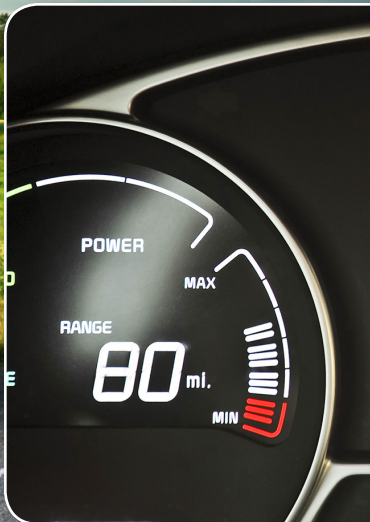


# A CONSUMER'S GUIDE TO PLUG-IN ELECTRIC VEHICLES

JANUARY 2016



# Today's Choices in Cars

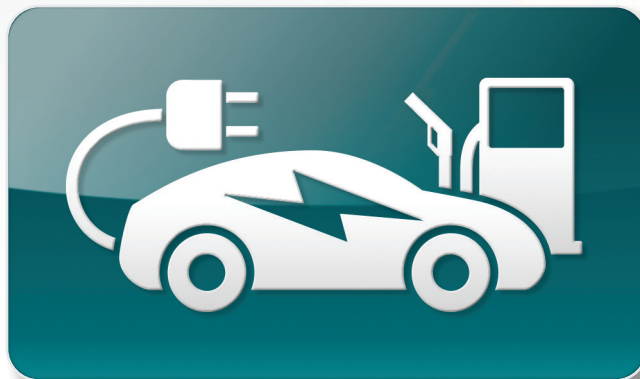
Plug-in electric vehicles are arriving in dealer showrooms across the country, bringing new car buyers a high-tech, clean vehicle option. Today, major automakers offer 24 models. Soon, American consumers will have even more choices as the industry invests in technologies to improve fuel economy, reduce emissions, and advance vehicle connectivity.

Plug-in electric cars offer performance, comfort, and safety. With plug-in cars, drivers benefit from convenient home charging using domestic electric fuel and save money over time. At the U.S. national average price of 12.5 cents per kilowatt-hour (kWh), buying electricity is roughly equivalent to buying gasoline at \$1 per gallon. Drivers can save even more with time-of-use rates offered by some utilities.

Displacing gasoline with electricity cuts petroleum use and emissions, which benefits public health. Electrifying the transportation sector can reduce greenhouse gas emissions in 2050 by 52% to 60% relative to 2015 levels.

Buyers should evaluate their own driving needs to determine how different plug-in electric vehicle technologies can work for them.

## Plug-in Electric Vehicles



Plug-in electric vehicles have batteries that recharge by plugging into the electricity grid. There are two main types. Plug-in hybrid electric vehicles (plug-in hybrids) are powered by an electric motor(s) and battery paired with an internal combustion engine. Battery electric vehicles are powered by an electric motor and battery alone; they never use gasoline.

Plug-in hybrid designs differ. Most drive on electricity alone using battery energy, and after the battery is discharged, continue driving using gasoline much like conventional hybrids. (Conventional hybrids have a smaller battery and do not plug in.) Some plug-in hybrids can travel 50 miles or more on electricity before they need to be plugged in. Others travel short distances only—around 10 miles—on electricity, and their gas tanks extend total range to between 300 and 600 miles. Some designs allow the driver to choose whether to use electricity or gasoline as they drive.

Battery electric vehicles can travel farther on electricity than plug-in hybrids, but their total range is limited by their battery size. Some current models can travel more than 200 miles between charges, however, most currently have a range of 80 to 100 miles. Future models promise more range—around 300 miles.

# Available Now Nationwide

These plug-in electric vehicles are available as of January 2016.



## 2016 BMW i3

The i3 battery electric vehicle is the first mass-produced car to use carbon fiber for the body (instead of aluminum or steel) to enhance strength and reduce weight.

