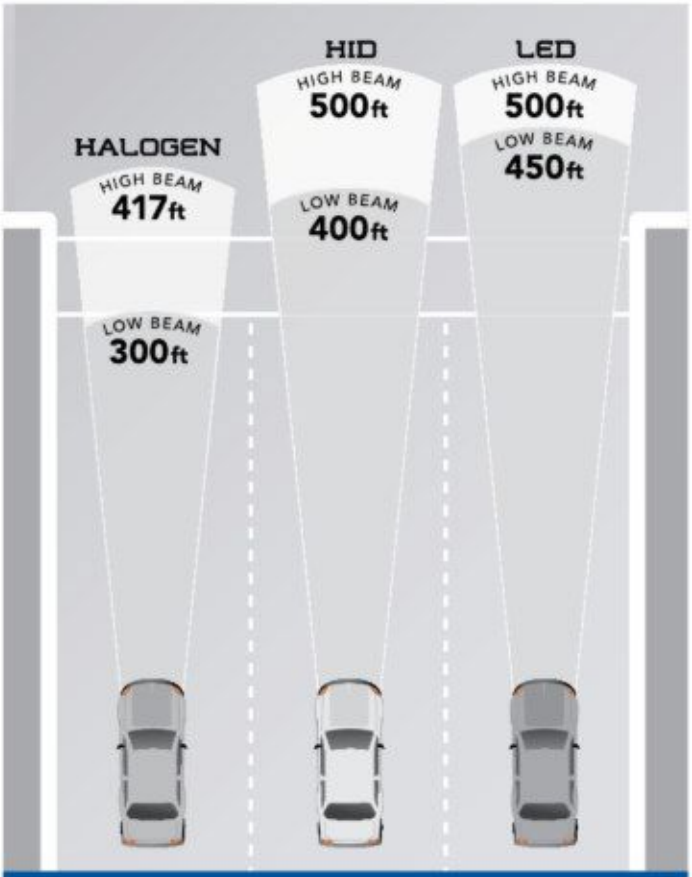
The important takeaway from AAA's research is that all ADAS have limitations, and multitasking or distracted drivers could be caught off guard by relying too heavily on the systems. The benefits of these systems could easily be outweighed if motorists don't become familiar with their operation or become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

Headlight-Effectiveness Study

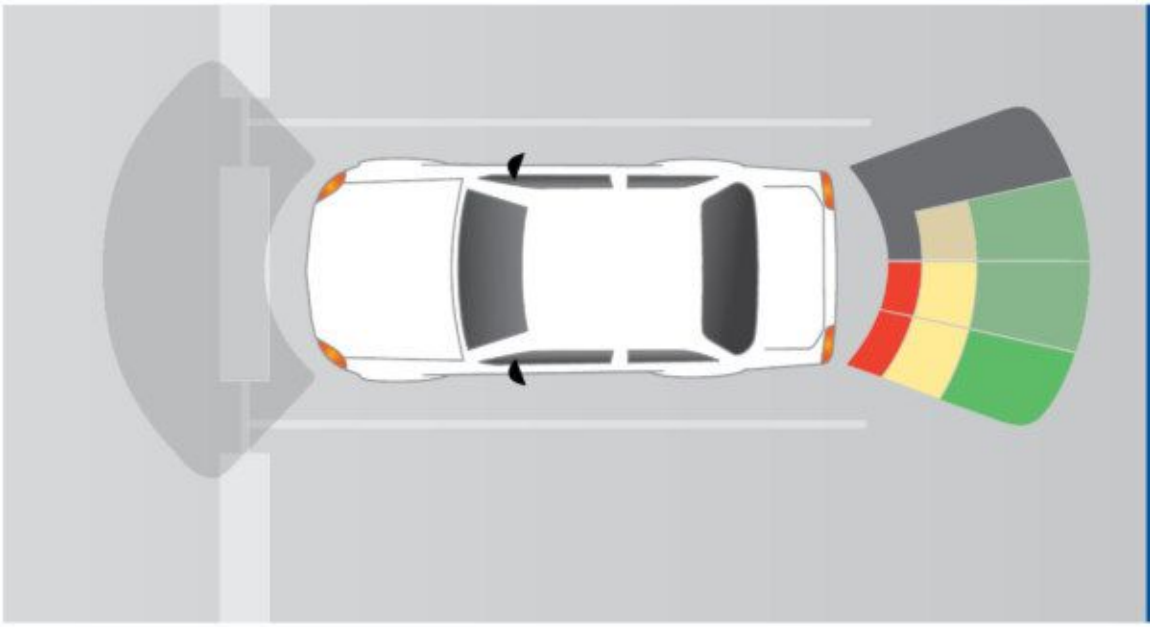
Effective vehicle headlights are critical in reducing the number of crashes that occur at night. Only 25 percent of driving is done at night, but 50 percent of crashes occur then, according to NHTSA. A study by IIHS and the University of Michigan Transportation Research Institute also discovered that most motorists rarely use their high beams, which are an effective safety measure when used appropriately. To better understand headlight effectiveness, AAA conducted tests on three types of headlights—halogen, high-intensity discharge (HID), and light-emitting diode (LED)—to find out, among other things, how much forward lighting is needed for safe nighttime driving, especially 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 effectiveness. On a low-beam setting, halogen headlights 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, on low-beam setting, halogen headlights provide inadequate lighting at speeds above 39 mph, and HID or LED headlights provide



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.

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 appropriate*.

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 pedestrians, animals, or objects in the roadway.

The study also found that dirty or deteriorated lenses could cut the effectiveness of *any* type of headlight significantly—up to 50 percent with halogen bulbs. But you can easily restore the clarity of plastic headlight lenses, which become cloudy over time. This 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 inexpensive 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 30 percent of those fatalities are children under age 5.

Fortunately, such accidents are preventable because rearview cameras have been 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. So in the interest of safety, NHTSA passed legislation requiring rearview cameras to be standard equipment on all cars and light trucks sold as of May 2018.

To gauge the effectiveness of rearview cameras, AAA, in conjunction with the ARC, tested 17 vehicles from 11 manufacturers equipped with both factory-installed and aftermarket rearview-camera systems to see whether the cameras improved rear visibility compared with drivers simply looking in their rearview mirrors. The study concluded that:

- In general, both factory-installed and aftermarket cameras worked well, producing clear images even at night and in low-light conditions and improving visibility in the blind zone behind cars by an average of 46 percent, ranging from a 36 percent improvement in smaller sedans to a 75 percent improvement in hatchbacks.
- Although these systems dramatically improve rearview visibility, most don't show 100 percent of the space behind the vehicle. They also have limitations—they don't provide a good image below a car's bumper, for example. And rain, snow, or slush can cloud the camera lens, delivering blurry images.

In short, rearview cameras are not a substitute for human vision and alertness. "Rearview cameras are a great supplement for drivers," says John Nielsen, AAA's managing director of automotive engineering and repair. "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."

Therefore, 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.

Fuel-Economy Testing

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

AAA and the ARC staff tested some of the cars that the EPA data show were getting worse mileage than that indicated on the EPA window sticker—specifically, a 2014 Ford F-150, a 2014 Hyundai Sonata, and a 2012 Nissan Altima—and tested them to see if in fact they got worse mileage than the EPA estimated.

Two kinds of tests were conducted: three EPA dynamometer tests [see the sidebar in Chapter 1 on EPA testing on page 15] and four week-long on-road tests involving four test drivers engaged in various types of driving.

The overall results indicated that the vehicles were able to repeat their EPA certification results when tested on the dynamometer and also that on-road mpg measurements were within the range of EPA window-sticker values. Each vehicle's lowest and highest on-road fuel economy varied significantly.

Not surprisingly, driving that involved many cold starts [engines use the most fuel when cold-started] and in-town or congested driving tended to have low mpg numbers. By comparison, free-flowing freeway driving and driving with long distances between stops tended to yield high mpg numbers.

Active Parking-Assist Systems

Introduced in the U.S. in 2006, active parking-assist systems use cameras and ultrasonic sensors to identify a correctly sized parallel parking spot and automatically back a vehicle into it. In most cases, the vehicle does all the steering; the driver operates the accelerator, gear selection, and brake pedal.

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

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

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

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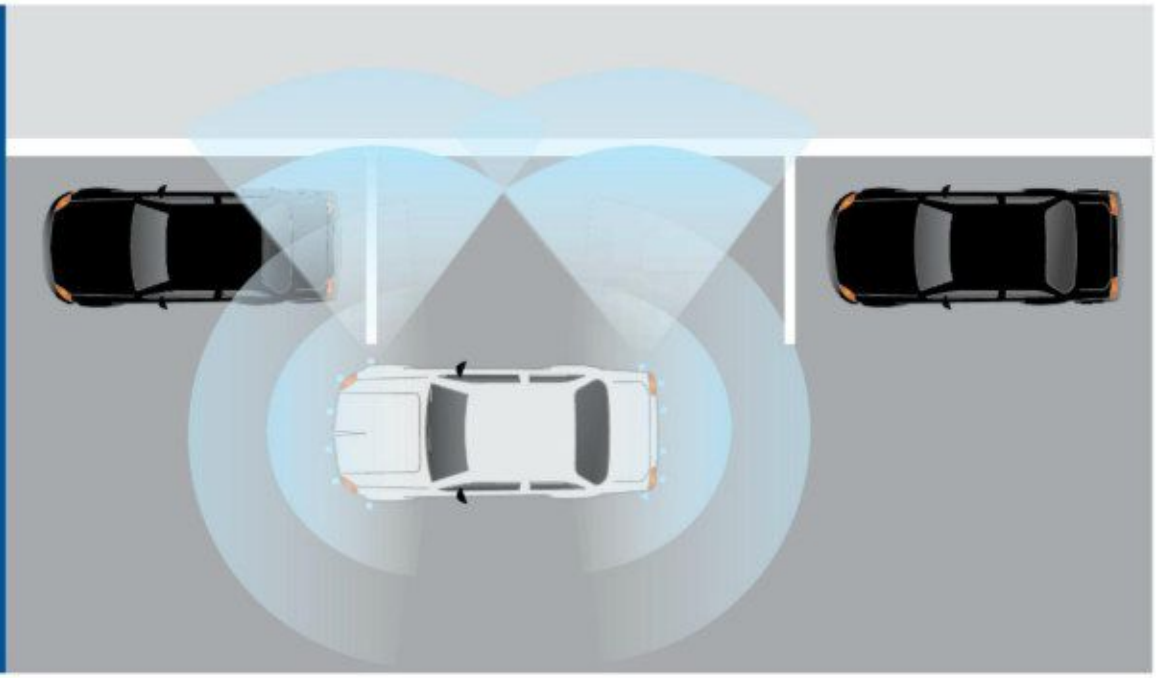
As automakers strive to make increasingly fuel-efficient and safer vehicles, it's inevitable that those vehicles will become more and more complex. In the coming years, you can count on AAA to provide the reliable, trustworthy information you'll need both to better understand the latest automotive technology and to continue to use and enjoy your vehicles for years to come.



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.

OVERALL GREEN CAR SCORES

TEST RESULTS AND RANKINGS The 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

RANK	YEAR	MAKE	MODEL	TYPE	CATEGORY	SCORE
1	2016	Tesla	**Model X 75D**	electric	CATEGORY WINNER	100.33
2	2017	Volvo	**XC90 T8 E-AWD Inscription**	hybrid		93.03
3	2017	Chevrolet	**Bolt EV Premier**	electric	CATEGORY WINNER	87.19
4	2016	Volkswagen	**e-Golf SE**	electric	CATEGORY WINNER	85.66
5	2016	Tesla	**Model S 60**	electric	CATEGORY WINNER	84.89
6	2016	Lexus	**GS 450h F Sport**	hybrid	CATEGORY WINNER	81.74
7	2016	Audi	**A3 Sportback e-tron Premium**	hybrid		81.53
8	2016	Hyundai	**Sonata Plug-in Hybrid Limited**	hybrid		80.70
9	2016	Volkswagen	**Golf GTI Autobahn Performance**	gas		80.61
10	2017	Nissan	**Leaf SL**	electric		76.20
11	2016	Acura	**RLX Sport Hybrid SH-AWD Advance**	hybrid		76.15
12	2016	Kia	**Soul EV+**	electric		75.85
13	2017	Toyota	**Highlander Hybrid Limited Platinum**	hybrid		75.77
14	2017	Honda	**Accord Hybrid Touring**	hybrid		75.29
15	2017	Subaru	**Outback 3.6R Touring**	gas		75.05
16	2017	Kia	**Optima Hybrid EX**	hybrid		74.96
17	2016	Honda	**Civic Touring**	gas		74.85
18	2016	Toyota	**Mirai**	fuel cell		74.84
19	2017	Toyota	**Prius Prime Advanced**	hybrid		74.55
20	2016	Volkswagen	**Passat 1.8T SE**	gas		74.45
21	2017	Lincoln	**MKZ HEV Reserve**	hybrid		74.28
22	2017	Honda	**CR-V 1.5T AWD Touring**	gas		74.25
23	2016	Chevrolet	**Volt Premier**	hybrid		73.86
24	2016	Toyota	**Prius Two Eco**	hybrid		73.26
25	2016	Volkswagen	**Beetle 1.8T Dune**	gas		73.19
26	2017	Mazda	**Mazda3**	gas		72.84
27	2016	Lexus	**ES 300h**	hybrid		72.65
28	2017	Toyota	**Camry Hybrid XLE**	hybrid		72.62
29	2017	Chevrolet	**Cruze Hatchback Premier 1SF**	gas		72.53

RANK	YEAR	MAKE	MODEL	TYPE	CATEGORY	SCORE
30	2017	Ford	Fusion Energi Titanium	hybrid		72.22
31	2016	Honda	Accord Sport Sensing	gas		72.10
32	2017	Hyundai	Elantra Limited	gas		71.86
33	2016	Ford	C-Max Energi SEL	hybrid		71.55
34	2016	Hyundai	Sonata Hybrid Limited	hybrid		71.36
35	2016	Chevrolet	Malibu Hybrid	hybrid		71.13
36	2017	Ford	Fusion Hybrid Titanium	hybrid		70.82
37	2017	Subaru	Legacy 2.5i Sport	gas		70.72
38	2016	Mitsubishi	i-MiEV ES	electric		70.00
38	2017	Toyota	Prius v Five	hybrid		70.00
40	2016	Chevrolet	Cruze Premier	gas		69.99
41	2017	Lexus	RX 450h	hybrid		69.95
42	2017	Kia	Forte S	gas		69.86
43	2016	Mazda	Mazda6 i Grand Touring	gas		69.84
44	2016.5	Mazda	CX-5 Grand Touring AWD	gas		69.52
45	2017	Nissan	Rogue SL FWD HEV	hybrid		68.54
46	2017	Buick	Encore Sport Touring FWD	gas		68.17
47	2016	Toyota	RAV4 Limited Hybrid	hybrid		67.89
48	2016	Lexus	CT 200h F Sport	hybrid		67.72
49	2016	Lexus	NX 300h	hybrid		67.62
50	2016	Ford	F-150 XLT Super Crew	gas	CATEGORY WINNER	67.31
51	2016	Mitsubishi	Outlander Sport 2.4 GT AWC	gas		66.54
52	2017	Honda	Fit EX M/T	gas		65.90
53	2016	Fiat	500X Trekking	gas		65.59
54	2016	Toyota	Avalon Hybrid XLE Plus	hybrid		65.16
55	2016	Honda	HR-V EX-L NAVI	gas		64.65
56	2016	Toyota	Prius c Four	hybrid		63.17
57	2016	Jeep	Renegade Latitude 4X4 75th Edition	gas		63.04
58	2016	Mazda	CX-3 Grand Touring	gas		62.73
59	2016	Chevrolet	Spark 2LT	gas		62.17
60	2017	Toyota	Yaris iA	gas		61.46
61	2016	Toyota	Corolla S Special Edition	gas		60.85
62	2016	Toyota	Corolla LE Eco	gas		60.68
63	2016	Subaru	Crosstrek 2.0i Premium	gas		60.23
64	2017	Mitsubishi	Mirage G4 SE	gas		59.30
65	2016	Chevrolet	Colorado 4WD Z71 Crew Short Box	diesel		56.34

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 65 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 76.

