

CONSUMER GUIDE TO ELECTRIC VEHICLES



JUNE 2021

WHY BUY AN ELECTRIC CAR?

Electric vehicles (EVs) are fun to drive, safe, comfortable, and convenient to refuel. They also cost less to operate per mile and produce no tailpipe emissions.

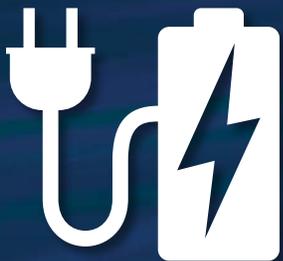
Today's electric cars do everything a gas car can do—and more. Most are high-performing vehicles with silent, instant torque, superb handling, and the latest technology and safety features. Most can travel 200–250 miles on a charge; many can go farther.

Most EV drivers prefer to charge at home for its convenience and savings. A growing national network of public charging sites enables more consumers—even those who can't plug in at home—to consider purchasing an EV.

Because EVs are powered by electricity instead of gasoline, they shift our energy reliance to domestic sources while also reducing emissions. Cutting vehicle emissions is especially critical in communities adjacent to heavily trafficked roadways. As local power generation grows cleaner, every electric car charged on that grid gets cleaner too—and the broader public health and climate benefits increase. Electrifying light-duty transport would reduce overall greenhouse gas emissions by 17% relative to 2018 levels.

EV 101

This guide highlights the two types of electric vehicles that plug into the grid to recharge their batteries. They are battery-electric (or all-electric) vehicles and plug-in hybrids.



All-electric vehicles are powered solely by an electric motor and battery. They burn no gasoline or diesel fuel, so they have no tailpipe and no emissions. Battery technology is rapidly advancing, vehicle costs are declining, and range between charges is increasing.



Plug-in hybrids pair an electric motor and battery with an internal-combustion engine. Plug-in hybrids drive on electricity until the battery is mostly empty. Then the engine turns on, and the car drives like a conventional hybrid.

Conventional hybrids, sometimes called “electrified vehicles,” refuel only with gasoline. Because they do not plug in, they are not included in this guide.



ELECTRIC VEHICLE AVAILABILITY

Electric cars are available in almost all body styles, from sedans to SUVs, hatchbacks to wagons. Each year, automakers expand their offerings. Some offer gasoline, battery-electric, and plug-in hybrid options in the same model. Many now say they aspire to electrify their entire fleet in response to global climate change.

EV range is increasing, and costs are falling thanks to better batteries and components and to rising production volumes. An EPRI analysis based on automaker announcements shows the average range of all-electric vehicles will increase from 246 miles in 2021 to 270 miles by 2024. In response, US consumers are warming up to EVs, and sales have risen over all but a couple of the last 10 years.

More than 50 EV models are available new today, and more than 130 different models are expected by 2024 (Figure 1).

Many EVs are available nationwide. Some, however, are sold only in select markets. (See FAQs, page 16.) Earlier generations of EVs are now available in the used-car market and serve as affordable EV options.

Several limited-edition or ultra-luxury models priced at \$150,000 or higher are also available. These models are listed in the tables but are not detailed in this guide.

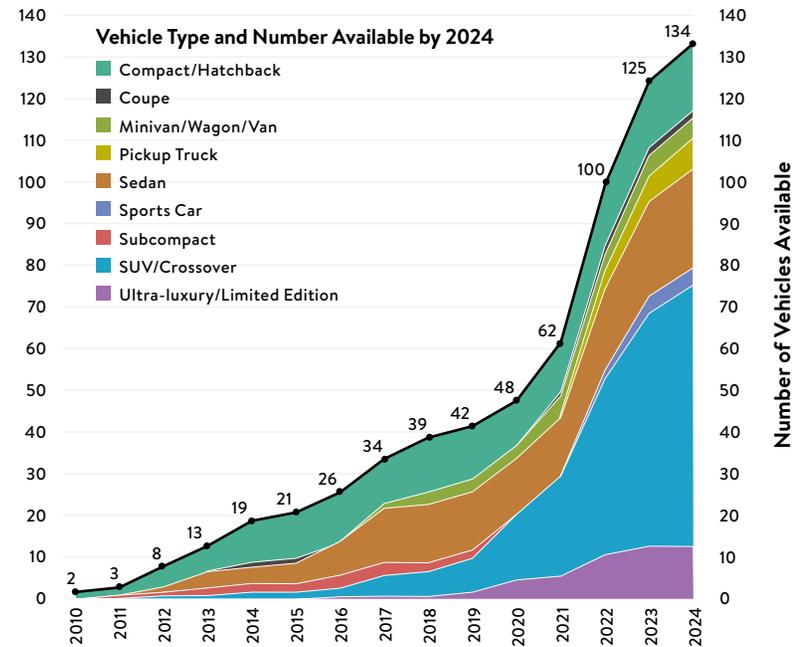


Figure 1. The number and variety of EVs continue to grow. By 2024, more than 130 models are projected to be available for US consumers.