**EPA electric range:** 81 miles

**Charging time:** 3.5 hours @ 240V; 20 hours @ 120V; fast-charging capable



## 2016 BMW i3 REx

A variation of the i3, the i3 REx has a small internal combustion engine to extend the car's overall driving range. EPA categorizes it as a plug-in hybrid.

**EPA electric range:** 72 miles

**EPA total range (gas + electric):** 150 miles

**Charging time:** 3.5 hours @ 240V; 20 hours @ 120V; fast-charging capable



## 2016 BMW i8

This plug-in hybrid sport coupe is the second model released under BMW's "i" lineup. A three-cylinder engine drives the back wheels and an electric motor drives the front wheels.

**EPA electric range:** 15 miles

**EPA total range (gas + electric):** 330 miles

**Charging time:** 2.5 hours @ 240V; 10 hours @ 120V



## 2016 BMW X5 xDrive40e

The X5 xDrive40e is the first plug-in hybrid production model from the core BMW brand, and the company's first plug-in hybrid sport utility vehicle.

**EPA electric range:** 14 miles

**EPA total range (gas + electric):** 540 miles

**Charging time:** 2.75 hours @ 240V; 7 hours @ 120V



## 2016 Cadillac ELR

The ELR plug-in hybrid, which General Motors calls an extended-range electric vehicle, has a redesigned electric drive system and a performance package option.

**EPA electric range:** 40 miles

**EPA total range (gas + electric):** 340 miles

**Charging time:** 5 hours @ 240V; 13 to 18 hours @ 120V



## 2016 Chevrolet Volt

The second-generation Volt improves on the first generation with a more efficient and lighter two-motor drive design for enhanced acceleration and increased range.

**EPA electric range:** 53 miles

**EPA total range (gas + electric):** 420 miles

**Charging time:** 4.5 hours @ 240V; 13 hours @ 120V



## 2016 Ford C-MAX Energi

The C-MAX Energi is the plug-in hybrid version of the C-MAX conventional hybrid compact hatchback. An EV mode button allows the driver to choose all-electric, gas power, or a combination of both.

**EPA electric range:** 20 miles

**EPA total range (gas + electric):** 550 miles

**Charging time:** 2.5 hours @ 240V; 7 hours @ 120V



## 2016 Ford Focus Electric

The Focus Electric is a battery electric version of the Focus compact hatchback. The dashboard display on the 2016 model provides enhanced feedback to help the driver improve driving efficiency.

**EPA electric range:** 76 miles

**Charging time:** 3.6 hours @ 240V; 20 hours @ 120V



Photo courtesy of Ford

## 2016 Ford Fusion Energi

The Fusion Energi is a plug-in hybrid version of the Fusion midsize sedan. An EV mode button allows the driver to choose all-electric, gas power, or a combination of both.

**EPA electric range:** 20 miles

**EPA total range (gas + electric):** 550 miles

**Charging time:** 2.5 hours @ 240V; 7 hours @ 120V



Photo courtesy of Mitsubishi

## 2016 Mitsubishi i-MiEV

The i-MiEV is a battery electric subcompact city car that was introduced in the United States in 2012. MiEV is an acronym for Mitsubishi innovative Electric Vehicle.

**EPA electric range:** 62 miles

**Charging time:** 6 hours @ 240V; 14 hours @ 120V; fast-charging capable



Photo courtesy of Nissan

## 2016 Nissan LEAF

The LEAF was the first battery electric vehicle to enter the U.S. market in late 2010. The updated LEAF comes with a 24kWh or 30kWh battery. Data listed below is for 30kWh battery.

**EPA electric range:** 107 miles

**Charging time:** 6 hours @ 240V; 26 hours @ 120V; fast-charging capable



Photo courtesy of Porsche

## 2016 Porsche Cayenne S E-Hybrid

The Cayenne S E-Hybrid is a plug-in hybrid version of the Cayenne midsize performance crossover.