CATEGORY

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

UNDER $30,000

RANK	YEAR	MAKE	MODEL	TYPE	CATEGORY	SCORE	PRICE AS TESTED
1	2016	Honda	**Civic Touring**	gas		74.85	$27,335
2	2016	Volkswagen	**Passat 1.8T SE**	gas		74.41	$27,100
3	2016	Toyota	**Prius Two Eco**	hybrid		73.26	$25,535
4	2016	Volkswagen	**Beetle 1.8T Dune**	gas		73.19	$26,760
5	2016	Mazda	**Mazda3**	gas		72.84	$29,080
6	2017	Chevrolet	**Cruze Hatchback Premier 1SF**	gas		72.47	$26,870
7	2016	Honda	**Accord Sport Sensing**	gas		72.10	$26,785
8	2017	Hyundai	**Elantra Limited**	gas		71.86	$27,710
9	2017	Subaru	**Legacy 2.5i Sport**	gas		70.72	$28,910
10	2016	Mitsubishi	**i-MiEV ES**	electric		70.00	$25,845
11	2016	Chevrolet	**Cruze Premier**	gas		69.99	$28,640
12	2017	Kia	**Forte S**	gas		69.86	$21,540
13	2017	Buick	**Encore Sport Touring FWD**	gas		68.17	$29,720
14	2016	Mitsubishi	**Outlander Sport 2.4 GT AWC**	gas		66.54	$28,245
15	2017	Honda	**Fit EX M/T**	gas		65.90	$18,735
16	2016	Fiat	**500X Trekking**	gas		65.59	$27,930
17	2016	Honda	**HR-V EX-L NAVI**	gas		64.65	$25,470
18	2016	Toyota	**Prius c Four**	hybrid		63.17	$25,930
19	2016	Jeep	**Renegade Latitude 4X4**	gas		63.04	$27,990
20	2016	Mazda	**CX-3 Grand Touring**	gas		62.73	$28,340
21	2016	Chevrolet	**Spark 2LT**	gas		62.17	$18,355
22	2017	Toyota	**Yaris iA**	gas		61.46	$17,915
23	2016	Toyota	**Corolla S Special Edition**	gas		60.85	$23,520
24	2016	Toyota	**Corolla LE Eco**	gas		60.68	$19,900
25	2016	Subaru	**Crosstrek 2.0i Premium**	gas		60.23	$26,240
26	2017	Mitsubishi	**Mirage G4 SE**	gas		59.30	$17,830

$30,000 – $50,000

RANK	YEAR	MAKE	MODEL	TYPE	CATEGORY	SCORE	PRICE AS TESTED
1	2017	Chevrolet	**Bolt EV Premier**	electric		87.19	$43,510
2	2016	Volkswagen	**e-Golf SE**	electric		85.66	$31,490
3	2016	Audi	**A3 Sportback e-tron Premium**	hybrid		81.53	$40,700
4	2016	Hyundai	**Sonata Plug-in Hybrid Limited**	hybrid		80.70	$39,610
5	2016	Volkswagen	**Golf GTI Autobahn Performance**	gas		80.61	$36,840
6	2017	Nissan	**Leaf SL**	electric		76.20	$39,425
7	2016	Kia	**Soul EV+**	electric		75.85	$38,025
8	2017	Toyota	**Highlander Hybrid Limited Platinum**	hybrid		75.77	$49,184
9	2017	Honda	**Accord Hybrid Touring**	hybrid		75.29	$36,790
10	2017	Subaru	**Outback 3.6R Touring**	gas		75.05	$39,070
11	2017	Kia	**Optima Hybrid EX**	hybrid		74.96	$36,840
12	2017	Toyota	**Prius Prime Advanced**	hybrid		74.55	$33,965
13	2017	Lincoln	**MKZ HEV Reserve**	hybrid		74.28	$48,520
14	2017	Honda	**CR-V 1.5T AWD Touring**	gas		74.25	$34,595
15	2016	Chevrolet	**Volt Premier**	hybrid		73.86	$40,225
16	2016	Lexus	**ES 300h**	hybrid		72.65	$47,240
17	2017	Toyota	**Camry Hybrid XLE**	hybrid		72.62	$34,710
18	2017	Ford	**Fusion Energy Titanium**	hybrid		72.22	$37,890
19	2016	Ford	**C-Max Energi SEL**	hybrid		71.55	$37,510
20	2016	Hyundai	**Sonata Hybrid Limited**	hybrid		71.36	$35,550
21	2016	Chevrolet	**Malibu Hybrid**	hybrid		71.13	$31,130
22	2017	Ford	**Fusion Hybrid Titanium**	hybrid		70.82	$35,550
23	2017	Toyota	**Prius v Five**	hybrid		70.00	$35,105
24	2016	Mazda	**Mazda6 i Grand Touring**	gas		69.84	$33,410
25	2016.5	Mazda	**CX-5 Grand Touring AWD**	gas		69.52	$34,185
26	2017	Nissan	**Rogue SL FWD HEV**	hybrid		68.54	$33,620
27	2016	Toyota	**RAV4 Limited Hybrid**	hybrid		67.89	$35,865
28	2016	Lexus	**CT 200h F Sport**	hybrid		67.72	$41,965
29	2016	Lexus	**NX 300h**	hybrid		67.62	$49,044
30	2016	Ford	**F-150 XLT Super Crew**	gas		67.31	$38,240
31	2016	Toyota	**Avalon Hybrid XLE Plus**	hybrid		65.16	$37,485
32	2016	Chevrolet	**Colorado 4WD Z71 Crew Short Box**	diesel		56.34	$41,905

OVER $50,000

RANK	YEAR	MAKE	MODEL	TYPE	CATEGORY	SCORE	PRICE AS TESTED
1	2016	Tesla	**Model X 75D**	electric		100.33	$99,200
2	2017	Volvo	**XC90 T8 E-AWD Inscription**	hybrid		93.03	$88,855
3	2016	Tesla	**Model S 60**	electric		84.89	$71,200
4	2016	Lexus	**GS 450h F Sport**	hybrid		81.74	$71,980
5	2016	Acura	**RLX Sport Hybrid SH-AWD Advance**	hybrid		76.15	$66,870
6	2016	Toyota	**Mirai**	hydrogen		74.84	$57,500
7	2017	Lexus	**RX 450h**	hybrid		69.95	$60,870

BASE PRICE: **$40,905;** PRICE AS TESTED: **$43,510**

SUBCOMPACT

In terms of size and usefulness, today's subcompacts aren't the subcompacts of yesteryear. For one thing, they're typically larger (cars in every category generally tend to get larger as they evolve). For another, automakers keep finding ingenious ways to make better use of existing space (the Honda Fit's Magic Seats, for instance) or to expand interior space by making cars taller—as with the crossover segment.

Subcompacts have unique and undeniable virtues: As a breed, they're less expensive, more fuel-efficient, and easier to park and maneuver than compact cars—and they can be a lot of fun to drive. Plus, they no longer have to play second fiddle to bigger, more prestigious cars. They can be as reliable, well equipped, and nearly as luxurious as cars costing many thousands of dollars more. So if you don't need something bigger, check out the wide range of subcompacts in the 2017 *AAA Green Car Guide*.

CHEVROLET

Bolt EV Premier

The new Chevy Bolt intends to be a game-changer in the EV arena. With the base model starting at about $37,500 before tax credits, the Bolt has an EPA-estimated 238-mile range from its 60-kWh battery. That's equivalent to the range for the Tesla Model S's smallest battery, and it's considerably more than any other fully electric vehicle in its price range. On the outside, the Bolt looks like a typical subcompact hatchback. The interior is high tech, and the electronic displays are clear and easy to understand, but there are some cheap-looking hard plastics on the doors and dash panels. The manually adjustable front seats are comfortable but surprisingly snug. The electronic shifter is similar to the Toyota Prius's, but the Bolt's is more awkward to use and shifts into reverse reluctantly. The rear seat back is upright, but with adequate headroom and plenty of legroom, the backseat is still comfortable. The throttle is responsive, and the Bolt accelerates quickly and smoothly. The steering feels precise, with good feedback. Ride quality is comfortable, like that of a larger car, and handling is predictable.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

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

OVERALL SCORE

STRONG POINTS

- Smooth EV powertrain
- Good handling, steering response, and feel
- High-tech displays
- Very good ride quality

WEAK POINTS

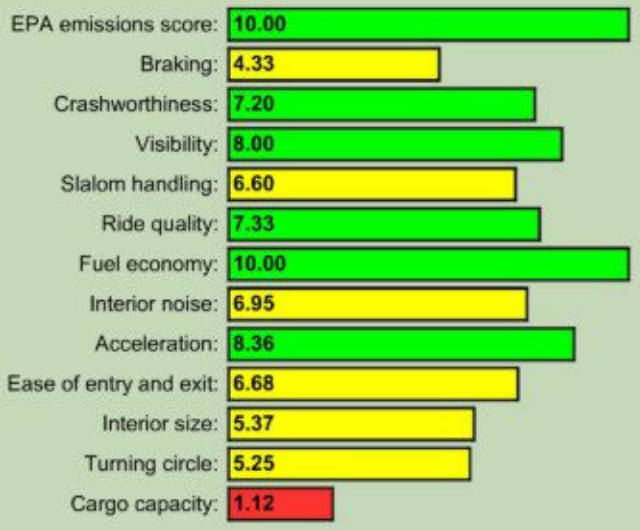
- Difficult-to-use shifter
- Some cheap interior plastics
- Some torque steer

FUEL INFORMATION

Fuel Type:	**Electricity**
Battery Capacity (kWh):	**60.0**
EPA Urban MPGe:	**128**
EPA Highway MPGe:	**110**
EPA Combined MPGe:	**119**
EPA Estimated Range (mi.):	**238**

BATTERY CHARGE TIME

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3580**
Exterior length (in):	**164.0**
Exterior width (in):	**69.5**
Exterior height (in):	**62.8**
Wheelbase (in):	**102.4**
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:	**N/A**
Horsepower @ rpm:	**N/A**
Electric motor horsepower:	**200 (150 kW)**

Volkswagen **Beetle 1.8T Dune**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

73.19

OVERALL RANKING **25**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**14.5**
EPA Urban mpg:	**25**
EPA Highway mpg:	**34**
EPA Combined mpg:	**28**

AVERAGE MPG AS TESTED BY AUTO CLUB

00023

BASE PRICE: **$23,995;** PRICE AS TESTED: **$26,760**

OVERALL OBSERVATIONS

The Volkswagen Beetle has been around in one form or another since 1938. The modern Beetle—with a water-cooled, front-mounted engine—was reintroduced in 1997 and then got a makeover in 2011 as the current model. Our 2016 retro Baja Bug lookalike, the Dune, has bronze paint with a low black stripe and a sporty trunk-mounted spoiler. The interior, too, is a blend of retro and modern styling. The front seats are comfortable and supportive, with a good amount of space in the front area. The rear seats, though, are quite tight. The Beetle Dune has a good ride/handling balance, with some understeer at the limit. But the steering itself is responsive and provides good road feel, and the highway ride is very good. Acceleration is adequate, although there is some turbo lag from the 1.8-liter engine, which generates 170 hp. A normal press of the start switch will just put the Beetle in accessory mode, and then the driver has to cycle the car off and back on again.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert

STRONG POINTS

- ⊕ Attractive, fun, retro styling
- ⊕ Good ride/handling balance
- ⊕ Accurate steering, with excellent feel
- ⊕ Strong brakes, with a firm pedal

WEAK POINTS

- ⊖ Tight rear seats
- ⊖ Some turbo lag
- ⊖ Small trunk and little interior storage
- ⊖ The proximity key is finicky when locking and unlocking the vehicle

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	7.62
Crashworthiness:	6.00
Visibility:	6.80
Slalom handling:	8.03
Ride quality:	7.46
Fuel economy:	3.78
Interior noise:	4.19
Acceleration:	6.02
Ease of entry and exit:	4.71
Interior size:	3.49
Turning circle:	7.23
Cargo capacity:	0.87

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/2**
Curb weight (lbs):	**3140**
Exterior length (in):	**168.4**
Exterior width (in):	**71.2**
Exterior height (in):	**58.5**
Wheelbase (in):	**100.0**
Restraint type:	**8 Air Bags**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Continental 235/45R18**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**1.8L TSI DOHC 16V Turbo I4**
Horsepower @ rpm:	**170 @ 4800**

Mitsubishi **i-MiEV ES**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

70.00

OVERALL RANKING **38**

FUEL INFORMATION

Fuel Type:	**Electricity**
Battery Capacity (kWh):	**16.0**
EPA Urban MPGe:	**126**
EPA Highway MPGe:	**99**
EPA Combined MPGe:	**112**
EPA Estimated Range (mi.):	**62**

BATTERY CHARGE TIME

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

NHTSA SAFETY RATING: ★★★★½

OVERALL OBSERVATIONS

The 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.