AVAILABLE NOW

BATTERY-ELECTRIC VEHICLE

MODEL NAME	RANGE (MILES) ¹	WHERE
 SUV/CROSSOVER		
Audi e-tron	222	Nationwide
Audi e-tron Sportback	218	Nationwide
Ford Mustang Mach-E AWD	211–270	Nationwide
Jaguar I-Pace	234	Nationwide
Tesla Model X	340–360	Nationwide
Tesla Model Y	303–326	Nationwide
Volvo XC40 Recharge	208	Nationwide
 COMPACT/HATCHBACK		
BMW i3	153	Nationwide
Chevrolet Bolt EV	259	Nationwide
Chevrolet Bolt EUV	247	Nationwide
Mini Cooper SE	110	Nationwide
Nissan Leaf and Leaf Plus	149 and 226	Nationwide
Volkswagen ID.4	250	Nationwide
Hyundai Ioniq Electric	170	Select Markets
Hyundai Kona Electric	258	Select Markets
Kia Niro EV	239	Select Markets
 SEDAN		
Polestar 2	233	Nationwide
Tesla Model 3	263–353	Nationwide
Tesla Model S	390–412	Nationwide
 MINIVAN/WAGON/VAN		
Porsche Taycan 4 Cross Turismo	215	Nationwide
 SPORTS CAR		
Porsche Taycan	200–225	Nationwide
 ULTRA-LUXURY/LIMITED EDITION		
Porsche Taycan Turbo and Cross Turismo	212 and 204	Nationwide

PLUG-IN HYBRID

MODEL NAME	RANGE (MILES) ¹	WHERE
 SUV/CROSSOVER		
Audi Q5 55 TFSI e Plug-in Hybrid	19/400	Nationwide
BMW X3 xDrive30e	18/340	Nationwide
BMW X5 xDrive45e	31/400	Nationwide
Ford Escape Plug-in Hybrid	37/530	Nationwide
Jeep Wrangler 4xe	22/370	Nationwide
Land Rover Range Rover PHEV	19/480	Nationwide
Land Rover Range Rover Sport PHEV	19/480	Nationwide
Mini Cooper SE Countryman All4	18/300	Nationwide
Mitsubishi Outlander Plug-in Hybrid	24/320	Nationwide
Porsche Cayenne E-Hybrid and E-Hybrid Coupe	17/430	Nationwide
Toyota RAV4 Prime	42/600	Nationwide
Volvo XC60 T8 eAWD	19/520	Nationwide
Volvo XC90 T8 eAWD	18/520	Nationwide
Lincoln Aviator Grand Touring	21/460	Select Markets
Lincoln Corsair Grand Touring	28/430	Select Markets
Mercedes-Benz GLC 350e	22/360	Select Markets
Subaru Crosstrek Hybrid	17/480	Select Markets
 COMPACT/HATCHBACK		
BMW i3 REx	126/200	Nationwide
Toyota Prius Prime	25/640	Nationwide
Hyundai Ioniq Plug-in Hybrid	29/620	Select Markets
Kia Niro Plug-in Hybrid	26/560	Select Markets
 SEDAN		
Audi A7 Sportback 55 TFSI e Plug-in Hybrid	24/440	Nationwide
Audi A8 L 60 TFSI e Plug-in Hybrid	18/420	Nationwide
BMW 330e and 330e xDrive	23/320 and 20/290	Nationwide
BMW 530e and 530e xDrive	21/350 and 19/330	Nationwide
BMW 745e xDrive iPerformance	16/290	Nationwide
Porsche Panamera 4 E-Hybrid	19/480	Nationwide
Volvo S60 Recharge Plug-in Hybrid	22/510	Nationwide
Volvo S90 Recharge Plug-in Hybrid	21/490	Nationwide
Honda Clarity Plug-in Hybrid	48/340	Select Markets
 MINIVAN/WAGON/VAN		
Chrysler Pacifica Hybrid	32/520	Nationwide
Porsche Panamera 4 E-Hybrid Sport Turismo	19/480	Nationwide
Volvo V60 Recharge Plug-in Hybrid	22/510	Nationwide
 ULTRA-LUXURY/LIMITED EDITION		
Bentley Bentayga Hybrid	18/390	Nationwide
Ferrari SF90 Stradale Coupe	9/330	Nationwide
Karma GS-6	61/330 and 54/280	Nationwide
Polestar 1	52/470	Nationwide
Porsche Cayenne Turbo S E-Hybrid and Coupe	15/370	Nationwide
Porsche Panamera Turbo S E-Hybrid and Sport Turismo	17/430	Nationwide

¹ Range for battery-electric vehicles is all-electric range. Range for plug-in hybrids is all-electric/combined (electric + gas) range. Sources for vehicles available now: www.fueleconomy.gov and manufacturer websites.