**EPA electric range:** 14 miles

**EPA total range (gas + electric):** 480 miles

**Charging time:** 1.3 to 2.7 hours @ 240V; 7.9 hours @ 120V



### 2016 Porsche Panamera S E-Hybrid

The Panamera S E-Hybrid is a plug-in hybrid version of the Panamera 4-door luxury performance sedan.

**EPA electric range:** 16 miles

**EPA total range (gas + electric):** 560 miles

**Charging time:** 2 to 3 hours @ 240V; 9.1 hours @ 120V



### 2016 Tesla Model S

The Model S is a five-door battery electric vehicle luxury sedan. It comes with different battery sizes (70kWh to 90kWh) and performance options, which affect vehicle range.

**EPA electric range:** 234 to 270 miles

**Charging time:** 4.75 to 12 hours @ 240V; 58.8 to 75.6 hours @ 120V; fast-charging capable



### 2016 Tesla Model X

The Model X is a battery electric vehicle that seats up to seven people in three rows. It comes with different battery sizes (70kWh to 90kWh) and performance options, which affect vehicle range.

**EPA electric range:** 250 to 257 miles

**Charging time:** 4.75 to 12 hours @ 240V; 58.8 to 75.6 hours @ 120V; fast-charging capable



### 2016 Volvo XC90 T8 Twin Engine

The XC90 T8 Twin Engine is the plug-in hybrid version of the XC90 performance crossover, and the company's first plug-in electric vehicle on the market.

**EPA electric range:** 14 miles

**EPA total range (gas + electric):** 350 miles

**Charging time:** 2 hours @ 240V; 4 hours @ 120V

# Available Now in Select Markets

Availability of some plug-in electric vehicles varies by state and manufacturer.



## 2016 Audi A3 Sportback e-tron

Design: Plug-in hybrid hatchback  
EPA electric range: 16 miles  
EPA total range (gas + electric): 380 miles  
Charging time: 2.25 hours @ 240V; 8 hours @ 120V



## 2016 Chevrolet Spark Electric Vehicle

Design: Battery electric vehicle compact hatchback  
EPA electric range: 82 miles  
Charging time: 7 hours @ 240V; 18 hours @ 120V;  
fast-charging capable



## 2016 Fiat 500e

Design: Battery electric vehicle subcompact  
EPA electric range: 87 miles  
Charging time: 4 hours @ 240V; 24 hours @ 120V



## 2016 Hyundai Sonata Plug-in Hybrid

Design: Plug-in hybrid sedan  
EPA electric range: 27 miles  
EPA total range (gas + electric): 600 miles  
Charging time: 3 hours @ 240V; 9 hours @ 120V



## 2016 Kia Soul EV

Design: Battery electric vehicle compact SUV  
EPA electric range: 93 miles  
Charging time: 5 hours @ 240V; 24 hours @ 120V;  
fast-charging capable