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

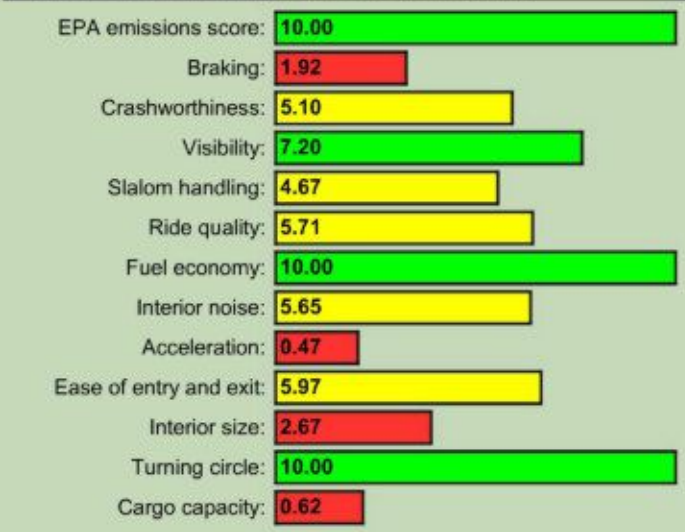
STRONG POINTS

- ⊕ 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 SCORE (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**

Honda **Fit EX M/T**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

65.90

OVERALL RANKING **52**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**10.6**
EPA Urban mpg:	**29**
EPA Highway mpg:	**36**
EPA Combined mpg:	**32**

AVERAGE MPG AS TESTED BY AUTO CLUB

00034

BASE PRICE: **$17,900;** PRICE AS TESTED: **$18,735**

OVERALL OBSERVATIONS

Honda's Fit—a sporty subcompact that's also very practical and fuel-efficient—was the third-best-selling subcompact in 2016. The exterior is an efficient, aerodynamic shape, while the interior is cleanly and efficiently styled. The front seats are comfortable, supportive, and attractive, and visibility from the driver's seat is excellent. Some dashboard plastics are hard, and many of the controls are good old-fashioned knobs, but overall, they work well. The rear seat is comfortable, too, with surprisingly generous legroom. That backseat tumbles into the floor—Honda's Magic Seats—creating a large cargo space with a completely flat floor and a very low lift-over height. The engine—a 130-hp 4-cylinder—has great drivability and adequate power, though some of our testers would have liked more. The engine can be a bit loud, but it sounds pleasant and sporty nonetheless. The 6-speed on our test car's manual transmission was excellent, with short, crisp throws. The clutch is just as good—light and progressive. The steering is very responsive, and the brakes feel good. Handling is good, with a touch of understeer but no torque steer.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

STRONG POINTS

- ⊕ Excellent, sports car–like shifter
- ⊕ Light, progressive clutch
- ⊕ Great outward visibility
- ⊕ Blind-spot camera
- ⊕ Fold-flat rear seats

WEAK POINTS

- ⊖ Loud engine (but sporty)
- ⊖ Radio touch-panel interface prone to mistaken inputs
- ⊖ No volume knob on the radio

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	3.03
Crashworthiness:	5.11
Visibility:	7.60
Slalom handling:	7.44
Ride quality:	7.06
Fuel economy:	4.67
Interior noise:	2.97
Acceleration:	5.44
Ease of entry and exit:	6.87
Interior size:	2.67
Turning circle:	5.92
Cargo capacity:	1.12

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2580**
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:	**Firestone 185/55R16**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Manual 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**1.5L DOHC 16V i-VTEC I4**
Horsepower @ rpm:	**130 @ 6600**

Toyota **Prius c Four**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

63.17

OVERALL RANKING **56**

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

00039

BASE PRICE: **$24,495;** PRICE AS TESTED: **$25,930**

OVERALL OBSERVATIONS

Introduced for 2012 and mildly refreshed in 2015, Toyota's Prius c is the smallest and least expensive vehicle in the Prius lineup. Our test car was well-equipped, with navigation, lane-departure warning, and a satellite radio. The Prius c has a modern and attractive interior and, for a small car, is relatively spacious in the front seating area. Surprisingly, the rear seats are comfortable for two average-size adults, but the cargo space under the rear hatch is pretty small. The 1.5-liter gas engine/electric motor combo is underpowered (99 hp total) and very noisy, but it gives the Prius c excellent fuel economy—an EPA-rated 53 mpg city/46 highway/50 combined. Ride quality is acceptable for a small car, with some body movement; handling limits are modest. There's a great deal of wind noise during highway driving, but for urban driving, the Prius c is a fine choice. If you cover many highway miles, though, consider the regular Prius hatchback. It's more expensive, but it's a newer design and provides a better ride and superior performance.

NHTSA SAFETY RATING: ★★★★½

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Lane-departure warning
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- ⊕ Excellent fuel economy
- ⊕ Modern, relatively spacious interior
- ⊕ Small turning circle; easy to park

WEAK POINTS

- ⊖ Underpowered, noisy powertrain
- ⊖ Lots of wind noise
- ⊖ Lacks interior storage space

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	3.32
Crashworthiness:	5.70
Visibility:	6.90
Slalom handling:	6.88
Ride quality:	6.58
Fuel economy:	8.67
Interior noise:	5.19
Acceleration:	1.83
Ease of entry and exit:	6.11
Interior size:	1.76
Turning circle:	2.11
Cargo capacity:	1.12

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2640**
Exterior length (in):	**153.3**
Exterior width (in):	**66.7**
Exterior height (in):	**57.3**
Wheelbase (in):	**100.4**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Bridgestone P195/50R16**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**1.5L 16V DOHC I4**
Horsepower @ rpm:	**73 @ 4800 (99 Total)**
Electric motor horsepower:	**60 hp (45 kW)**

Chevrolet **Spark 2LT**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

62.17

OVERALL RANKING **59**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**9.0**
EPA Urban mpg:	**31**
EPA Highway mpg:	**41**
EPA Combined mpg:	**35**

AVERAGE MPG AS TESTED BY AUTO CLUB

00032

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

OVERALL OBSERVATIONS

The Chevy Spark, completely redesigned for 2016, is priced at about $18,000 and averages 35 mpg, making it a very affordable green vehicle. The Spark lacks power (its 1.4-liter turbocharged engine produces just 98 hp). But it's a great car for people who live in large cities because it's easy to drive, inexpensive to maintain, nimble, and easy to park. The 2016 2LT model we tested had many amenities usually reserved for more expensive vehicles, such as a leather-wrapped steering wheel, leatherette upholstery, satellite radio, rearview camera, heated front seats, and power mirrors. Also, an optional package including lane-departure warning and forward-collision alert can be ordered on the 2LT. The downside: Adults will be unhappy in the cramped backseat, and the trunk is tiny.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- ⊕ Economical 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 SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	3.97
Crashworthiness:	5.16
Visibility:	6.90
Slalom handling:	7.26
Ride quality:	5.88
Fuel economy:	5.33
Interior noise:	3.56
Acceleration:	2.12
Ease of entry and exit:	5.79
Interior size:	2.16
Turning circle:	6.67
Cargo capacity:	0.37

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**

Toyota **Yaris iA**

2017 IIHS TOP SAFETY PICK

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

61.46

OVERALL RANKING 60

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**11.6**
EPA Urban mpg:	**32**
EPA Highway mpg:	**40**
EPA Combined mpg:	**35**

AVERAGE MPG AS TESTED BY AUTO CLUB

00033

BASE PRICE: **$17,050;** PRICE AS TESTED: **$17,915**

OVERALL OBSERVATIONS

The Toyota Yaris iA is good basic transportation. It carries over unchanged from its previous life as a Scion iA; that brand was discontinued in 2016. The engine (1.5-liter 4-cylinder, 106 hp) is a bit coarse and feels underpowered. Acceleration is weak, and the engine growls loudly when pushed. The brakes feel strong, and highway stability is good for a small car. The interior is cleanly styled, with stitching on the dash and faux carbon-fiber trim on the dash and the doors. The front seats are comfortable, but snug. The trunk is large for a subcompact car, and the rear seatbacks can be easily folded forward to increase cargo space. Many of the iA's features are manually controlled, including the seats, the HVAC system, and the headlights, which don't have an auto position. The iA has a convenient push-button start feature, but the doors and trunk must be opened by using the key fob. The controller for the radio and vehicle settings is overly complicated; simple radio-adjustment tasks take multiple steps. A low-speed forward-collision–warning system is standard, which is unusual for a car of this class.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning

STRONG POINTS

- ⊕ Good steering feel and response
- ⊕ Good stability on the highway
- ⊕ Stitching on dash and faux carbon-fiber trim

WEAK POINTS

- ⊖ Modest power, slow acceleration
- ⊖ Noisy powertrain
- ⊖ Manual controls for many features
- ⊖ No center storage console

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	1.42
Crashworthiness:	4.88
Visibility:	7.00
Slalom handling:	6.25
Ride quality:	6.54
Fuel economy:	5.33
Interior noise:	3.03
Acceleration:	3.73
Ease of entry and exit:	6.21
Interior size:	2.67
Turning circle:	7.77
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2440**
Exterior length (in):	**171.7**
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**

COMPACT

Subcompact cars can be fun to scoot around town in, but let's face it, they lack a certain, well...gravitas. For longer drives, a little more elbow room, and a greater number and variety of creature comforts or advanced safety features, you might want to consider a compact car.

You'll pay a little more for a compact car, of course, but the added benefits will generally be commensurate with the added expense. You'll get more headroom, legroom, and cargo space, for example. Fuel economy can be on a par with subcompacts—depending on the vehicle, of course. Plus, because it's larger and more substantial, a compact car will likely be a quieter and more enjoyable vehicle to drive, especially on longer trips.

We review 21 compact cars in this year's *AAA Green Car Guide*: perennial best-sellers like the Honda Civic; drivers' cars like the Mazda Mazda3; EVs like the Nissan Leaf; mileage champs like the Toyota Prius; and entry-level luxury cars like the Audi A3 Sportback e-tron plug-in hybrid—in other words, something for just about everyone.

BASE PRICE: **$28,995;** PRICE AS TESTED: **$31,490**

VOLKSWAGEN

e-Golf SE

The Volkswagen e-Golf is proof that affordable battery-electric efficiency and sporty driving don't have to be mutually exclusive. The e-Golf's powertrain—a 115-hp electric motor and 24.2-kWh battery pack—is very smooth, providing strong, linear acceleration, with no power surges. There's also no harsh feel of the regenerative braking, which also contributes to the smooth acceleration. Steering is quick and responsive, with a comfortable ratio for everyday driving. Handling is sharp and lively, with little body roll. Ride quality is firm and controlled, but not uncomfortable, although jolts from potholes and uneven pavement are transmitted through the chassis. The interior is a bit plain, but materials quality is good, and all controls and switches are easy to operate. (The radio text, however, is small and difficult to read.) The front seats are comfortable and supportive, with an unusual combination of manual and power controls. The rear seating area feels narrow but has adequate legroom and headroom. Cargo capacity is limited, and there's not much interior storage. For 2017, the e-Golf receives a fundamental redesign (see Chapter 4, "What's On the Horizon," page 47).

NHTSA SAFETY RATING: N/R

ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning
- Automatic emergency braking

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

85.66

OVERALL RANKING 4

STRONG POINTS

- Quick, responsive steering
- Sharp handling
- No regenerative effect; smooth acceleration and braking

WEAK POINTS

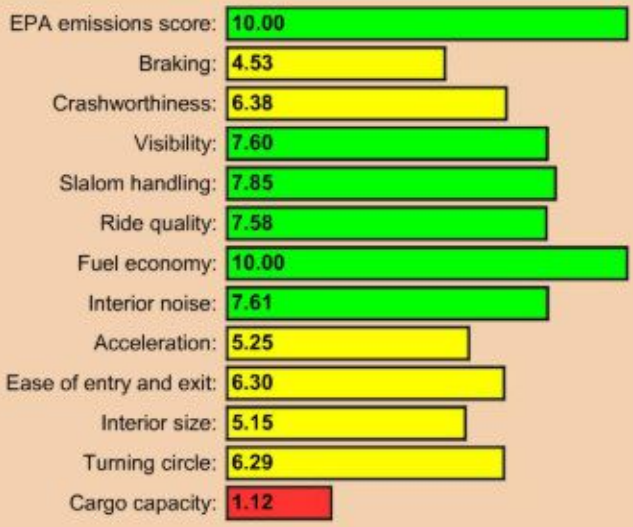
- Firm, sometimes bumpy ride quality
- Soft brake pedal, longish stopping distances
- Plain interior
- Radio text is small and hard to read

FUEL INFORMATION

Fuel Type:	**Electricity**
Battery Capacity (kWh):	**24.2**
EPA Urban MPGe:	**126**
EPA Highway MPGe:	**105**
EPA Combined MPGe:	**116**
EPA Estimated Range (mi.):	**83**

BATTERY CHARGE TIME

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3380**
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:	**Bridgestone 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 (85 kW)**

Audi **A3 Sportback e-tron Premium**

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

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

81.53

OVERALL RANKING **7**

FUEL INFORMATION

Fuel Type:	**Electricity/Premium**
Fuel Capacity (gal):	**10.6**
EPA Urban mpg:	**33**
EPA Highway mpg:	**37**
EPA Combined mpg:	**35**
EPA Combined MPGe:	**83**

BATTERY CHARGE TIME

8 HRS 120V

2.5 HRS 240V

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

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

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

OVERALL OBSERVATIONS

In 2016, Audi entered the world of plug-in hybrids with its A3 e-tron hatchback, which features a turbocharged, 1.4-liter 4-cylinder engine and an electric motor (204 hp total) plus 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 on the e-tron. The EPA estimates that the A3 e-tron will get 35 mpg and 83 MPGe in combined driving. For 2017, forward-collision avoidance is standard.

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 SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	4.28
Crashworthiness:	7.36
Visibility:	7.20
Slalom handling:	9.18
Ride quality:	7.58
Fuel economy:	8.00
Interior noise:	5.79
Acceleration:	7.39
Ease of entry and exit:	5.58
Interior size:	3.92
Turning circle:	6.50
Cargo capacity:	0.75

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)**

Volkswagen **Golf GTI Autobahn Performance**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

80.61

OVERALL RANKING 9

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.2**
EPA Urban mpg:	**25**
EPA Highway mpg:	**33**
EPA Combined mpg:	**28**

AVERAGE MPG AS TESTED BY AUTO CLUB

00023

BASE PRICE: **$32,730;** PRICE AS TESTED: **$36,840**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

Introduced in the U.S. in 1983, the VW Golf GTI was one of the original hot hatchbacks. Our 2016 Autobahn Performance model combined high performance with PZEV emissions. The Golf GTI may be a sporty hatchback, but it's at the expense of driver comfort. The front seats are heavily bolstered to keep the driver in place, but the seats are hard, and the side bolsters fit snugly. Quality interior materials and good fit and finish are evident, but so too is an austere, no-frills atmosphere. The GTI has go-cart-like handling, with quick turn-in and little body roll, along with powerful brakes and excellent steering. But the brake pedal is somewhat touchy in stop-and-go driving, at times applying more bite than necessary. The 2.0-liter turbo 4-cylinder engine (220 hp) is powerful, and the 6-speed automatic transmission shifts quickly—although it seems to always seek the highest gear. The engine is relatively quiet when cruising, but during acceleration it's noisy, with a raspy quality that's neither pleasant nor sporty. For 2017, the two-door GTI has been discontinued, the GTI receives more standard features, and a new Sport trim level has been added.