COMING LATER IN 2021

BATTERY-ELECTRIC VEHICLE

MODEL NAME	RANGE (MILES) ¹
 SUV/CROSSOVER	
Audi Q4 e-tron	250
Audi Q4 Sportback e-tron	250
Hyundai Ioniq 5	300
Kia EV6	300
Rivian R1S	300
 COMPACT/HATCHBACK	
Genesis G60e	TBA
Mazda MX-30	100
Mini Cooper SE	114
 SEDAN	
Audi e-tron GT	248
Genesis Electrified G80	TBA
Mercedes-Benz EQS	350
Polestar 2	260
Volvo C40 Recharge	210
 PICKUP TRUCK	
Rivian R1T	300
GMC Hummer EV	300
 ULTRA-LUXURY/LIMITED EDITION	
Karma GSe-6	300

PLUG-IN HYBRID

MODEL NAME	RANGE (MILES) ¹
 SUV/CROSSOVER	
Hyundai Santa Fe Plug-in Hybrid	31/440
Hyundai Tucson Plug-in Hybrid	32/TBA
Jeep Grand Cherokee L 4xe	TBA
Lexus NX 450h+	36/TBA



AVAILABLE NATIONWIDE

- Electric cars available nationwide as of June 2021; discontinued models or older model years may still be available.
- Range sources: www.fueleconomy.gov and automaker specifications.
- Range per hour of charging assumes home or workplace charging; see FAQs, page 15.
- Fast-charging times are provided by automakers or calculated from automaker statements. These rates vary due to many factors, including battery charge level and ambient temperature.
- Starting manufacturer suggested retail prices (MSRPs) are retrieved from automaker websites and may vary.
- Models that offer different configurations and battery sizes may show multiple numbers for driving range, charging time, and starting MSRP.
- Despite industry classifications of five-door vehicles as crossovers or compact SUVs, this guide categorizes them as hatchbacks unless they are offered with all-wheel drive.



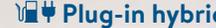
2021 Audi A7 Sportback 55 TFSI e Plug-in Hybrid

 Plug-in hybrid  Sedan

EPA electric range: 24 miles
EPA total range (gas + electric): 440 miles
Range/hour of charging: 10 miles
Starting MSRP: \$74,900



2021 Audi A8 L 60 TFSI e Plug-in Hybrid

 Plug-in hybrid  Sedan

EPA electric range: 18 miles
EPA total range (gas + electric): 420 miles
Range/hour of charging: 7 miles
Starting MSRP: \$95,900



2021 Audi e-tron

 Battery-electric  SUV/Crossover

EPA electric range: 222 miles
Range/hour of charging: 22 miles
Fast charging: 160 miles in 30 minutes
Starting MSRP: \$65,900



2021 Audi e-tron Sportback

 Battery-electric  SUV/Crossover

EPA electric range: 218 miles
Range/hour of charging: 22 miles
Fast charging: 160 miles in 30 minutes
Starting MSRP: \$69,100



Photo courtesy Audi

2021 Audi Q5 55 TFSI e Plug-in Hybrid

Plug-in hybrid SUV/Crossover

EPA electric range: 19 miles
EPA total range (gas + electric): 400 miles
Range/hour of charging: 8 miles
Starting MSRP: \$51,900



Photo courtesy BMW

2021 BMW 330e and 330e xDrive

Plug-in hybrid Sedan

EPA electric range: 23 and 20
EPA total range (gas + electric): 320 and 290
Range/hour of charging: 8 miles
Starting MSRP: \$44,550 and \$46,550



Photo courtesy BMW

2021 BMW 530e and 530e xDrive

Plug-in hybrid Sedan

EPA electric range: 21 and 19
EPA total range (gas + electric): 350 and 330
Range/hour of charging: 7 miles
Starting MSRP: \$57,200 and \$59,500



Photo courtesy BMW

2021 BMW 745e xDrive iPerformance

Plug-in hybrid Sedan

EPA electric range: 16
EPA total range (gas + electric): 290
Range/hour of charging: 4 miles
Starting MSRP: \$95,900



Photo courtesy BMW

2021 BMW i3

Battery-electric Compact/Hatchback

EPA electric range: 153 miles
Range/hour of charging: 30 miles
Fast charging: 120 miles in 40 minutes
Starting MSRP: \$44,450



Photo courtesy BMW

2021 BMW i3 REx

Plug-in hybrid Compact/Hatchback

EPA electric range: 126 miles
EPA total range (gas + electric): 200 miles
Range/hour of charging: 18 miles
Fast charging: 100 miles in 40 minutes
Starting MSRP: \$48,300

AVAILABLE NATIONWIDE



2021 BMW X3 xDrive30e

🔌 Plug-in hybrid 🚗 SUV/Crossover

EPA electric range: 18 miles
EPA total range (gas + electric): 340 miles
Range/hour of charging: 6 miles
Starting MSRP: \$49,600



2021 BMW X5 xDrive45e

🔌 Plug-in hybrid 🚗 SUV/Crossover

EPA electric range: 31 miles
EPA total range (gas + electric): 400 miles
Range/hour of charging: 6 miles
Starting MSRP: \$65,400



2022 Chevrolet Bolt EV

🔌 Battery-electric 🚗 Compact/Hatchback

EPA electric range: 259 miles
Range/hour of charging: 34 miles
Fast charging: 100 miles in 30 minutes
Starting MSRP: \$31,995



2022 Chevrolet Bolt EUV

🔌 Battery-electric 🚗 Compact/Hatchback

EPA electric range: 247 miles
Range/hour of charging: 34 miles
Fast charging: 95 miles in 30 minutes
Starting MSRP: \$33,995



2021 Chrysler Pacifica Hybrid

🔌 Plug-in hybrid 🚗 Minivan/Wagon/Van

EPA electric range: 32 miles
EPA total range (gas + electric): 520 miles
Range/hour of charging: 16 miles
Starting MSRP: \$39,995