### 2016 Mercedes-Benz B250e

Design: Battery electric vehicle hatchback

EPA electric range: 87 miles

Charging time: 3.5 hours @ 240V; 23.5 hours @ 120V



### 2016 Mercedes-Benz S550e

Design: Plug-in hybrid luxury sedan

EPA electric range: 14 miles

EPA total range (gas + electric): 450 miles

Charging time: 2.5 hours @ 240V; 7.3 hours @ 120V



### 2016 smart fortwo electric drive

Design: Battery electric vehicle subcompact

EPA electric range: 68 miles

Charging time: 6 hours @ 240V; 13 hours @ 120V



### 2016 Volkswagen e-Golf

Design: Battery electric vehicle hatchback

EPA electric range: 83 miles

Charging time: 4 to 7 hours @ 240V; 20 hours @ 120V;  
fast charging capable



# Vehicle Availability at a Glance

Model Name	Plug-in Type	Body Style	Range (miles) <sup>1</sup>	Availability <sup>2</sup>
<b>Available Now</b>				
BMW i3	Battery electric vehicle	Hatchback	81	Nationwide
BMW i3 REx	Plug-in hybrid	Hatchback	72/150	Nationwide
BMW i8	Plug-in hybrid	Sport coupe	15/330	Nationwide
BMW X5 xDrive40e	Plug-in hybrid	SUV	14/540	Nationwide
Cadillac ELR	Plug-in hybrid	Luxury sedan	40/340	Nationwide
Chevrolet Volt	Plug-in hybrid	Compact	53/420	Nationwide
Ford C-MAX Energi	Plug-in hybrid	Hatchback	20/550	Nationwide
Ford Focus Electric	Battery electric vehicle	Hatchback	76	Nationwide
Ford Fusion Energi	Plug-in hybrid	Sedan	20/550	Nationwide
Mitsubishi iMiEV	Battery electric vehicle	Subcompact	62	Nationwide
Nissan LEAF	Battery electric vehicle	Hatchback	107	Nationwide
Porsche Cayenne S E-Hybrid	Plug-in hybrid	Crossover	14/480	Nationwide
Porsche Panamera S E-Hybrid	Plug-in hybrid	Luxury sedan	16/560	Nationwide
Tesla Model S	Battery electric vehicle	Luxury sedan	234-270	Nationwide
Tesla Model X	Battery electric vehicle	Crossover	250-257	Nationwide
Volvo XC90 T8 Twin Engine	Plug-in hybrid	SUV	14/350	Nationwide
Audi A3 Sportback e-tron	Plug-in hybrid	Hatchback	16/380	Select Markets
Chevrolet Spark	Battery electric vehicle	Compact hatchback	82	Select Markets
Fiat 500e	Battery electric vehicle	Subcompact	87	Select Markets
Hyundai Sonata	Plug-in hybrid	Sedan	27/600	Select Markets
Kia Soul EV	Battery electric vehicle	Compact SUV	93	Select Markets
Mercedes-Benz B250e	Battery electric vehicle	Hatchback	87	Select Markets
Mercedes-Benz S550e	Plug-in hybrid	Luxury sedan	14/450	Select Markets
smart fortwo electric drive	Battery electric vehicle	Subcompact	68	Select Markets
Volkswagen e-Golf	Battery electric vehicle	Hatchback	83	Select Markets
<b>Coming Soon</b>				
Mercedes-Benz GLE550e	Plug-in hybrid	SUV	TBA	Early 2016
BMW 330e	Plug-in hybrid	Luxury sedan	22/370	Spring 2016
BMW 740e xDrive	Plug-in hybrid	Luxury sedan	23/TBA	Summer 2016
Audi Q7 e-tron	Plug-in hybrid	SUV	25/TBA	Late 2016
Cadillac CT6	Plug-in hybrid	Luxury sedan	30/TBA	Late 2016
Chevrolet Bolt	Battery electric vehicle	Hatchback	200	Late 2016
Chrysler Pacifica Hybrid	Plug-in hybrid	Minivan	30/TBA	Late 2016
Ford Focus Electric (Gen. 1+)	Battery electric vehicle	Hatchback	100	Late 2016
Kia Optima	Plug-in hybrid	Midsize sedan	TBA	Late 2016
Mitsubishi Outlander	Plug-in hybrid	Crossover	TBA	Late 2016
Toyota Prius Plug-in (Gen. 2)	Plug-in hybrid	Hatchback	TBA	Late 2016
Volvo V60	Plug-in hybrid	Wagon	TBA	Late 2016
Volvo S90 T8 Twin Engine	Plug-in hybrid	Luxury sedan	TBA	Late 2016
<b>Coming Later and Concept Cars<sup>3</sup></b>				
BMW X3 edrive	Plug-in hybrid	Crossover	20/TBA	2017
BMW i3 (Gen. 1+)	Battery electric vehicle	Hatchback	120	2017
Hyundai Ioniq	Battery electric vehicle and Plug-in hybrid	Sedan	TBA	2017
Kia Soul EV (Gen. 1+)	Battery electric vehicle	Compact SUV	TBA	2017
Tesla Model 3	Battery electric vehicle	Sedan and crossover	200	2017
VW e-Golf (Gen. 1+)	Battery electric vehicle	Hatchback	108	2017
VW CrossCoupe	Plug-in hybrid	SUV	20/TBA	2017
VW Tiguan	Plug-in Hybrid	Crossover	TBA	2017
Audi e-tron Quattro	Battery electric vehicle	SUV	300	2018
BMW i5	Plug-in hybrid	Luxury sedan	TBA	2018
Nissan LEAF (Gen. 2)	Battery electric vehicle	Hatchback	200-300	2018-2020
Porsche Pajun	Battery electric vehicle	Luxury sedan	220	2018
Subaru Crosstek XV	Plug-in hybrid	Crossover	TBA	2018
Jaguar F-Pace	Battery electric vehicle	Crossover	300	2019
VW Budd-e	Battery electric vehicle	Van	233	2019
Porsche Mission E	Battery electric vehicle	Sports car	TBA	TBA
VW Phaeton	Battery electric vehicle	Luxury sedan	TBA	TBA