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

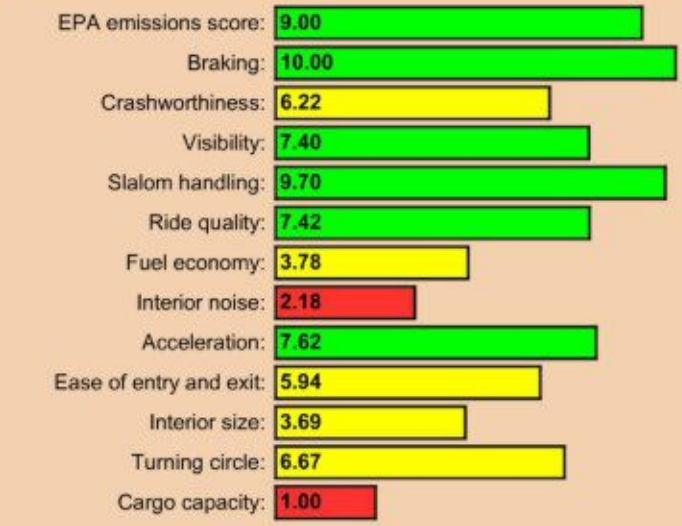
STRONG POINTS

- Quick, go-cart-like handling
- Powerful brakes
- Smooth and quick-shifting 6-speed automatic transmission
- Accurate, quick steering with excellent feel

WEAK POINTS

- Tight-fitting front sport seats
- Noisy and raspy-sounding engine/exhaust
- Touchy brakes in urban driving
- Finicky proximity key when locking and unlocking the vehicle

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3280**
Exterior length (in):	**168.0**
Exterior width (in):	**70.8**
Exterior height (in):	**56.8**
Wheelbase (in):	**103.6**
Restraint type:	**8 Air Bags**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Bridgestone 225/40R18**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L TSI DOHC 16V Turbo I4**
Horsepower @ rpm:	**220 @ 4700**

Nissan **Leaf SL**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

76.20

OVERALL RANKING 10

FUEL INFORMATION

Fuel Type:	**Electricity**
Battery Capacity (kWh):	**30.0**
EPA Urban MPGe:	**124**
EPA Highway MPGe:	**101**
EPA Combined MPGe:	**112**
EPA Estimated Range (mi.):	**107**

BATTERY CHARGE TIME

BASE PRICE: **$36,790;** PRICE AS TESTED: **$39,425**

OVERALL OBSERVATIONS

The Nissan Leaf, introduced for 2011, is equipped with a 107-hp electric motor and a 30-kWh battery, which provides an EPA estimated 107-mile range and 112 MPGe. The Leaf's body structure is solid and tight, befitting a much larger vehicle, and the ride quality is very good, with excellent bump-absorption ability. The steering is a surprise, with excellent effort and feedback. There's some understeer, but handling is even a bit sporty, with minimal body roll. Although our track testing resulted in a slow 0–60 mph time of 10.5 seconds, acceleration in normal driving 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, its EV charge, range, and power meters are simple to understand, as are the conventional radio and HVAC controls. The Leaf's rear seat is fairly cramped, with tight legroom. A few of our testers would have liked better markings on the electronic shift-by-wire gear selector, which operates like the tried-and-true Prius shifter. For 2017, the base S model also gets the 30-kWh battery. In 2018, a new Leaf will arrive, with new sheet metal, a more modern interior, better performance, and more range.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

STRONG POINTS

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

WEAK POINTS

- Short EV range
- Small backseat area
- Electronic shift-by-wire may take some getting used to

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	10.00
Braking:	2.29
Crashworthiness:	6.41
Visibility:	7.30
Slalom handling:	5.46
Ride quality:	7.13
Fuel economy:	10.00
Interior noise:	7.73
Acceleration:	4.13
Ease of entry and exit:	6.85
Interior size:	3.43
Turning circle:	3.47
Cargo capacity:	2.00

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
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:	**N/A**
Horsepower @ rpm:	**N/A**
Electric motor horsepower:	**107 @ 2730 (80 kW)**

Kia **Soul EV+**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

75.85

OVERALL RANKING 12

FUEL INFORMATION

Fuel Type:	**Electricity**
Battery Capacity (kWh):	**27.0**
EPA Urban MPGe:	**120**
EPA Highway MPGe:	**92**
EPA Combined MPGe:	**105**
EPA Estimated Range (mi.):	**93**

BATTERY CHARGE TIME

BASE PRICE: **$35,950;** PRICE AS TESTED: **$38,025**

OVERALL OBSERVATIONS

Kia's Soul EV has a 109-hp electric motor and a 27-kWh lithium-ion polymer battery located under the floor for more cabin space and a lower center of gravity. Low-end torque is good, but power drops off as speed increases. The EPA-estimated range is 93 miles, with 105 MPGe in combined city/highway driving. Our test car, the high-end + (Plus) trim, was equipped with a huge panoramic moonroof with a power visor. The spacious front seating area is comfortable, with shiny white plastic interior panels. The dashboard, however, looks and feels hard. All of the Soul EV's controls are easy to read, understand, and use. There's good front-area storage, including a decent-sized center console. The backseat is spacious and comfortable for two people, with plenty of headroom, and cargo space is generous. Some wind noise enters during highway driving, but otherwise the cabin is quiet. The steering response and feel are very good. Over smooth surfaces, the ride is composed, but potholes and pavement irregularities make themselves felt in the cabin. For 2017, the Soul EV gets a better fast-charging system and other minor changes.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

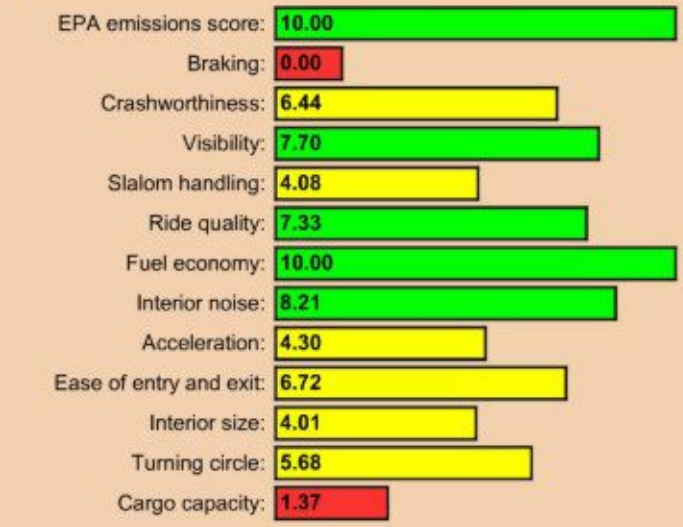
STRONG POINTS

- Very good steering response and feel
- Quiet cabin
- Regenerative braking isn't excessive

WEAK POINTS

- Estimated 93-mile range could create range anxiety
- Bumps are clearly transmitted into the cabin
- The quality of interior plastics could be better

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3420**
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:	**109 HP AC Synch. Motor**
Horsepower @ rpm:	**N/A**
Electric motor horsepower:	**109 (81 kW)**

Honda **Civic Touring**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.85

OVERALL RANKING 17

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

00032

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

OVERALL OBSERVATIONS

The Honda Civic has been one of the most popular small cars in the U.S. for decades. We tested the top-of-the-line Civic Touring, completely redesigned for 2016, which came with Bluetooth, heated front and rear seats and side mirrors, adaptive cruise control, lane-keeping assist, forward-collision warning, and lots more. That's 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 1.5-liter turbocharged engine and a CVT transmission. It drives well, with a comfortable ride befitting a larger car, but it still has nimble handling. Reliability, too, should be high. However, the center infotainment control screen is awkward to use and can be distracting, and Honda ought to provide more insulation to keep engine and road noise out of the cabin. All in all, the latest Civic is a noticeable improvement over the previous iteration, which also was a very good car, and its continued popularity seems assured. For 2017, a new Civic hatchback is available.

NHTSA SAFETY RATING: ★★★★★

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—35 mpg combined
- LED headlights provide good illumination
- Modern, aggressive styling
- Well equipped with optional safety and convenience features
- Passenger-side camera is a useful safety feature
- PZEV version is available

WEAK POINTS

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

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	6.74
Crashworthiness:	5.68
Visibility:	7.10
Slalom handling:	7.53
Ride quality:	7.58
Fuel economy:	5.33
Interior noise:	4.35
Acceleration:	6.72
Ease of entry and exit:	6.62
Interior size:	3.31
Turning circle:	5.02
Cargo capacity:	0.87

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**

Toyota **Mirai**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.84

OVERALL RANKING **18**

FUEL INFORMATION

Fuel Type:	**Hydrogen**
Fuel Capacity (kg):	**5**
EPA Urban MPGe:	**67**
EPA Highway MPGe:	**67**
EPA Combined MPGe:	**67**

AVERAGE MPG AS TESTED BY AUTO CLUB

00049

BASE PRICE: **$57,500;** PRICE AS TESTED: **$57,500**

OVERALL OBSERVATIONS

Toyota's hydrogen fuel–cell vehicle is the Mirai, which means "future" in Japanese, and the Mirai could well be the future of electric vehicles. Like other EVs, hydrogen-powered vehicles burn no fossil fuels and therefore are zero-emission vehicles (ZEVs). The Mirai's 151-hp electric motor accelerates the 4,100-pound car relatively slowly, without the low-end torque punch of most EVs and hybrids. But it does pull all the way through its power range, unlike some hydrogen fuel–cell vehicles that run out of steam at the top end. The cabin, which has a high-tech look and feel, is comfortable and quiet, but the Mirai has a soft brake pedal, with long stopping distances, and the steering provides little feel or feedback. Its range is approximately 300 miles, and refueling takes only 5 to 10 minutes. Toyota provides free hydrogen fuel for the first three years and warranties the powertrain for eight years/100,000 miles. The automaker expects to sell 3,000 Mirais in the U.S. and plans to produce 5,700 worldwide by the end of 2017.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Excellent build quality
- High-tech feel and operation
- Quick refueling
- Range of about 300 miles
- Lease rate of $349 a month for 36 months

WEAK POINTS

- Sparse fueling-station availability; most stations are currently in California
- Polarizing exterior styling
- Small trunk
- High purchase price of $57,500

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	10.00
Braking:	0.31
Crashworthiness:	8.03
Visibility:	7.90
Slalom handling:	4.98
Ride quality:	7.92
Fuel economy:	10.00
Interior noise:	7.99
Acceleration:	5.30
Ease of entry and exit:	6.12
Interior size:	3.63
Turning circle:	2.54
Cargo capacity:	0.12

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/2**
Curb weight (lbs):	**4100**
Exterior length (in):	**192.5**
Exterior width (in):	**71.5**
Exterior height (in):	**60.4**
Wheelbase (in):	**109.4**
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:	**Hydrogen Fuel Cell**
Horsepower @ rpm:	**N/A**
Electric motor horsepower:	**151 (113 kW) Max.**

Toyota **Prius Prime Advanced**

2017 IIHS TOP SAFETY PICK+

BASE PRICE: **$33,100;** PRICE AS TESTED: **$33,965**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.55

OVERALL RANKING 19

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**11.3**
EPA Urban mpg:	**55**
EPA Highway mpg:	**53**
EPA Combined mpg:	**54**
EPA Combined MPGe:	**133**

BATTERY CHARGE TIME

AVERAGE MPG (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0073

NHTSA SAFETY RATING: N/R

OVERALL OBSERVATIONS

The new second-generation Toyota Prius plug-in hybrid, known as the Prius Prime, combines all the Prius attributes—excellent hybrid fuel economy, efficient size, and modern exterior and interior styling—with plug-in electric efficiency. The anime-like exterior styling of the standard Prius has been toned down somewhat for the Prime. The inside, though, is high-tech style, with high-gloss white plastics and white synthetic leather on the door panels and dash. There's also a large (11.5-inch) high-tech center display. However, many of the buttons in the display are small, making it easy to make a mistake when operating it. The front seats are very comfortable. The rear seats, also comfortable, have two-place seating and a fixed armrest between the two seats. Steering and handling are much better compared with the previous Prius plug-in hybrid, but they're not as good as that of the standard Prius, probably because of the larger, heavier battery in the Prime. The brakes have a natural feeling, without much regenerative effect, and the transition from electric operation to the gasoline engine is smooth.

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
- Automatic emergency braking

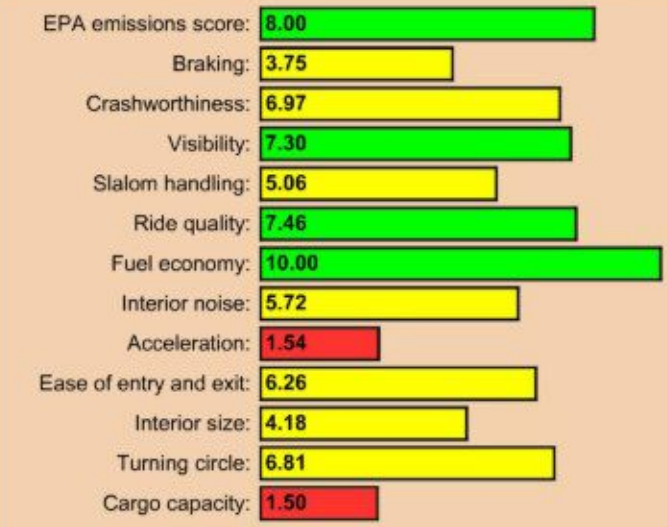
STRONG POINTS

- ⊕ Plug-in hybrid electric efficiency
- ⊕ Smooth hybrid power
- ⊕ Natural-feeling brakes
- ⊕ Apple-like high-tech interior

WEAK POINTS

- ⊖ Soft brake pedal
- ⊖ Small buttons on radio display
- ⊖ Two-persons-only rear seating

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3440**
Exterior length (in):	**182.9**
Exterior width (in):	**69.3**
Exterior height (in):	**57.9**
Wheelbase (in):	**106.3**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Toyo P195/65R15**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**1.8L I4 Hybrid**
Horsepower @ rpm:	**95 @ 5200 (121 total)**
Electric motor horsepower:	**91 (68 kW)**

Chevrolet **Volt Premier**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

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

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

73.86

OVERALL RANKING 23

FUEL INFORMATION

Fuel Type:	**Electricity/Regular**
Fuel Capacity (gal):	**8.9**
EPA Urban mpg:	**42**
EPA Highway mpg:	**43**
EPA Combined mpg:	**42**
EPA Combined MPGe:	**106**

BATTERY CHARGE TIME

13 HRS 120V

4.5 HRS 240V

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

NHTSA SAFETY RATING: ★★★★★ (2017 Model)

OVERALL OBSERVATIONS

The second-generation Chevrolet Volt plug-in hybrid, which debuted in 2016, is a big improvement over the first version. And that's saying a lot, since the original Volt was a pretty nice car. The gen-two Volt's exterior is sleeker, and the interior design is more mainstream and less futuristic. The new powertrain has a more powerful gasoline engine (101 hp), two electric motors (149 hp), and a bigger battery (18.4 kWh vs. 16 kWh). As a result, the all-electric range jumps from 38 to 53 miles, and the combined fuel-economy rating improves from 37 to 42 mpg in hybrid mode and from 98 to 106 MPGe as an EV. Also, premium gas is no longer required. The Volt's acceleration is decent—our 0–60 time at the track was 8.2 seconds—and the ride is quiet and comfortable. However, the steering is unresponsive, and the backseat is cramped and hard to get in and out of. Full recharging time is 4.5 hours on 240 volts and 13 hours on 120 volts. For 2017, adaptive cruise control and an upgraded automatic emergency braking system are available.

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
- Automatic emergency braking

STRONG POINTS

- Efficient use of energy; good mpg/MPGe
- 53 miles of electric range
- The gas engine eliminates range anxiety
- Rear windows open fully
- Certified as an AT PZEV

WEAK POINTS

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

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	0.12
Crashworthiness:	7.20
Visibility:	6.90
Slalom handling:	5.51
Ride quality:	6.96
Fuel economy:	10.00
Interior noise:	8.49
Acceleration:	6.40
Ease of entry and exit:	5.11
Interior size:	3.56
Turning circle:	4.25
Cargo capacity:	1.37

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)**

Toyota **Prius Two Eco**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

73.26

OVERALL RANKING 24

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

00050

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

OVERALL OBSERVATIONS

The fourth-generation Toyota Prius, redesigned for 2016, is similar to previous versions, with 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 our test car, the Eco version, is now an EPA-estimated 56 mpg combined. The new exterior is bold and anime-like in character. Inside, the styling features white plastics that evoke the look and feel of Apple's iPhone. The biggest surprise, however, is the car's 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 gasoline 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. For 2017, Safety Sense, a suite of safety features that includes forward-collision warning, lane-departure warning, lane-keeping assist, automatic high-beam control, and adaptive cruise control, is standard.