2021 Ford Escape Plug-in Hybrid

🔌 Plug-in hybrid 🚗 Compact/Hatchback

EPA electric range: 37 miles
EPA total range (gas + electric): 530 miles
Range/hour of charging: 11 miles
Starting MSRP: \$32,650



Photo courtesy Ford

2021 Ford Mustang Mach-E AWD

Battery-electric SUV/Crossover

EPA electric range: 211–270 miles
Range/hour of charging: 25 miles
Fast charging: 168–216 miles in 45 minutes
Starting MSRP: \$42,895–\$47,000



Photo courtesy Jaguar

2021 Jaguar I-Pace

Battery-electric SUV/Crossover

EPA electric range: 234 miles
Range/hour of charging: 18 miles
Fast charging: 187 miles in 85 minutes
Starting MSRP: \$69,850



Photo courtesy Jeep

2021 Jeep Wrangler 4xe

Plug-in hybrid SUV/Crossover

EPA electric range: 22 miles
EPA total range (gas + electric): 370
Range/hour of charging: 10 miles
Starting MSRP: \$47,995



Photo courtesy Land Rover

2021 Land Rover Range Rover PHEV

Plug-in hybrid SUV/Crossover

EPA electric range: 19
EPA total range (gas + electric): 480
Range/hour of charging: 6 miles
Starting MSRP: \$97,000



Photo courtesy Land Rover

2021 Land Rover Range Rover Sport PHEV

Plug-in hybrid SUV/Crossover

EPA electric range: 19
EPA total range (gas + electric): 480
Range/hour of charging: 6 miles
Starting MSRP: \$83,000



Photo courtesy BMW

2021 Mini Cooper SE

Battery-electric Compact/Hatchback

EPA electric range: 110 miles
Range/hour of charging: 27 miles
Fast charging: 88 miles in 36 minutes
Starting MSRP: \$29,900

AVAILABLE NATIONWIDE



2021 Mini Cooper SE Countryman All4

🔌 Plug-in hybrid 🚗 SUV/Crossover

EPA electric range: 18 miles
EPA total range (gas + electric): 300 miles
Range/hour of charging: 7 miles
Starting MSRP: \$41,500



2021 Mitsubishi Outlander Plug-in Hybrid

🔌 Plug-in hybrid 🚗 SUV/Crossover

EPA electric range: 24 miles
EPA total range (gas + electric): 320 miles
Range/hour of charging: 6 miles
Fast charging: 18 miles in 25 minutes
Starting MSRP: \$36,295



2021 Nissan Leaf and Leaf Plus

🔌 Battery-electric 🚗 Compact/Hatchback

EPA electric range: 149 and 226 miles
Range/hour of charging: 19 miles
Fast charging: 120 miles in 40 minutes (Leaf)
Fast charging: 180 miles in 60 minutes (Leaf Plus)
Starting MSRP: \$31,670 and \$38,270



2021 Polestar 2

🔌 Battery-electric 🚗 Sedan

EPA electric range: 233 miles
Range/hour of charging: 29 miles
Fast charging: 186 miles in 40 minutes
Starting MSRP: \$59,900



2021 Porsche Cayenne E-Hybrid and E-Hybrid Coupe

🔌 Plug-in hybrid 🚗 SUV/Crossover

EPA electric range: 17 miles
EPA total range (gas + electric): 430 miles
Range/hour of charging: 8 miles
Starting MSRP: \$81,800 and \$87,600



2021 Porsche Panamera 4 E-Hybrid

🔌 Plug-in hybrid 🚗 Sedan

EPA electric range: 19 miles
EPA total range (gas + electric): 480 miles
Range/hour of charging: 5 miles
Starting MSRP: \$103,800



2021 Porsche Panamera 4 E-Hybrid Sport Turismo

🔌 Plug-in hybrid 🚐 Minivan/Wagon/Van

EPA electric range: 19 miles
EPA total range (gas + electric): 480 miles
Range/hour of charging: 5 miles
Starting MSRP: \$107,800



2021 Porsche Taycan

🔌 Battery-electric 🚗 Sports car

EPA electric range: 200–225 miles
Range/hour of charging: 21 miles
Fast charging: 160–180 miles in 93 minutes (at 50 kW)
Fast charging: 160–180 miles in 22 minutes (at 270 kW)
Starting MSRP: \$79,900–\$85,680



2021 Porsche Taycan 4 Cross Turismo

🔌 Battery-electric 🚐 Minivan/Wagon/Van

EPA electric range: 215 miles
Range/hour of charging: 21 miles
Fast charging: 160–180 miles in 93 minutes (at 50 kW)
Fast charging: 160–180 miles in 22 minutes (at 270 kW)
Starting MSRP: \$90,900



Tesla Model 3

🔌 Battery-electric 🚗 Sedan

EPA electric range: 263–353 miles
Range/hour of charging: 33 miles
Fast charging: Up to 175 miles in 15 minutes
Starting MSRP: \$39,990–\$48,990



Tesla Model S

🔌 Battery-electric 🚗 Sedan

EPA electric range: 390–412 miles
Range/hour of charging: 27 miles
Fast charging: Up to 200 miles in 15 minutes
Starting MSRP: \$79,990–\$119,990



Tesla Model X

🔌 Battery-electric 🚗 SUV/Crossover

EPA electric range: 340–360 miles
Range/hour of charging: 25 miles
Fast charging: Up to 175 miles in 15 minutes
Starting MSRP: \$89,990–\$119,990