<sup>1</sup> Range for battery electric vehicles is all-electric range. Range for plug-in hybrids is all-electric/combined (electric + gas) range. On vehicles available now, source is [www.fueleconomy.gov](http://www.fueleconomy.gov). On future cars, information source is manufacturer or industry media. Subject to change.

<sup>2</sup> Cars that are currently available are listed alphabetically by manufacturer. Future cars are listed chronologically by their expected market arrival date, then alphabetically by manufacturer.

<sup>3</sup> Information source on availability of future cars is manufacturer or industry media. Subject to change.

# Answers to Important Questions

## How far do plug-in electric vehicles go on a charge?

Depending on battery size and vehicle design, plug-in hybrids can typically drive from 11 to 53 miles between charges, and about 300 to 600 miles on gasoline. If the vehicle is plugged in every day as recommended, often at home or at work, it may be possible to drive 1,000 to 2,000 miles or more between gasoline fill-ups.

The advertised range of battery electric vehicles varies by model from about 60 to 270 miles, but most current models are in the 80- to 100-mile range. Each driver's experience is different. Range depends heavily on the driver's individual driving habits, weather, and environmental conditions. A new battery electric vehicle driver can expect to achieve about 80% of the advertised range.

Studies show that limited range is less problematic for most battery electric vehicle drivers than they initially expected. Most drivers find their daily driving is well within the vehicle's range. On days with more driving, they use public or workplace charging during the day or swap cars with another member of their household. Many drivers become comfortable enough with the vehicle's range to drive for a couple of days between charges.

## What environmental factors could affect vehicle performance?

During very hot or very cold weather, and in certain driving conditions, energy that would otherwise power the plug-in electric vehicle is needed for interior air-conditioning, heating, and window defrosting or defogging. Although this energy use is much less than that required to actually move the car, it may reduce driving range. To balance these extreme temperature effects, plug-in electric vehicles can be programmed to pre-condition the car interior and battery while plugged in. Automakers continue to make progress on technologies that reduce these effects. Windshield wipers, headlights, and similar accessories do not have a significant effect on range.

## What styles of plug-in electric vehicles are available, and where?

Most currently available plug-in electric vehicles are compact hatchbacks or sedans, but mid-size sedans, crossovers, and SUVs are coming soon. The plug-in electric vehicle market will evolve the way the hybrid car market developed during its first decade; conventional hybrids are now available in nearly all vehicle classes.

Some plug-in electric vehicle models are available now nationwide. Others are available only in California, Oregon, and some Northeast states. With new technologies, manufacturers face early production limitations and need to train and equip dealers and service technicians, so they typically roll out plug-in electric vehicles in select markets, then expand availability in response to market demand and readiness.

## How, when, and where will I charge?

You can charge your plug-in electric vehicle's battery any time you have access to an outlet or charging station—but you will probably find it most convenient to charge at home, overnight. Many utilities offer lower time-of-use or special plug-in electric vehicle rates to encourage charging overnight when electricity is plentiful.