NHTSA SAFETY RATING: ★★★★★

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
- Automatic emergency braking

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
- 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 SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	0.76
Crashworthiness:	6.31
Visibility:	6.80
Slalom handling:	6.62
Ride quality:	7.00
Fuel economy:	10.00
Interior noise:	6.10
Acceleration:	3.67
Ease of entry and exit:	6.19
Interior size:	3.63
Turning circle:	6.81
Cargo capacity:	2.37

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)**

Mazda **Mazda3**

2017 IIHS TOP SAFETY PICK+ (with optional front crash prevention and specific headlights)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.84

OVERALL RANKING 26

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.2**
EPA Urban mpg:	**26**
EPA Highway mpg:	**35**
EPA Combined mpg:	**30**

AVERAGE MPG AS TESTED BY AUTO CLUB

00028

BASE PRICE: **$24,945;** PRICE AS TESTED: **$29,080**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

The Mazda3 five-door hatchback is a good balance of practicality, efficiency, and fun. For 2017, it receives a number of cosmetic and equipment updates, including refreshed front and rear fascias, a revamped dashboard, and a retuned suspension. The interior has clean styling, and a three-spoke steering wheel, paddle shifters, and bucket seats announce the Mazda3's sporting intentions. There's also a sport switch that increases the throttle response and quickens the 6-speed automatic transmission's shifting. The 2.5-liter 4-cylinder engine (184 hp) makes decent power but is loud during acceleration. Handling is sharp and agile, and ride quality is good for a small car. Inside, the front seats are comfortable and supportive but may be a tight fit for larger drivers. The radio and navigation display are needlessly difficult to use; even adjusting radio station settings takes multiple steps. The rear seat legroom is fine, as is the headroom, but shoulder room is a bit tight. Many advanced driver-assist safety features are available, including blind-spot monitoring, lane-departure warning, lane-keeping assist, forward-collision warning, and automatic emergency braking.

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
- Automatic emergency braking

STRONG POINTS

- Agile handling
- Sport driving-mode switch livens things up
- Available advanced driver-assist safety features

WEAK POINTS

- Engine feels and sounds coarse
- Heavy steering, especially at parking speeds
- Clumsy controller for navigation, audio, and vehicle settings

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	4.93
Crashworthiness:	5.90
Visibility:	7.40
Slalom handling:	7.54
Ride quality:	7.54
Fuel economy:	4.22
Interior noise:	4.12
Acceleration:	6.27
Ease of entry and exit:	6.33
Interior size:	4.20
Turning circle:	4.65
Cargo capacity:	1.75

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3080**
Exterior length (in):	**175.6**
Exterior width (in):	**70.7**
Exterior height (in):	**57.3**
Wheelbase (in):	**106.3**
Restraint type:	**8 Air Bags**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Dunlop 215/45R18**
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**

Chevrolet **Cruze Hatchback Premier 1SF**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.53

OVERALL RANKING 29

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.7**
EPA Urban mpg:	**28**
EPA Highway mpg:	**37**
EPA Combined mpg:	**31**

AVERAGE MPG AS TESTED BY AUTO CLUB

00027

BASE PRICE: **$23,945;** PRICE AS TESTED: **$26,870**

OVERALL OBSERVATIONS

The Cruze hatchback, brand new for 2017, is practical and a lot of fun to drive. The exterior styling is modern, sleek, and functional, while inside the design is clean but a bit plain. The front seats are comfortable, covered in high-quality vinyl with contrasting stitching. Interior storage is decent, too, and the controls are easy to use. In the rear seats, the headroom is okay if you're not too tall, and there's plenty of legroom. The cargo area isn't very big, but it's fine for this small car. The interior has some hard plastics on the top of the dashboard and on the doors, which cheapen the Cruze's looks. The steering wheel is also made of a hard plastic, and the leading edge is somewhat sharp and uncomfortable to hold. But the steering itself is responsive, with good feel. The same is true for the Cruze's handling, which is very good for its class. The powertrain—a 1.4-liter turbo 4 that puts out 153 hp and is mated to a 6-speed automatic transmission—has good drivability, but is weak at the low end of the power band and loud during acceleration.

NHTSA SAFETY RATING: ★★★★☆

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- ⊕ Great steering, with good feel
- ⊕ Responsive handling
- ⊕ Nonintrusive engine stop/start system
- ⊕ Many advanced safety features

WEAK POINTS

- ⊖ Hard steering wheel material with a sharp surface
- ⊖ Bluetooth disconnects randomly
- ⊖ Hard interior plastics on the doors and dashboard
- ⊖ Slightly underpowered

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	6.87
Crashworthiness:	6.50
Visibility:	7.10
Slalom handling:	8.11
Ride quality:	7.38
Fuel economy:	4.44
Interior noise:	5.29
Acceleration:	5.85
Ease of entry and exit:	6.32
Interior size:	4.14
Turning circle:	4.23
Cargo capacity:	0.25

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3140**
Exterior length (in):	**175.3**
Exterior width (in):	**70.5**
Exterior height (in):	**57.7**
Wheelbase (in):	**106.3**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Firestone 225/45R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**1.4L VVT DOHC 16V I4 Turbo**
Horsepower @ rpm:	**153 @ 5600**

Hyundai **Elantra Limited**

2017 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

71.86

OVERALL RANKING 32

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**14.0**
EPA Urban mpg:	**28**
EPA Highway mpg:	**37**
EPA Combined mpg:	**32**

AVERAGE MPG AS TESTED BY AUTO CLUB

00028

BASE PRICE: **$22,350;** PRICE AS TESTED: **$27,710**

OVERALL OBSERVATIONS

The 2017 Hyundai Elantra Limited goes head-to-head with the Toyota Corolla and the Honda Civic in the compact sedan class, differentiating itself with advanced-technology features and delivering ULEV emissions from its 2.0-liter 4-cylinder engine, which produces 147 hp and is mated to a 6-speed automatic transmission. The cabin is nicely styled, but Hyundai uses hard plastics in the interior, including the dashboard. The standout features of the Elantra are its body structure and vehicle dynamics. The body is very solid and stiff, due in part to an increase in the use of structural adhesives in assembly. The Elantra has excellent, communicative steering for its class, along with good ride quality. The brake pedal is a bit soft, though. Available advanced-technology safety features include blind-spot monitoring, forward-collision warning, lane-departure warning, lane-keeping assist, and automatic emergency braking with pedestrian detection.

NHTSA SAFETY RATING: ★★★★☆

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
- Automatic emergency braking

STRONG POINTS

- Solid body structure
- Great steering feel
- Good ride quality
- Nice interior styling and build quality
- Available advanced driver—safety technologies

WEAK POINTS

- Soft brake pedal
- Long reach to the radio/navigation display
- Use of hard interior plastics, including on the dash

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	5.88
Crashworthiness:	5.25
Visibility:	7.50
Slalom handling:	7.08
Ride quality:	7.54
Fuel economy:	4.67
Interior noise:	5.87
Acceleration:	4.62
Ease of entry and exit:	6.35
Interior size:	3.63
Turning circle:	4.77
Cargo capacity:	0.75

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2360**
Exterior length (in):	**179.9**
Exterior width (in):	**70.9**
Exterior height (in):	**56.5**
Wheelbase (in):	**106.3**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**60/60,000**
Tire manufacturer and size:	**Nexen 225/45R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L DOHC 16V CVVT I4**
Horsepower @ rpm:	**147 @ 6200**

Toyota **Prius v Five**

2017 IIHS TOP SAFETY PICK+

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

70.00

OVERALL RANKING **38**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**11.9**
EPA Urban mpg:	**43**
EPA Highway mpg:	**39**
EPA Combined mpg:	**41**

AVERAGE MPG AS TESTED BY AUTO CLUB

00038

BASE PRICE: **$30,935;** PRICE AS TESTED: **$35,105**

OVERALL OBSERVATIONS

The Prius v is based on the Prius hatchback, which was fully redesigned for 2016, but the Prius v has had only minor changes since its 2012 introduction. It's the largest vehicle in the Prius lineup, with passenger and cargo space comparable to some SUVs. The Prius v's exterior is sleek and aerodynamic; the interior is modern and attractive, with digital and video displays on the dash, and plenty of interior storage. The stitching on the faux-leather seats and the grained plastics on the door and instrument panels give the cabin an upscale feel. The driving position is comfortable, but the steering column has a limited range. All-round visibility is excellent because of the thin roof pillars and small port windows. The rear seats, which recline and slide fore and aft, are very comfortable. On the downside, acceleration from the 1.8-liter gas engine and two electric motors (134 hp total) is underwhelming, and when revved, the engine is loud and the CVT drones. Handling is lackluster, and the steering lacks any feel. EPA-estimated fuel economy, however, is excellent: 41 mpg in combined driving.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Lane-departure warning
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- Modern, spacious interior
- Large cargo area
- Plenty of interior storage spaces
- Spacious rear seat that slides
- Excellent visibility

WEAK POINTS

- Slow acceleration
- Noisy powertrain
- Lots of wind and road noise

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	4.66
Crashworthiness:	6.94
Visibility:	7.40
Slalom handling:	5.12
Ride quality:	6.92
Fuel economy:	6.67
Interior noise:	5.09
Acceleration:	2.60
Ease of entry and exit:	6.80
Interior size:	5.38
Turning circle:	1.17
Cargo capacity:	3.25

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3420**
Exterior length (in):	**182.3**
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:	**Toyo P215/50R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**1.8L DOHC 16V I4 Hybrid**
Horsepower @ rpm:	**98 @ 5200 (134 total)**
Electric motor horsepower:	**80 hp (60 kW)**

Chevrolet **Cruze Premier**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

69.99

OVERALL RANKING **40**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.7**
EPA Urban mpg:	**30**
EPA Highway mpg:	**40**
EPA Combined mpg:	**34**

AVERAGE MPG AS TESTED BY AUTO CLUB

00027

BASE PRICE: **$23,120;** PRICE AS TESTED: **$28,640**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

The Cruze, Chevrolet's popular compact sedan, came on the market in 2011 and was completely redesigned for 2016. We reviewed the top-of-the-line Premier trim level, which has bold interior styling, with stitched surfaces and chrome trim throughout. One of today's better compacts, the Cruze balances a comfortable ride with responsive handling. It also has strong brakes with a firm pedal feel. Acceleration from the Cruze's turbocharged 1.4-liter inline 4 engine (153 hp) is just average for its class, but fuel economy is good for a nonhybrid: an EPA-estimated 34 mpg combined and 40 mpg highway. A 6-speed automatic transmission is standard on the Premier trim level, as is auto engine stop-start. In addition, the Cruze's trunk is large for a compact car. A couple of areas could use some improvement, however: Front visibility is good, but the rear window is small; the Cruze's steering wheel and headrests feel hard and uncomfortable; and the cabin has few storage areas. On the road, the Cruze's light steering doesn't give much feedback, and the car exhibits mild torque steer. Changes for 2017 are minimal, with the exception of a new hatchback body style (reviewed separately).

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Good ride/handling balance
- Bold interior styling
- Strong brakes, with a firm pedal feel
- Large trunk
- EPA-estimated 40 mpg highway

WEAK POINTS

- Light, disconnected steering feel; mild torque steer
- Hard steering wheel and headrest surfaces
- Small center console; little interior storage
- Small rear window
- Body-kit styling with a front air dam that scrapes dips in the road

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	5.39
Crashworthiness:	6.34
Visibility:	7.00
Slalom handling:	7.64
Ride quality:	7.25
Fuel economy:	5.11
Interior noise:	5.77
Acceleration:	5.07
Ease of entry and exit:	6.19
Interior size:	3.57
Turning circle:	4.41
Cargo capacity:	0.25

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3040**
Exterior length (in):	**183.7**
Exterior width (in):	**70.6**
Exterior height (in):	**57.4**
Wheelbase (in):	**106.3**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Michelin P225/40R18**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**1.4L DOHC 16V VVT Turbo I4**
Horsepower @ rpm:	**153 @ 6300**

Kia **Forte S**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

69.86

OVERALL RANKING 42

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.2**
EPA Urban mpg:	**29**
EPA Highway mpg:	**38**
EPA Combined mpg:	**32**

AVERAGE MPG AS TESTED BY AUTO CLUB

0 0 0 2 7

BASE PRICE: **$19,200;** PRICE AS TESTED: **$21,540**

OVERALL OBSERVATIONS

Kia's compact Forte sedan has been mildly refreshed for 2017. Our test car was the new S trim level, which has a new 2.0-liter 4-cylinder engine that produces 147 hp, a 6-speed automatic transmission, a sport-tuned suspension, a rear spoiler, and a leather-wrapped steering wheel. The exterior is attractive and resembles Kia's midsize Optima; the interior is cleanly styled but a bit bland. The front seats are comfortable, although larger drivers might find them a bit tight. The backseat easily accommodates two passengers but is cramped for three. There's plenty of interior storage space, but Kia omitted a center armrest and cup holders for rear-seat passengers. The trunk is large for a compact car, although it's difficult to fold the rear seatbacks down to increase its capacity. The Forte's steering is responsive, and the ride is soft and comfortable. But it's not well controlled, so there's a lot of body movement—that's surprising, given the car's sport-tuned suspension. The automatic transmission is geared high—better suited for cruising than strong acceleration—and it feels like a CVT. The EPA-estimated combined fuel economy: 32 mpg.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- ⊕ Good steering feel and response
- ⊕ Plenty of interior storage and trunk space
- ⊕ Good EPA-estimated fuel economy
- ⊕ Long warranty

WEAK POINTS

- ⊖ Underpowered engine
- ⊖ Longish stopping distances, with a soft brake-pedal feel
- ⊖ 6-speed automatic transmission behaves like CVT; gearing is too high
- ⊖ Cushy ride quality isn't well controlled

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	1.98
Crashworthiness:	5.61
Visibility:	7.40
Slalom handling:	6.49
Ride quality:	7.46
Fuel economy:	4.67
Interior noise:	6.61
Acceleration:	4.51
Ease of entry and exit:	6.68
Interior size:	4.61
Turning circle:	4.98
Cargo capacity:	0.87

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2900**
Exterior length (in):	**179.5**
Exterior width (in):	**70.1**
Exterior height (in):	**56.3**
Wheelbase (in):	**106.3**
Restraint type:	**8 Air Bags**
Warranty (months/miles):	**60/60,000**
Tire manufacturer and size:	**Nexen 205/55R16**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L DOHC 16V MPI I4**
Horsepower @ rpm:	**147 @ 6200**

Lexus **CT 200h F Sport**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

67.72

OVERALL RANKING **48**

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

00033

BASE PRICE: **$31,250;** PRICE AS TESTED: **$41,965**

OVERALL OBSERVATIONS

Lexus's entry-level car, the CT 200h, is actually a sporty version of the previous-generation Toyota Prius; they share the same underbody platform and powertrain. The F Sport package on our test car included special 17-inch alloy wheels, a sport-tuned suspension, a rearview camera, a larger rear spoiler, alloy pedals, and other styling tweaks that give the car a racy look. The interior is clean and functional, and the front seating area is cozy, with snug bucket seats; the rear seats, too, are tight. The hybrid powertrain—a 1.8-liter 4-cylinder engine, two electric motors, a battery pack, and a CVT—is underpowered (134 hp total) and noisy, but it gives the CT excellent fuel economy, an EPA-rated 42 mpg in combined city/highway driving. The ride quality is unusually busy, with a lot of body movement, handling limits are modest, and the CVT drones under hard acceleration. The CT 200h's greatest competition might be the current version of the car on which it's based—the Toyota Prius, which has better steering, handling, ride quality, and fuel economy than the CT 200h.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Forward-collision warning