AVAILABLE NATIONWIDE



Photo courtesy Tesla

Tesla Model Y

 Battery-electric  SUV/Crossover

EPA electric range: 303–326 miles
Range/hour of charging: 45 miles
Fast charging: Up to 162 miles in 15 minutes
Starting MSRP: \$51,990–\$60,990



Photo courtesy Toyota

2021 Toyota Prius Prime

 Plug-in hybrid  Compact/Hatchback

EPA electric range: 25 miles
EPA total range (gas + electric): 640 miles
Range/hour of charging: 12 miles
Starting MSRP: \$28,220



Photo courtesy Toyota

2021 Toyota RAV4 Prime

 Plug-in hybrid  SUV/Crossover

EPA electric range: 42 miles
EPA total range (gas + electric): 600 miles
Range/hour of charging: 9 miles
Starting MSRP: \$38,100



Photo courtesy Volkswagen

2021 Volkswagen ID.4

 Battery-electric  Compact/Hatchback

EPA electric range: 250
Range/hour of charging: 33 miles
Fast charging: 60 miles in 10 minutes
Starting MSRP: \$39,995



Photo courtesy Volvo

2021 Volvo S60 Recharge Plug-in Hybrid

 Plug-in hybrid  Sedan

EPA electric range: 22 miles
EPA total range (gas + electric): 510 miles
Range/hour of charging: 7 miles
Starting MSRP: \$47,650



Photo courtesy Volvo

2021 Volvo S90 Recharge Plug-in Hybrid

 Plug-in hybrid  Sedan

EPA electric range: 21 miles
EPA total range (gas + electric): 490 miles
Range/hour of charging: 7 miles
Starting MSRP: \$60,050



Photo courtesy Volvo

2021 Volvo V60 Recharge Plug-in Hybrid

Plug-in hybrid Minivan/Wagon/Van

EPA electric range: 22 miles
EPA total range (gas + electric): 510 miles
Range/hour of charging: 7 miles
Starting MSRP: \$67,300



Photo courtesy Volvo

2021 Volvo XC40 Recharge

Battery-electric SUV/Crossover

EPA electric range: 208
Range/hour of charging: 26 miles
Fast charging: 166 miles in 40 minutes
Starting MSRP: \$53,990



Photo courtesy Volvo

2021 Volvo XC60 Recharge Plug-in Hybrid

Plug-in hybrid SUV/Crossover

EPA electric range: 19 miles
EPA total range (gas + electric): 520 miles
Range/hour of charging: 6 miles
Starting MSRP: \$53,500



Photo courtesy Volvo

2021 Volvo XC90 Recharge Plug-in Hybrid

Plug-in hybrid SUV/Crossover

EPA electric range: 18 miles
EPA total range: 520 miles
Range/hour of charging: 6 miles
Starting MSRP: \$63,450



AVAILABLE IN SELECT MARKETS

- Electric cars available in select markets as of June 2021; discontinued models or older model years may still be available.
- Range sources: www.fueleconomy.gov and automaker specifications.
- Range per hour of charging assumes home or workplace charging; see FAQs, page 15.
- Fast-charging times are provided by automakers or calculated from automaker statements. These rates vary due to many factors, including battery charge level and ambient temperature.
- Starting MSRPs are retrieved from automaker websites and may vary.
- Models that offer different configurations and battery sizes may show multiple numbers for driving range, charging time, and starting MSRP.
- Despite industry classifications of five-door vehicles as crossovers or compact SUVs, this guide categorizes them as hatchbacks unless they are offered with all-wheel drive.



2021 Honda Clarity Plug-in Hybrid

 Plug-in hybrid  Sedan

EPA electric range: 48 miles
EPA total range (gas + electric): 340 miles
Range/hour of charging: 22 miles
Starting MSRP: \$33,400



2021 Hyundai Ioniq Electric

 Battery-electric  Compact/Hatchback

EPA electric range: 170 miles
Range/hour of charging: 29 miles
Fast charging: 136 miles in 54 minutes
Starting MSRP: \$33,245



2021 Hyundai Ioniq Plug-in Hybrid

 Plug-in hybrid  Compact/Hatchback

EPA electric range: 29 miles
EPA total range (gas + electric): 620 miles
Range/hour of charging: 13 miles
Starting MSRP: \$26,700



2021 Hyundai Kona Electric

 Battery-electric  Compact/Hatchback

EPA electric range: 258 miles
Range/hour of charging: 27 miles
Fast charging: 200 miles in 54 minutes
Starting MSRP: \$37,390



2020 Kia Niro EV

Battery-electric Compact/Hatchback

EPA electric range: 239 miles
Range/hour of charging: 25 miles
Fast charging: 100 miles in 30 minutes
Starting MSRP: \$39,090



2021 Kia Niro Plug-in Hybrid

Plug-in hybrid Compact/Hatchback

EPA electric range: 26 miles
EPA total range: 560 miles
Range/hour of charging: 11 miles
Starting MSRP: \$29,590



2021 Lincoln Aviator Grand Touring

Plug-in hybrid SUV/Crossover

EPA electric range: 21
EPA total range (gas + electric): 460
Range/hour of charging: 8 miles
Starting MSRP: \$69,070