You can plug into a standard 120V outlet (like most household appliances) using the cord that comes with the car, or you can install a 240V charging station for faster charging. Charging time will vary based on the car's battery size and onboard charger capacity, and the electrical circuit's capacity. Dedicated 240V charging stations provide 3kW to 7kW—about the same power draw as a residential clothes dryer or an air-conditioning system. All vehicles except Tesla are equipped with standard connectors. (Tesla has its own connector.)

Sometimes you may need to charge away from home. Many cities, states, and private companies are establishing public and workplace charging locations. Nationwide, this charging network is growing rapidly, especially in markets where plug-in electric vehicle sales are robust. Several subscription charging services offer smartphone apps that communicate with your car's charging software, or locate and guide you to the nearest charging station. Despite the charging network growth, every region is different, and some places have limited or no public infrastructure.

In addition to 120V and 240V charging, fast-charging networks are expanding across the country. A fast charger can charge a properly equipped battery electric vehicle to 80% full in 30 minutes or less. Not all vehicles, however, are fast-charging capable. Tesla has developed its own Supercharger fast-charging network exclusively to serve Tesla drivers.

## What incentives are available?

The federal government offers a tax credit of up to \$7,500 toward the purchase of a qualified plug-in electric vehicle. Many states and some counties offer vehicle purchase incentives and rebates. Other incentives are available for the purchase or installation of a charging station. In some urban areas, plug-in electric vehicles are granted access to carpool lanes with a single driver. Other perks, such as free or priority parking and free charging are available in many cities. These incentives are designed to entice consumers to consider purchasing a plug-in electric vehicle. They are subject to limitations and may change over time.

## What should I consider in making a purchase?

**Consider your driving needs and lifestyle.** If you have only one car, or often drive long distances, a plug-in hybrid could be a good choice. With their back-up internal combustion engine, plug-in hybrids provide a worry-free transition to electric-drive vehicles. If you have a second place to charge during the day, typically at work, you can effectively double the electric range of your plug-in hybrid.

If you have a predictable commute, access to a second car for long trips, or if the idea of a gasoline-free driving experience appeals to you, a battery electric vehicle could be a good choice. Battery electric vehicles have larger batteries than plug-in hybrids and can usually drive more electric miles per day. Their limited range, however, requires you to carefully consider your needs. If you have access to workplace or public charging, you may be able to charge when necessary, alleviating any range concerns.

**Consider costs and benefits.** With manufacturer lease options, utility time-of-use rates, and government purchase incentives, plug-in electric vehicles can be less expensive to operate over their lifetime despite costing more at first. For more information, read EPRI publication, "Total Cost of Ownership for Current Plug-in Electric Vehicles: Update to Model 2013 and 2014 Model Year Vehicles" (Product ID 3002004054).

**Consider environmental benefits.** Plug-in electric vehicles have lower emissions than gasoline-powered vehicles, even in areas where much of the electricity is generated by power plants that use fossil fuels such as coal or natural gas. For more information, read EPRI publication, "Environmental Assessment of Plug-In Hybrid Electric Vehicles" (Product ID 1015325). For detailed information, consider the three-volume EPRI-NRDC study, "Environmental Assessment of a Full Electric Transportation Portfolio" (Product IDs 3002006875, 3002006876, and 3002006880).

## How can I learn more?

Explore automakers' websites for product updates and check your local electric utility website for information about plug-in electric vehicles. Other sources:

Electric Drive Transportation Association

[www.electricdrive.org](http://www.electricdrive.org) and [www.goelectricdrive.com](http://www.goelectricdrive.com)

U.S. Dept. of Energy Alternative Fuels Data Center

[www.afdc.energy.gov/fuels/electricity.html](http://www.afdc.energy.gov/fuels/electricity.html)

U.S. Dept. of Energy Fuel Economy Information

<http://www.fueleconomy.gov/>

Plug In America

[www.pluginamerica.org](http://www.pluginamerica.org)



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