STRONG POINTS

- Eco, Normal, and Sport drive-mode selector
- Hatchback utility in a Lexus
- Sporty bucket seats and metal-finish pedals
- Great fuel economy

WEAK POINTS

- Underpowered, noisy powertrain
- Artificially heavy steering
- Busy ride quality
- Tight rear seat

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	3.07
Crashworthiness:	6.75
Visibility:	7.50
Slalom handling:	7.68
Ride quality:	7.54
Fuel economy:	6.89
Interior noise:	5.22
Acceleration:	2.45
Ease of entry and exit:	5.43
Interior size:	1.48
Turning circle:	5.96
Cargo capacity:	0.75

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3300**
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 VVT-i I4**
Horsepower @ rpm:	**134 @ 5200 total**
Electric motor horsepower:	**80 hp (60 kW)**

Fiat **500X Trekking**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

65.59

OVERALL RANKING **53**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.2**
EPA Urban mpg:	**21**
EPA Highway mpg:	**30**
EPA Combined mpg:	**24**

AVERAGE MPG AS TESTED BY AUTO CLUB

00020

BASE PRICE: **$25,235;** PRICE AS TESTED: **$27,930**

OVERALL OBSERVATIONS

The Fiat 500X, which looks like a tall, jacked-up Fiat 500, combines small crossover utility and available AWD with Italian style. Inside, you'll find a cockpit-like cabin with sporty, cloth-covered bucket seats and contrast piping. The high seating position gives drivers a commanding view of the road, and the modern, stylish controls are easy to use, but the radio/navigation screen is small. Ingress into the backseat is a bit tight; seating is comfortable nonetheless, although headroom is just adequate. The cargo area is decent sized, with additional underfloor storage space. The 500X's 2.4-liter, 180-hp engine isn't very smooth, is loud during acceleration, and power is just adequate. However, the steering is responsive and the handling is lively, making the 500X fun to drive, although some torque steer is present. The ride quality is comfortable but firm; it can get bouncy on rough pavement. Thin roof pillars, a blind-spot monitor, rear parking sonar, and a rearview camera aid visibility.

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-keeping assist
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- Sporty feel and handling
- Good outward visibility
- High seating position aids visibility
- AWD traction available

WEAK POINTS

- Loud powertrain
- Some torque steer
- Transmission tends to hunt for the right gear

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	4.98
Crashworthiness:	6.78
Visibility:	7.30
Slalom handling:	4.56
Ride quality:	7.00
Fuel economy:	2.89
Interior noise:	5.58
Acceleration:	4.49
Ease of entry and exit:	6.28
Interior size:	4.21
Turning circle:	4.20
Cargo capacity:	1.31

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3320**
Exterior length (in):	**168.2**
Exterior width (in):	**70.7**
Exterior height (in):	**63.1**
Wheelbase (in):	**101.2**
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 9 speed**
Drivetrain type:	**All Wheel - Full Time**
Engine size:	**2.4L I4 MultiAir**
Horsepower @ rpm:	**180 @ 6400**

Toyota **Corolla S Special Edition**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

60.85

OVERALL RANKING **61**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.2**
EPA Urban mpg:	**29**
EPA Highway mpg:	**37**
EPA Combined mpg:	**32**

AVERAGE MPG AS TESTED BY AUTO CLUB

00025

BASE PRICE: **$20,635;** PRICE AS TESTED: **$23,520**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

Our test vehicle was the sporty Corolla S Special Edition, powered by a 1.8-liter 4-cylinder engine paired with a CVT. The interior is equipped with black seats with red trim, plus a sporty, small-diameter steering wheel with paddle shifters. Although it's an economical car, the Special Edition has plenty of premium features, including standard LED headlamps, automatic climate control, and a stylish interior. The cabin is comfortable and very quiet, with plenty of interior storage. However, the Corolla Special Edition lacks sporting performance, with slow acceleration from its slightly noisy 132-hp engine and modest handling capabilities at the limit. Nevertheless, the steering feels responsive, with an easy effort. And the Corolla handles decently in everyday driving, providing a comfortable, controlled ride. Finally, the Corolla delivers an EPA-estimated fuel-economy rating of 29 city/37 highway/32 combined. For 2017, the Corolla gets a restyled front end, upgraded upholstery, a standard rearview camera (all trim lines), and new available advanced safety features.

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

STRONG POINTS

- Stylish interior with good materials for its class
- Quiet cabin with plenty of interior storage
- Great fuel economy
- Standard LED headlamps and automatic climate control
- Plenty of rear-seat legroom

WEAK POINTS

- Modest power and slow acceleration
- Slightly noisy powertrain
- Low handling limits

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	5.00
Braking:	2.41
Crashworthiness:	6.11
Visibility:	7.00
Slalom handling:	5.68
Ride quality:	6.79
Fuel economy:	4.67
Interior noise:	4.48
Acceleration:	3.54
Ease of entry and exit:	6.35
Interior size:	3.54
Turning circle:	4.65
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2900**
Exterior length (in):	**183.1**
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:	**Firestone P215/45R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**1.8L Dual VVT-i 16V I4**
Horsepower @ rpm:	**132 @ 6000**

Toyota **Corolla LE Eco**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

60.68

OVERALL RANKING **62**

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

00027

BASE PRICE: **$19,065;** PRICE AS TESTED: **$19,900**

OVERALL OBSERVATIONS

The Toyota Corolla is a perennial top-selling car in the U.S., routinely ringing up over 300,000 sales annually. Our LE Eco test vehicle had the standard Corolla attributes of good build quality and finish, along with the highest fuel economy available for a Corolla. For an economy-minded car, the LE Eco has plenty of premium features: Standard LED headlamps, automatic climate control, and a stylish interior with quality materials are all included. But surprisingly, the headlamps don't include an Auto position, and there's no interior trunk release; you have to use the key fob. Toyota, usually known for excellent ergonomics, also surprises with a raised protrusion into the left side of the driver's footwell. The rest of the cabin, though, is quite comfortable and exceptionally quiet. "Eco" is short for "economy," and the LE Eco delivers that in spades, with an EPA-estimated fuel-economy rating of 30 mpg city and 42 mpg highway. Unfortunately, the LE Eco is miserly in its performance, too, with slow acceleration from its noisy 140-hp engine and modest handling capabilities. The steering lacks feeling at lower speeds, the brake pedal is soft, and the stopping distances are long.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

STRONG POINTS

- Great fuel economy
- Stylish interior with good-quality materials
- Quiet cabin
- LED headlamps and automatic climate control

WEAK POINTS

- Modest power and slow acceleration
- Noisy powertrain
- Soft brake pedal, long stopping distances
- Variable-assist power steering feels disconnected at low speeds
- Low handling limits

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	5.00
Braking:	2.02
Crashworthiness:	6.02
Visibility:	6.90
Slalom handling:	4.95
Ride quality:	6.71
Fuel economy:	5.33
Interior noise:	3.65
Acceleration:	4.19
Ease of entry and exit:	6.28
Interior size:	4.35
Turning circle:	4.65
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2840**
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 195/65R15**
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**

Mitsubishi **Mirage G4 SE**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

59.30

OVERALL RANKING **64**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**9.2**
EPA Urban mpg:	**35**
EPA Highway mpg:	**42**
EPA Combined mpg:	**37**

AVERAGE MPG AS TESTED BY AUTO CLUB

00028

BASE PRICE: **$16,995;** PRICE AS TESTED: **$17,830**

NHTSA SAFETY RATING: N/R

OVERALL OBSERVATIONS

The all-new 2017 subcompact Mitsubishi Mirage is propelled by a 1.2-liter 3-cylinder gasoline engine (78 hp) that lacks both power and torque and is quite loud when revved. Our test car came equipped with a CVT transmission. Starting the Mirage for the first time is confusing because the ignition switch is hidden behind the left side of the steering wheel. The Mirage's cabin is sparse yet spacious. There's also good visibility to the front and sides, and a rearview camera helps in backing up. But the steering wheel doesn't have a telescoping function, and although the radio supports Apple CarPlay, it requires too many steps just to change the station presets. In city driving, the Mirage is a capable urban commuter, and to its credit it gets an EPA-estimated 37 mpg in combined driving. But on the highway, its lack of power, tendency to wander from a straight line, excessive road noise, and noisy engine make for unpleasant road trips.

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera

STRONG POINTS

- EPA-estimated 37 mpg combined
- Good front and side visibility
- Good front and rear seat room
- Low purchase price

WEAK POINTS

- The engine is loud and unrefined
- Wanders and feels unstable on the freeway
- A lot of road noise enters the cabin
- The audio system is difficult to use

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	4.94
Crashworthiness:	4.00
Visibility:	6.60
Slalom handling:	5.62
Ride quality:	5.00
Fuel economy:	5.78
Interior noise:	1.61
Acceleration:	0.16
Ease of entry and exit:	5.83
Interior size:	3.03
Turning circle:	9.11
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**2200**
Exterior length (in):	**169.5**
Exterior width (in):	**65.7**
Exterior height (in):	**59.2**
Wheelbase (in):	**100.4**
Restraint type:	**7 Air Bags**
Warranty (months/miles):	**60/60,000**
Tire manufacturer and size:	**Yokohama 175/55R15**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**1.2L MiVEC DOHC 12V I3**
Horsepower @ rpm:	**78 @ 6000**

MIDSIZE

Midsize cars are the most popular type of car—car, mind you, not vehicle. (That would be crossovers/SUVs.) But of the nearly 17.6 million vehicles sold in 2016, more than 3.2 million were midsize cars. And it's easy to see why. Consider: For around $26,000–$28,000—considerably less than the $34,000 price tag of the average new car—you can get a well-equipped midsize ride that's good-looking, fun to drive, roomy, loaded with the latest amenities and advanced safety features, and ultra-reliable. That includes best-selling, popular cars like the Chevy Malibu, Ford Fusion, Honda Accord, Mazda Mazda6, Subaru Legacy, and Toyota Camry. Add to that ride comfort that smaller cars just can't match and highway fuel economy potentially in the mid to high 30s, and what's not to like?

BASE PRICE: **$63,080;** PRICE AS TESTED: **$71,980**

LEXUS

GS 450h F Sport

Our test Lexus GS 450h F Sport is a rare bird. Very few Lexus hybrids come with the F Sport package, which includes 19-inch sporty wheels, a sport-tuned suspension, and special styling accents. Inside, the leather front seats are comfortable, though the cockpit-style seating area is snug. In general, the instruments and controls are easy to sort out and use. But the infotainment/navigation system uses Lexus's notorious remote-touch mouse controller. Some testers liked it; others didn't. Rear seating is comfy, although the bucket seats are a bit tight. The trunk is large for a midsize car and, unlike with previous GS hybrids, the battery pack doesn't intrude into it. The GS 450h's powertrain—a 3.5-liter V6, two electric motors (338 hp total), and a CVT—lacks smoothness at low speeds and during acceleration. For a sporty car, the 450h's steering is surprisingly lifeless and artificial, merely becoming heavier in Sport or Sport+ drive modes. Ride quality, however, is both comfortable and controlled, but the brake pedal is too soft. For 2017, the Lexus Safety System+, optional in 2016, is now standard.




NHTSA SAFETY RATING: N/R

ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

81.74

OVERALL RANKING 6

STRONG POINTS

- Good power from the hybrid powertrain
- Smooth, controlled ride quality
- Responsive handling
- Many available advanced safety and convenience systems
- Sporty but still fuel-efficient

WEAK POINTS

- Powertrain lacks smoothness at low speeds
- Artificial feel to the steering
- Soft brake pedal

FUEL INFORMATION

Fuel Type:	**Premium**
Fuel Capacity (gal):	**17.4**
EPA Urban mpg:	**29**
EPA Highway mpg:	**34**
EPA Combined mpg:	**31**

AVERAGE MPG AS TESTED BY AUTO CLUB

00025

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	6.88
Crashworthiness:	8.28
Visibility:	7.90
Slalom handling:	7.97
Ride quality:	8.08
Fuel economy:	2.44
Interior noise:	7.66
Acceleration:	7.99
Ease of entry and exit:	6.60
Interior size:	4.72
Turning circle:	5.59
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**4260**
Exterior length (in):	**192.1**
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:	**Bridgestone 235/40R19 F**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Rear Wheel**
Engine size:	**3.5L DOHC 24V V6**
Horsepower @ rpm:	**286 @ 6000 (338 total)**
Electric motor horsepower:	**197 (147 kW)**

Hyundai **Sonata Plug-in Hybrid Limited**

BASE PRICE: **$38,600;** PRICE AS TESTED: **$39,610**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

80.70

OVERALL RANKING **8**

FUEL INFORMATION

Fuel Type:	**Electricity/Regular**
Fuel Capacity (gal):	**14.5**
EPA Urban mpg:	**38**
EPA Highway mpg:	**41**
EPA Combined mpg:	**40**
EPA Combined MPGe:	**99**

BATTERY CHARGE TIME

AVERAGE MPG (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0041

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

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

OVERALL OBSERVATIONS

Introduced in 2016, the Sonata Plug-in Hybrid is Hyundai's midsize sedan entry in the growing plug-in hybrid market. Based on the gasoline-powered Sonata, redesigned in 2015, the Sonata Hybrid has a 2.0-liter 4-cylinder engine and an electric motor (202 hp total), a 6-speed automatic transmission, and a 9.8-kWh lithium-ion battery. The interior is spacious and comfortable, with upscale styling and materials, including, on the Limited trim, perforated leather upholstery, xenon headlights, and an upgraded Infinity sound system. The layout of the controls is very good, but there's a long reach to the navigation system, which can also be complicated to use. Ride quality is comfortable for highway cruising, but acceleration is slow in around-town driving, with little of the strong electric torque of most hybrids. The steering has an artificial feel, especially on center, and there's plenty of understeer during cornering. The brake pedal feels soft, and braking distances are long. Available advanced safety systems include forward-collision warning, lane-departure warning, and blind-spot monitoring. EPA combined fuel-economy ratings are 40 mpg and 99 MPGe.