2021 Lincoln Corsair Grand Touring

Plug-in hybrid SUV/Crossover

EPA electric range: 28
EPA total range (gas + electric): 430
Range/hour of charging: 8 miles
Starting MSRP: \$50,390



Mercedes-Benz GLC 350e

Plug-in hybrid SUV/Crossover

EPA electric range: 22
EPA total range (gas + electric): 360
Range/hour of charging: 17 miles
Starting MSRP: \$51,900



2021 Subaru Crosstrek Hybrid

Plug-in hybrid SUV/Crossover

EPA electric range: 17 miles
EPA total range (gas + electric): 480 miles
Range/hour of charging: 8 miles
Starting MSRP: \$35,345

FREQUENTLY ASKED QUESTIONS

WHAT ARE KILOWATTS AND KILOWATT-HOURS, ANYWAY?

A kilowatt (kW) is a measure of power. A kilowatt-hour (kWh) is a measure of energy, or how much power is used over time. An EV battery's size, measured in kWh, tells you how much energy it may contain and therefore how far the EV can go. The rate at which you use (and recharge) the battery is expressed in kW.

To understand their relationship, think of a hose and a bucket. Power (kW) is comparable to the rate of water flowing through the hose. Energy (kWh) is much like the amount of water that collects in the bucket over time (Figure 2a).



Figure 2a. Power (kW) is comparable to the rate of water flowing through the hose. Energy (kWh) is much like the amount of water that collects in the bucket over time.



Figure 2b. With high charging power (high kW), the car's battery fills faster than with low charging power (low kW).

How do kilowatt-hours compare to gallons of gasoline?

Just as internal combustion cars have different size gas tanks, EVs have different size batteries. The amount of energy stored in a typical EV battery varies:



Plug-in hybrid: ≤ 20 kWh



All-electric car: 40–100+ kWh

The distance the energy takes you in your EV depends on your battery size, how you drive, and factors such as weather. Driving fast, uphill, having a “lead foot,” or running the heat or air-conditioning in your EV increase energy use. Conversely, making frequent stops or driving in stop-and-go traffic and downhill can add energy to your battery.

An EV travels roughly 2 to 4 miles on each kWh of energy, so 3 miles per kWh is a good rule of thumb for calculating how many miles your EV can go, based on the kWh in your battery.

Here's another way to compare EV battery energy to gas cars: One gallon of gasoline contains about 33 kWh of energy. So, a 25-mpg car with a 12-gallon tank has the equivalent of 400 kWh, which is many times the size of the largest EV battery. Conventional gas cars need more energy storage because they waste two-thirds of that energy in heat and noise, whereas EVs use less energy to cover the same 300 miles.

When you refuel your gas car, the price is shown in dollars per gallon. When you refuel your electric car, prices are often shown in cents per kWh.

Explain kilowatts and EV charging.

Continuing our hose analogy, just as more water would travel through a garden hose than a drinking straw, with EV charging, the amount of energy that can be added to your battery over time depends on the charging rate or power (kW) (Figure 2b). With high charging power (high kW), the car's battery fills faster than with low charging power (low kW). The car, not the charging station, determines the charging power.

Even if a public charging station can provide a high rate of power, such as 250 kW DC, only a few of today's EVs can accept that rate. Most current all-electric cars accept less than 150 kW DC, and most plug-in hybrids accept much lower rates, around 3.3 kW AC. Rapid industry advances are leading to cars that can accept high power rates and chargers that can supply that power. The next two questions have more charging details.

WHERE CAN I CHARGE AND HOW LONG DOES IT TAKE?

With gas cars, you stop at a gas station to refuel on the road. With an electric car you charge at home, at work, or on the road. Simply plug it in, like your smart phone or computer; your car charges while you sleep, work, or play.

Most drivers with a driveway or garage prefer the convenience of charging at home. They can either plug into a standard 120-volt household outlet using the cord that comes with the car or install a dedicated 240-volt charging station.

The first option, called Level 1 charging, is the simplest and most economical home-charging solution because it requires no other equipment or installation provided the 120-volt outlet is up to date. Charging at Level 1 (typically 1.4 to 1.9 kW) delivers roughly 3 to 5 miles of range per hour.

A dedicated 240-volt charging station, called Level 2 charging, requires sufficient electrical capacity, and may need to be installed by a licensed electrician. (It's similar

to the outlet for a clothes dryer or other 240-volt appliance.) Charging at Level 2, (typically 3.3 kW to 19.2 kW) delivers roughly 8 to 24 miles of range per hour or more, depending on the car, the charging station, and the electrical service.

Public charging stations and some workplaces also offer Level 2—and sometimes Level 1—charging.

All electric cars can charge at Levels 1 and 2, and many are equipped to accept an even faster level of charging, called DC fast charging.

While DC fast chargers cannot be installed at home, a growing number of fast-charging stations are available in strategic locations nationwide along highway corridors and near shopping centers. The speed at which a car charges at a DC fast charging station varies, depending on the car and the power availability at the station (typically 50 kW to 350 kW) (Figure 3).