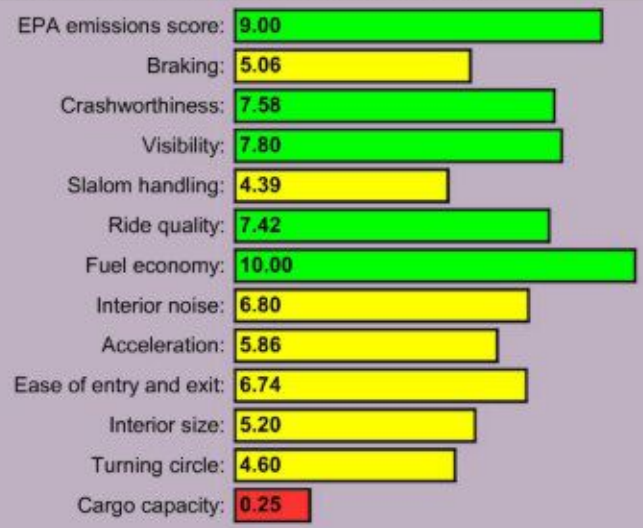
STRONG POINTS

- Comfortable ride
- Spacious passenger cabin
- Upscale interior styling and materials
- Available advanced safety systems

WEAK POINTS

- Slow acceleration
- Soft brake pedal
- Artificial steering feel
- Long reach to the radio/navigation display

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3820**
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:	**Kumho 215/55R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**Auto 6 speed**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L GDI DOHC 16V I4 Hybrid**
Horsepower @ rpm:	**154 @ 6000 (202 total)**
Electric motor horsepower:	**67 (50 kW) @ 2330-3300**

Honda **Accord Hybrid Touring**

2017 IIHS TOP SAFETY PICK+ (with optional front crash prevention and specific headlights)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

75.29

OVERALL RANKING 14

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**15.8**
EPA Urban mpg:	**49**
EPA Highway mpg:	**47**
EPA Combined mpg:	**48**

AVERAGE MPG AS TESTED BY AUTO CLUB

00039

BASE PRICE: **$35,955;** PRICE AS TESTED: **$36,790**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

The Honda Accord Hybrid Touring, all new for 2017, sits atop the Accord lineup. It's well equipped, with comfortable seats and headrests, and standard advanced safety features such as a lane-keeping assist and automatic emergency braking. The powertrain (a 2.0-liter 4-cylinder engine, two electric motors, 212 hp total) is smooth, and the ride quality is very good. The cabin is quiet for the most part, although some loud engine noise enters during hard acceleration. There are plenty of convenient storage areas in the front of the cabin. Honda's terrific LaneWatch blind-spot–monitoring camera helps you change lanes with confidence, and if you fail to signal properly, lane-keeping assist will attempt to keep you in your current lane. A few of the Accord Hybrid's qualities aren't up to par, however. For example, the steering lacks feel, and the front tires wander on rain grooves. On the dash, the upper section of the two-tiered display is difficult to configure and control, and the lower panel is finicky regarding touch inputs. The Accord Hybrid achieves an EPA-rated 49 mpg city/47 highway/48 combined.

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
- Automatic emergency braking

STRONG POINTS

- Excellent fuel economy
- Very good ride quality
- Quiet cabin
- Forward-collision warning/ braking and blind-spot monitoring

WEAK POINTS

- The steering feels disconnected
- The front tires wander on rain grooves
- The lower touch panel on the dash doesn't respond well to inputs
- The upper touch-panel display is difficult to set up and use

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	2.70
Crashworthiness:	6.63
Visibility:	7.90
Slalom handling:	7.16
Ride quality:	8.08
Fuel economy:	8.22
Interior noise:	5.89
Acceleration:	6.59
Ease of entry and exit:	6.92
Interior size:	4.06
Turning circle:	2.14
Cargo capacity:	1.00

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3540**
Exterior length (in):	**194.1**
Exterior width (in):	**72.8**
Exterior height (in):	**57.5**
Wheelbase (in):	**109.3**
Restraint type:	**8 Air Bags**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Michelin 225/50R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L DOHC 16V i-VTEC I4**
Horsepower @ rpm:	**212 @ 6200 total**
Electric motor horsepower:	**181 @ 5000-6000**

Kia **Optima Hybrid EX**

2017 IIHS TOP SAFETY PICK (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.96

OVERALL RANKING 16

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**15.9**
EPA Urban mpg:	**39**
EPA Highway mpg:	**46**
EPA Combined mpg:	**42**

AVERAGE MPG AS TESTED BY AUTO CLUB

00030

BASE PRICE: **$30,990;** PRICE AS TESTED: **$36,840**

OVERALL OBSERVATIONS

Kia's marketing slogan used to be "The Power to Surprise." Well, its Optima Hybrid EX, fully redesigned for 2017, lives up to that promise. The exterior has the handsome Optima styling we've seen in recent years, and the interior is clean and functional. The hybrid powertrain—a 2.0-liter 4-cylinder engine and electric motor, 192 hp total—is exceptionally smooth, rivaling that of luxury hybrid vehicles. The steering is excellent, with great response and feel, and handling is also very good. The cockpit-like front seating area has decent room but isn't what you'd call spacious. All the controls are easy to use, and the white LED overhead lights and power folding exterior mirrors add a luxury touch. However, the steering wheel is made of a hard plastic that's uncomfortable to hold. And the radio/navigation screen has a huge black plastic bezel on the sides. That's wasted space; the screen could easily be two or three inches wider. The bucket rear seats have good legroom, but headroom is just adequate because of the sloping roofline. The trunk is surprisingly large and deep, with no visible intrusion from the hybrid battery.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Great steering feel and response
- Smooth hybrid drivability
- Great EPA-estimated fuel economy—42 mpg combined

WEAK POINTS

- Underpowered engine
- Slightly soft brake-pedal feel
- Some hard interior plastics and a hard steering wheel

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3660**
Exterior length (in):	**191.1**
Exterior width (in):	**73.2**
Exterior height (in):	**57.5**
Wheelbase (in):	**110.4**
Restraint type:	**9 Air Bags or more**
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 I4 Hybrid**
Horsepower @ rpm:	**154 @ 6000 (192 total)**
Electric motor horsepower:	**50 @ 1630-3000**

Volkswagen **Passat 1.8T SE**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.45

OVERALL RANKING 20

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

00024

BASE PRICE: **$26,280;** PRICE AS TESTED: **$27,100**

OVERALL OBSERVATIONS

Our Volkswagen Passat test vehicle—the German automaker's roomy, sophisticated midsize sedan—was a midlevel 1.8T SE model. It's equipped with a 1.8-liter turbocharged direct-injected engine and a 6-speed automatic transmission good for 170 hp and 29 mpg in combined driving. Even though the Passat is relatively large—including a spacious trunk (for a midsize car)—it's still fun to drive, with good power and a smooth, quiet, comfortable ride under all driving conditions. A rearview camera is 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 automatic braking. For 2017, apart from some shifting of features among trim levels, the Passat carries over unchanged.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- Fun to drive
- Good braking performance
- Large trunk for its class
- Plenty of backseat legroom

WEAK POINTS

- Noisy engine, especially when cold
- Small center console
- Cruise control, seat controls, and adaptive cruise control are difficult to figure out

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	6.22
Crashworthiness:	6.32
Visibility:	6.50
Slalom handling:	6.55
Ride quality:	7.19
Fuel economy:	4.00
Interior noise:	6.80
Acceleration:	5.94
Ease of entry and exit:	6.79
Interior size:	6.16
Turning circle:	3.94
Cargo capacity:	1.00

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**

Lincoln **MKZ HEV Reserve**

2017 IIHS TOP SAFETY PICK

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

74.28

OVERALL RANKING 21

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**14.0**
EPA Urban mpg:	**41**
EPA Highway mpg:	**38**
EPA Combined mpg:	**40**

AVERAGE MPG AS TESTED BY AUTO CLUB

00033

BASE PRICE: **$39,510;** PRICE AS TESTED: **$48,520**

OVERALL OBSERVATIONS

The Lincoln MKZ might be considered a luxury version of the Ford Fusion Hybrid on which it's based. The exterior silhouette is similar to the Fusion's, but the front grille and rear fascia are unique to Lincoln. Its drivetrain consists of a 2.0-liter 4-cylinder engine and an electric motor (188 hp total), a hybrid battery pack, and a CVT. Inside, the front bucket seats are comfortable and snug, and there's ample headroom front and rear (despite the sloping roofline). There's a large touch-screen display in the center stack that controls vehicle settings, navigation, and audio; a Revel hi-fi audio system is an option. The rear seat has a decent amount of legroom. One feature that sets the MKZ apart is the push-button shifter on the dash, which is convenient and easy to use. The hybrid powertrain is smooth throughout the power band and quiet, except during acceleration. The steering is responsive, and the ride quality is smooth and controlled. Many advanced safety features are available. Interestingly, the MKZ Hybrid costs no more than a comparable nonhybrid MKZ, but it gets 40 mpg in combined city/highway driving versus the nonhybrid's 24 mpg.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Smooth hybrid powertrain
- Smooth, controlled ride quality
- Many available advanced-technology safety and convenience features
- Comfortable seats and headrests
- Easy-to-use push-button shifter

WEAK POINTS

- Lacks torque when accelerating from a stop
- Lacks usable trunk space due to hybrid-battery placement
- Heavy doors

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	3.83
Crashworthiness:	7.83
Visibility:	7.90
Slalom handling:	7.03
Ride quality:	8.58
Fuel economy:	6.44
Interior noise:	6.79
Acceleration:	5.00
Ease of entry and exit:	6.15
Interior size:	3.55
Turning circle:	2.68
Cargo capacity:	0.50

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3980**
Exterior length (in):	**193.9**
Exterior width (in):	**83.3**
Exterior height (in):	**58.1**
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:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L I4 HEV**
Horsepower @ rpm:	**188 @ 6000 total**
Electric motor horsepower:	**118 (88 kW)**

Lexus **ES 300h**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.65

OVERALL RANKING 27

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

00031

BASE PRICE: **$40,920;** PRICE AS TESTED: **$47,240**

OVERALL OBSERVATIONS

The Lexus ES 300h, the company's stylish midsize hybrid sedan, has a luxurious, spacious cabin with amenities befitting a luxury vehicle—available heated and cooled leather seating, LED lighting, and a large touch screen for radio, navigation, and settings controlled by a remote-touch mouselike interface. Some of our testers liked it; others found it frustrating. Fortunately, the radio can be controlled with two traditional knobs. The backseat has ample legroom, but headroom is only adequate because of the sloping line roof. Trunk size is acceptable, though the hybrid battery takes up potential storage space. The ES 300h's hybrid powertrain—a 2.5-liter 4-cylinder engine and single electric motor, which produces 200 hp total—is very smooth and pulls strongly throughout the power band. The steering is light, but not too light, and provides decent feel and response. The brakes, however, are a letdown, with a soft pedal feel and long stopping distances. EPA-estimated fuel economy is an impressive 40 mpg city/39 highway/40 combined. For 2017, some formerly optional safety features are now standard.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert

STRONG POINTS

- Smooth hybrid powertrain
- Smooth, compliant ride
- Light but responsive steering
- Excellent fuel economy
- Many available advanced-technology safety and convenience systems

WEAK POINTS

- Soft brake pedal, long stopping distances
- Trunk space only adequate because of the hybrid battery
- Remote-touch infotainment interface is difficult to use

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	3.88
Crashworthiness:	7.48
Visibility:	7.60
Slalom handling:	4.19
Ride quality:	8.08
Fuel economy:	6.44
Interior noise:	7.07
Acceleration:	5.89
Ease of entry and exit:	6.72
Interior size:	5.29
Turning circle:	2.49
Cargo capacity:	0.50

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3760**
Exterior length (in):	**192.7**
Exterior width (in):	**71.7**
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 I4**
Horsepower @ rpm:	**156 @ 5700 (200 total)**
Electric motor horsepower:	**67 hp (50 kW)**

Toyota **Camry Hybrid XLE**

2017 IIHS TOP SAFETY PICK+ (with optional front crash prevention and specific headlights)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.62

OVERALL RANKING 28

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**17.0**
EPA Urban mpg:	**40**
EPA Highway mpg:	**37**
EPA Combined mpg:	**38**

AVERAGE MPG AS TESTED BY AUTO CLUB

00032

BASE PRICE: **$30,140;** PRICE AS TESTED: **$34,710**

OVERALL OBSERVATIONS

The Toyota Camry Hybrid is a quiet, comfortable sedan with exceptional fuel economy. Significantly updated in 2015, the exterior is bolder than previous Camrys but still conservative. The interior of our high-end XLE model, however, was upscale, with high-tech accessories like a wireless smartphone charging pad and leather seats with contrasting stitching. The cabin is spacious and welcoming, with a lot of interior storage compartments. The controls are easy to understand and use, with large radio and navigation switches. The backseat is also large and provides comfortable seating. The rear seat doesn't fold down (typical for a hybrid), but the trunk is sizable, with little intrusion from the battery pack. The Camry Hybrid features good drivability and power, including selectable EV and Eco driving modes. The powertrain—a 2.5-liter engine and electric motor that combine for 200 hp—isn't always smooth, however, especially during acceleration, where it's also noisy. The steering lacks feedback and feels slightly heavy during parking. The brake pedal feels soft, and the stopping distances are a bit long. EPA-estimated fuel economy, however, is excellent: 38 mpg in mixed city/highway driving.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Excellent fuel economy
- Very good ride quality
- Quiet cabin
- Good interior storage; large trunk space

WEAK POINTS

- High level of engine noise during acceleration
- Little steering feel
- Steering is slightly heavy when parking
- Soft brake-pedal feel

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	4.37
Crashworthiness:	7.23
Visibility:	7.50
Slalom handling:	4.46
Ride quality:	7.79
Fuel economy:	6.00
Interior noise:	7.38
Acceleration:	6.32
Ease of entry and exit:	6.55
Interior size:	3.63
Turning circle:	2.77
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3600**
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:	**Bridgestone P215/55R17**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**2.5L DOHC 16V I4 Hybrid**
Horsepower @ rpm:	**156 @ 5700 (200 total)**
Electric motor horsepower:	**105 kW @ 4500**

Ford **Fusion Energi Titanium**

BASE PRICE: **$34,120;** PRICE AS TESTED: **$37,890**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.22

OVERALL RANKING **30**

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**14.0**
EPA Urban mpg:	**43**
EPA Highway mpg:	**41**
EPA Combined mpg:	**42**
EPA Combined MPGe:	**97**

BATTERY CHARGE TIME

AVERAGE MPG (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0042

NHTSA SAFETY RATING: N/R

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

OVERALL OBSERVATIONS

The Fusion Energi Titanium is the plug-in hybrid version of Ford's popular midsize sedan. We previously tested a 2014 model; the powertrain is unchanged since then, consisting of a 2.0-liter 4-cylinder engine and electric motor fed by a lithium-ion battery pack. Total horsepower is 188, the same as the Fusion Hybrid's. A CVT is standard, and only FWD is available. The Fusion Energi can be driven up to 22 miles on electric power alone. Apart from that, it performs very much like the Fusion Hybrid. The powertrain is smooth, and power is sufficient at cruising speeds, but low-end torque is lacking, and the engine is noisy when revved. Otherwise, the cabin is quiet. The steering has good feel and response, and ride quality is smooth and controlled. The interior is spacious and comfortable, with good headroom and legroom both front and rear. The trunk is smaller than the standard Fusion's because of the battery-pack placement. EPA-estimated fuel economy is an excellent 42 mpg and 97 MPGe. The MSRP is about $8,000 higher than the Fusion Hybrid's; that's offset somewhat by a $4,000 federal tax incentive. Many advanced safety features are available.

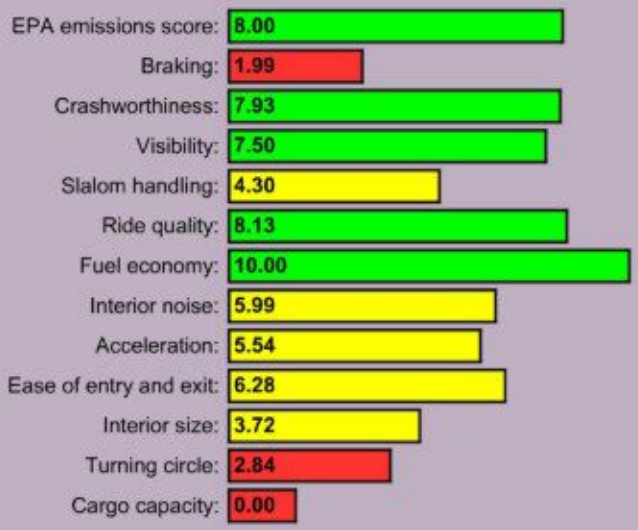
STRONG POINTS

- Smooth hybrid powertrain
- Comfortable, controlled ride
- Many available advanced-technology safety and convenience systems
- Excellent plug-in hybrid fuel economy

WEAK POINTS

- Lack of usable trunk space because of hybrid-battery placement
- Lackluster acceleration from a stop
- Soft brake pedal
- Some hard interior plastics

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)



VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**4040**
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 HEV**
Horsepower @ rpm:	**141 @ 6000 (188 total)**
Electric motor horsepower:	**118 @ 6000 (88 kW)**

Honda **Accord Sport Sensing**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

72.10

OVERALL RANKING 31

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**17.2**
EPA Urban mpg:	**26**
EPA Highway mpg:	**35**
EPA Combined mpg:	**30**

AVERAGE MPG AS TESTED BY AUTO CLUB

00024

BASE PRICE: **$25,965;** PRICE AS TESTED: **$26,785**

NHTSA SAFETY RATING: ★★★★★

OVERALL OBSERVATIONS

Fully redesigned most recently in 2013 and refreshed in 2016, the Honda Accord is perennially one of the country's best-selling cars. Over the decades, the carmaker has sold nearly 13 million of them, and for good reason: The Accord features high build quality and reliability, a smooth but taut ride, good handling, a roomy and comfortable interior, high safety ratings from NHTSA and IIHS, and a reasonable price. The standard 189-hp 2.4-liter inline-4 engine in our test car was matched with a CVT transmission. Certified as a PZEV, it has an EPA-estimated fuel economy of 26 mpg city/35/highway/30 combined. The Accord is available with lots of high-tech safety and convenience features; our test car came with adaptive cruise control, lane-keeping assist, dual-zone automatic climate control, a rearview camera, and forward-collision warning. Any nits to pick? A couple: The backseat is short on legroom and the cabin could be a bit quieter. For 2017, the Accord gains a new trim level: the Sport Special Edition.

AVAILABLE ADVANCED SAFETY FEATURES

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

STRONG POINTS

- Loaded with safety/convenience technology
- 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 the rear seat folded down, the opening to the trunk is narrow

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	4.84
Crashworthiness:	6.38
Visibility:	7.00
Slalom handling:	8.55
Ride quality:	7.46
Fuel economy:	4.22
Interior noise:	6.42
Acceleration:	5.58
Ease of entry and exit:	7.18
Interior size:	5.09
Turning circle:	0.38
Cargo capacity:	1.00

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**

Ford **C-Max Energi SEL**

BASE PRICE: **$31,770;** PRICE AS TESTED: **$37,510**

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

71.55

OVERALL RANKING **33**

FUEL INFORMATION

Fuel Type:	**Electricity/Regular**
Fuel Capacity (gal):	**14.0**
EPA Urban mpg:	**40**
EPA Highway mpg:	**36**
EPA Combined mpg:	**38**
EPA Combined MPGe:	**88**

BATTERY CHARGE TIME

7 HRS 120V

2.5 HRS 240V

AVERAGE MPG (GASOLINE AND ELECTRICITY) **AS TESTED BY AUTO CLUB** 0048

NHTSA SAFETY RATING: ★★★★½

OVERALL OBSERVATIONS

The C-Max Energi is Ford's entry in the growing plug-in hybrid segment. The C-Max Energi has good drivability and smooth (albeit slow) acceleration. The ride is fine on smooth roads, but the body undulates going over rougher pavement. The brake pedal is soft, and under hard braking the C-Max Energi's front end wanders from side to side. The cabin is spacious, with a high seating position for the front seats and plenty of headroom for both front and rear passengers. The radio is difficult to use, however, with a touch screen that has a long reach and a screen-and-button logic that's difficult to sort out even for simple tasks like adjusting the radio presets. The trunk capacity is surprisingly tiny—just 43 cubic feet—a big disappointment. A tall battery bay takes up most of the potential storage room. For 2017, the C-Max Energi gets minor styling tweaks and two new trim levels.

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert

STRONG POINTS

- ⊕ High plug-in hybrid fuel economy
- ⊕ High, SUV-like seating position
- ⊕ Spacious cabin with plenty of headroom
- ⊕ Comfortable headrests

WEAK POINTS

- ⊖ Undulating ride on bumpy roads
- ⊖ Front end wanders under hard braking
- ⊖ Difficult-to-use infotainment system
- ⊖ Tiny cargo space
- ⊖ Large turning radius

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	2.02
Crashworthiness:	7.71
Visibility:	7.50
Slalom handling:	3.88
Ride quality:	7.04
Fuel economy:	10.00
Interior noise:	6.14
Acceleration:	5.90
Ease of entry and exit:	6.97
Interior size:	5.92
Turning circle:	0.09
Cargo capacity:	1.37

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3900**
Exterior length (in):	**173.6**
Exterior width (in):	**82.1**
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 Atkinson-Cycle I4 Hybrid**
Horsepower @ rpm:	**141 @ 6000 (Total 188 hp 140**
Electric motor horsepower:	**35 kW**

Hyundai **Sonata Hybrid Limited**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

71.36

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

00033

BASE PRICE: **$30,100;** PRICE AS TESTED: **$35,550**

OVERALL OBSERVATIONS

The midsize Hyundai Sonata Hybrid, introduced in 2011, was completely redesigned for 2016. Its drivetrain, with a new 2.0-liter engine and electric motor (193 total horsepower), delivers an EPA-estimated 41 mpg overall, a nearly 10 percent improvement. Our test car, with the Limited trim and the Ultimate package, had an MSRP of just over $35,000, 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 SAFETY RATING: ★★★★★

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 rear-seat legroom
- ⊕ Front seat entry and exit is easy
- ⊕ Excellent, extensive warranty

WEAK POINTS

- ⊖ Slightly underpowered
- ⊖ Engine is noisy at low speeds
- ⊖ Grabby brakes
- ⊖ Sloppy handling in slalom course
- ⊖ Small trunk
- ⊖ No spare tire

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	5.00
Braking:	3.91
Crashworthiness:	7.36
Visibility:	7.10
Slalom handling:	4.56
Ride quality:	7.25
Fuel economy:	6.67
Interior noise:	7.71
Acceleration:	5.64
Ease of entry and exit:	6.80
Interior size:	4.38
Turning circle:	4.37
Cargo capacity:	0.62

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**

Chevrolet **Malibu Hybrid**

2016 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

71.13

OVERALL RANKING 35

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**13.0**
EPA Urban mpg:	**47**
EPA Highway mpg:	**46**
EPA Combined mpg:	**46**

AVERAGE MPG AS TESTED BY AUTO CLUB

00029

BASE PRICE: **$27,770;** PRICE AS TESTED: **$31,130**

OVERALL OBSERVATIONS

The Malibu, restyled for 2016, is Chevrolet's challenger in the midsized sedan market. Our test vehicle was the Malibu Hybrid, which achieves a spectacular EPA-rated 46 mpg in combined driving. The new fastback styling makes the Malibu attractive and competitive. Inside, though, you're greeted with a lot of hard plastic. The driver-information module in the center of the display is quite busy, providing perhaps too much information. The cloth seat covering is attractive and comfortable; apparently, Chevy liked it enough to install it on the dashboard, too. The Malibu's Hybrid power has an even quality, with no abrupt transition from electric to gasoline power. The steering is light and smooth, and the car is very maneuverable, but the steering wheel is hard and uncomfortable to hold. The ride quality is quite good, and the vehicle has modest handling capabilities. However, the brake pedal feels soft, and stopping distances are on the long side. Our test car was equipped with many advanced safety features, including blind-spot monitoring, a rearview camera, parking sonar, and lane-keeping assist.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- Modern, attractive fastback styling
- Smooth hybrid power
- Good ride quality
- Excellent EPA-estimated 46 mpg combined

WEAK POINTS

- Lots of hard interior plastics; seat-cloth material on dashboard
- Soft brake pedal; long stopping distances
- Hard steering-wheel surface
- Busy driver-information display

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	6.00
Braking:	3.16
Crashworthiness:	6.82
Visibility:	7.20
Slalom handling:	6.15
Ride quality:	7.79
Fuel economy:	7.78
Interior noise:	4.42
Acceleration:	6.35
Ease of entry and exit:	6.78
Interior size:	4.96
Turning circle:	3.10
Cargo capacity:	0.62

VEHICLE SPECIFICATIONS

Model year tested:	**2016**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3340**
Exterior length (in):	**193.8**
Exterior width (in):	**73.0**
Exterior height (in):	**57.7**
Wheelbase (in):	**111.4**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Goodyear P225/55R17**
Towing cap. (lbs) w/wo brakes:	**1000**
Transmission type:	**Auto 2-Motor**
Drivetrain type:	**Front Wheel**
Engine size:	**1.8L Hybrid SIDI DOHC I4 VVT**
Horsepower @ rpm:	**182 @ 5000 (total)**
Electric motor horsepower:	**1.5 kW**

Ford **Fusion Hybrid Titanium**

2017 IIHS TOP SAFETY PICK (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

70.82

OVERALL RANKING 36

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**14.0**
EPA Urban mpg:	**43**
EPA Highway mpg:	**41**
EPA Combined mpg:	**42**

AVERAGE MPG AS TESTED BY AUTO CLUB

00035

BASE PRICE: **$31,010;** PRICE AS TESTED: **$35,550**

OVERALL OBSERVATIONS

The Fusion Hybrid Titanium is the hybrid version of Ford's popular midsize sedan; introduced in 2010, it has changed little since its 2013 redesign. It's equipped with a 2.0-liter 4-cylinder gas engine and an electric motor that produce 188 horsepower and transmit power to the front wheels through a CVT. The Fusion's drivetrain is exceptionally smooth throughout the power band and provides a controlled, supple ride. Acceleration is weak from a stop, but power is sufficient once you get up to cruising speed, and the steering has good feel and response. The cabin is generally quiet, except when the engine is revved hard. The front bucket seats are comfortable and snug. A large touch-screen display controls the infotainment system and other vehicle settings, and there's plenty of storage space. The backseat has a decent amount of legroom, and headroom is ample all round—surprising, considering the sloping line roof. The trunk is small, compromised by the position of the battery pack. Many advanced safety features are available, including forward-collision warning, lane-keeping assist, blind-spot monitoring with rear cross-traffic alert, and adaptive cruise control. EPA- estimated fuel economy is 42 mpg combined.

NHTSA SAFETY RATING: ★★★★★

AVAILABLE ADVANCED SAFETY FEATURES

- Rearview camera
- Blind-spot monitoring
- Rear cross-traffic alert
- Lane-keeping assist
- Adaptive cruise control
- Forward-collision warning
- Automatic emergency braking

STRONG POINTS

- ⊕ Smooth hybrid powertrain
- ⊕ Smooth, controlled ride quality
- ⊕ Many available advanced safety and convenience systems
- ⊕ Excellent fuel economy

WEAK POINTS

- ⊖ Lack of usable trunk space due to hybrid-battery placement
- ⊖ Lacks low-end power when accelerating from a stop
- ⊖ Some hard interior plastics

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	8.00
Braking:	2.86
Crashworthiness:	7.55
Visibility:	7.40
Slalom handling:	5.73
Ride quality:	8.17
Fuel economy:	6.89
Interior noise:	5.23
Acceleration:	4.98
Ease of entry and exit:	6.10
Interior size:	4.32
Turning circle:	3.08
Cargo capacity:	0.50

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3800**
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 235/45R18**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**Front Wheel**
Engine size:	**2.0L I4 Atkinson-Cycle Hybrid**
Horsepower @ rpm:	**141 @ 6000 (188 total)**
Electric motor horsepower:	**88 kW**

Subaru **Legacy 2.5i Sport**

2017 IIHS TOP SAFETY PICK+ (with optional front crash prevention)

OVERALL SCORE

LOWEST 56.34 — HIGHEST 100.33

70.72

OVERALL RANKING 37

FUEL INFORMATION

Fuel Type:	**Regular**
Fuel Capacity (gal):	**18.5**
EPA Urban mpg:	**25**
EPA Highway mpg:	**34**
EPA Combined mpg:	**29**

AVERAGE MPG AS TESTED BY AUTO CLUB

00022

BASE PRICE: **$23,995;** PRICE AS TESTED: **$28,910**

OVERALL OBSERVATIONS

Subaru's Legacy 2.5i Sport, a new trim category for 2017, has interior and exterior styling cues that aim to make it a bit sportier than its competition. The Legacy Sport is equipped with a 2.5-liter flat-4 engine that produces 175 hp. Overall, the power is acceptable, and the engine growls with a sporty exhaust note, but a bit more torque would be nice. The CVT transmission is responsive and smooth, and drivers can also use paddle shifters. The steering is very responsive, with good feedback and quickness, and the ride quality is good. AWD is standard, but handling is just average, with some understeer. The brake pedal feels soft, as does the suspension, which allows a lot of body roll. In general, fit and finish is good, although large gaps between body panels were noticeable. Our Legacy Sport was equipped with a full suite of advanced safety features, including blind-spot monitoring, automatic emergency braking, forward-collision warning, lane-departure warning, lane-keeping assist, and reverse automatic braking. EPA-estimated combined city/highway fuel economy is 29 mpg.

NHTSA SAFETY RATING: ★★★★★

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
- Automatic emergency braking

STRONG POINTS

- ⊕ Sporty exhaust note
- ⊕ Quick and responsive steering, with good feel
- ⊕ Good ride quality
- ⊕ Comprehensive advanced safety-system features

WEAK POINTS

- ⊖ Soft suspension, with body roll
- ⊖ Noisy engine
- ⊖ Soft brake pedal
- ⊖ Average handling, with some understeer

TEST DATA TEST VEHICLE SCORE (0 TO 10 POINTS)

EPA emissions score:	7.00
Braking:	4.81
Crashworthiness:	6.97
Visibility:	7.60
Slalom handling:	6.62
Ride quality:	7.63
Fuel economy:	4.00
Interior noise:	6.32
Acceleration:	4.07
Ease of entry and exit:	6.66
Interior size:	5.20
Turning circle:	2.96
Cargo capacity:	0.87

VEHICLE SPECIFICATIONS

Model year tested:	**2017**
Number of passengers (F/R):	**2/3**
Curb weight (lbs):	**3440**
Exterior length (in):	**188.8**
Exterior width (in):	**72.4**
Exterior height (in):	**59.0**
Wheelbase (in):	**108.3**
Restraint type:	**9 Air Bags or more**
Warranty (months/miles):	**36/36,000**
Tire manufacturer and size:	**Goodyear 225/50R18**
Towing cap. (lbs) w/wo brakes:	**Not Recommended**
Transmission type:	**CVT**
Drivetrain type:	**All Wheel - Full Time**
Engine size:	**2.5L DOHC H4 Boxer**
Horsepower @ rpm:	**175 @ 5800**