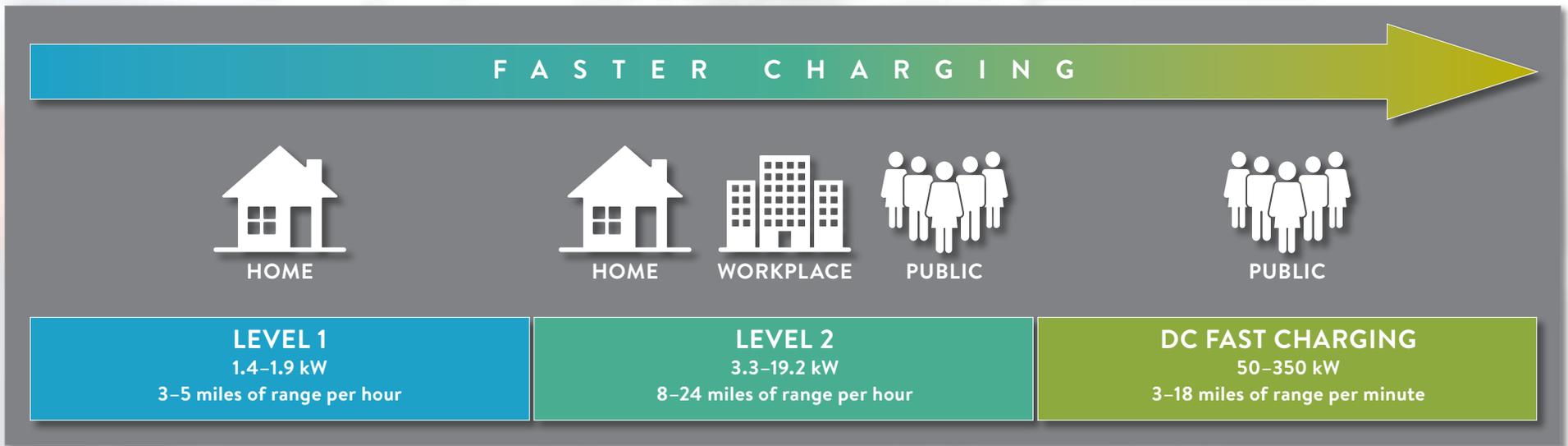


Figure 3. Charging locations, levels, and range replenished¹

¹ The amount of range replenished at all charging levels may vary beyond the numbers shown, depending on the charger type and vehicle. Most current US DC fast chargers offer a maximum power level of 50 kW–150 kW. Tesla Superchargers offer 120 kW–150 kW, and V3 Superchargers offer up to 250 kW. Some stations from Electrify America and other networks offer higher power, roughly 250 kW in some locations, and multiple networks promise to offer 350 kW and higher DC fast chargers for future vehicles that can take advantage of them.

HOW MUCH DOES IT COST TO CHARGE?

Charging cost depends on several factors: the price of electricity, your car's efficiency (how much electricity it uses to travel one mile), and how many miles you drive.

Home charging is the most economical. At the US national average residential price of 13 cents per kWh, fueling a car with electricity is roughly equivalent to buying gasoline at \$1 per gallon. Many utilities offer discounted residential EV rates that further cut the cost.

Public charging costs vary by region and network provider. Some public stations are free and open to all, with electricity subsidized by the property owner. Fee structure and membership requirements vary by charging network. Charging on the go usually costs more than charging at home though less than the current average cost of gasoline (Table 1).

Table 1. Average cost to drive 30, 100, and 200 miles using electricity (with home and public charging options) compared to gasoline. Although gasoline prices vary by region and season, the cost of home charging is roughly equivalent to gasoline at \$1/gallon.¹

MILES DRIVEN	GASOLINE COST	ELECTRICITY COST HOME CHARGING	ELECTRICITY COST PUBLIC CHARGING LEVEL 2	ELECTRICITY COST PUBLIC CHARGING DC FAST
30	\$3.33	\$1.33	\$2.70	\$3.10
100	\$11.12	\$4.44	\$8.99	\$10.33
200	\$22.24	\$8.89	\$17.99	\$20.66

¹ These calculations assume: an average US light-duty vehicle efficiency of 25 mpg and a regular unleaded gasoline price of \$2.78/gallon (US Energy Information Administration 2021 Summer Forecast); an average electric vehicle efficiency of 3 miles/kWh; an average US residential electricity price of \$0.1334 (US Energy Information Administration, February 2021); and an average value of \$0.27/kWh and \$0.31/kWh for public Level 2 and DC fast charging, respectively.

WHERE CAN I BUY AN EV?

You can buy a used or new EV through a conventional car dealer or online.

Some carmakers invite buyers to order a new car online and pick it up at a regional retail center. Automakers that rely on traditional dealer networks (i.e., all but the startups) may also accept online orders and then deliver the EV to your local dealer.

Some carmakers choose to limit EV sales to major urban areas, or to states that have adopted regulations to promote clean cars and EVs (Figure 4). Likewise, some may offer plug-in hybrids nationwide but limit sales of their battery-electric models to certain states. Each manufacturer's strategy differs and may change in response to market signals and regulatory pressures.

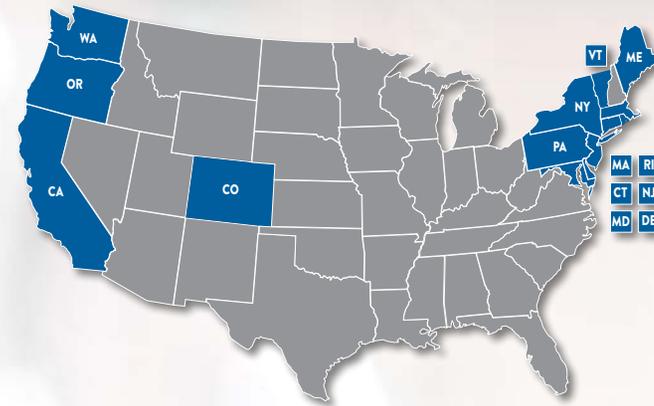


Figure 4. While some EVs are available everywhere, dealers in states with EV-friendly regulations (blue) tend to offer more all-electric and plug-in hybrid choices.

WHAT INCENTIVES ARE AVAILABLE?

A federal tax credit of up to \$7,500 may be available for qualified EVs and buyers whose tax circumstances allow them to take advantage of it. A federal EV charging-station incentive may also be available. Additional federal incentives are under consideration.

Many states and local governments also offer vehicle purchase and charging station incentives. In some cities, electric cars may use carpool lanes with a single driver and receive parking and charging perks. Some utilities also offer EV charging incentives. The US Dept. of Energy Office of Energy Efficiency and Renewable Energy tracks currently available government incentives.

WHAT SHOULD I CONSIDER IN EVALUATING AN EV?

Consider your driving needs. If your daily driving patterns are predictable, or if you like the idea of a gasoline-free driving experience, an all-electric vehicle can be a good choice. Today's longer-range EVs together with access to workplace or public charging may alleviate range anxiety. If you often drive long distances, a plug-in hybrid with its backup internal-combustion engine can provide a worry-free transition to EVs.

Consider costs and benefits. Despite higher sticker prices, EVs can cost less to operate over their lifetime, thanks to purchase incentives, lease options, and discounted electricity rates. Like other innovations, EV costs are falling as technology improves and production volumes rise.

Consider environmental benefits. Electric cars have lower emissions than gasoline-powered vehicles, even in areas where much of the electricity is generated by power plants that burn fossil fuels. As power generation gets cleaner, the electric cars charged on those grids get cleaner, too.

ARE EVS HERE TO STAY?

In 2020, despite a decline in US vehicle sales overall, EV sales grew. Although EVs represent a small share of the US light-duty vehicle market today, the market is transforming and a global shift toward electrification is underway, fueled largely by regulations, and driven by those in Europe and China.

As more jurisdictions embrace climate change policies, as more automakers pledge to electrify their fleets, and as more consumers experience EVs, the transformation is expected to accelerate. One forecast shows global EV sales increasing from 1.7 million in 2020 to 8.5 million in 2025, 26 million in 2030, and 54 million by 2040—or more than half of all new cars built.¹

¹ "Electric Vehicle Outlook 2020" Bloomberg NEF, 2020. <https://about.bnef.com/electric-vehicle-outlook/>

MORE INFORMATION

Explore automakers' websites for product updates and check your local electricity provider's website for information about EVs.

Additional EPRI Resources:

Consumer Guide to Electric Vehicles

(Online version, updated periodically throughout the year)

<https://evconsumerguide.epri.com/>

Consumer Guide to Electric Vehicle Charging

October 2019 (EPRI Product ID 3002016961)

<https://www.epri.com/research/products/000000003002016961>

Environmental Assessment of a Full Electric Transportation Portfolio

September 2015 (EPRI Product ID 3002006881)

<https://www.epri.com/research/products/000000003002006881>

Other Resources:

GoElectricDrive Foundation

<https://www.goelectricdrive.org/>

US Dept. of Energy Alternative Fuels Data Center

<https://afdc.energy.gov/fuels/electricity.html>

US Dept. of Energy Office of Energy Efficiency and Renewable Energy

<https://www.energy.gov/eere/office-energy-efficiency-renewable-energy>

US Dept. of Energy and US Environmental Protection Agency fuel economy information

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

US Environmental Protection Agency, Fast Facts on Transportation and Greenhouse Gases

<https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions>

Plug In America

<https://pluginamerica.org/>

The Electric Power Research Institute, Inc. (EPRI, www.epri.com) (EPRI, www.epri.com) conducts research and development relating to the generation, delivery and use of electricity for the benefit of the public. An independent, nonprofit organization, EPRI brings together its scientists and engineers as well as experts from academia and industry to help address challenges in electricity, including reliability, efficiency, affordability, health, safety and the environment. EPRI also provides technology, policy and economic analyses to drive long-range research and development planning, and supports research in emerging technologies. EPRI members represent 90% of the electricity generated and delivered in the United States with international participation extending to nearly 40 countries. EPRI's principal offices and laboratories are located in Palo Alto, Calif.; Charlotte, N.C.; Knoxville, Tenn.; Dallas, Texas; Lenox, Mass.; and Washington, D.C..

3420 Hillview Avenue, Palo Alto, California 94304-1338
PO Box 10412, Palo Alto, California 94303-0813 • USA
800.313.3774 • 650.855.2121 • askepri@epri.com • www.epri.com

©2021 Electric Power Research Institute (EPRI), Inc. All rights reserved. Electric Power Research Institute, EPRI, and TOGETHER...SHAPING THE FUTURE OF ELECTRICITY are registered service marks of the Electric Power Research Institute.

3002021789