EV Range: Everything You Need to Know

We explain EPA ratings, factors that affect range, how EVs have performed in our testing, and why it's all very complicated.

BY DAVE VANDERWERP MAY 22, 2020

PORSCHE

When it comes to electric vehicles, range is *the* all-important stat. Whether or not you make it to the next public-charging spot, are able to complete your daily commute, or are instead stranded on the side of the road depends on it.

Range is so heavily scrutinized because EVs can travel average barely half the distance of gas-powered vehicles before they require a "fill-up" and because gas pumps are far more ubiquitous than fast chargers. Most EV range discussions are centered around the EPA combined range, as that's the one that's published prominently on the window sticker. For the 2020 model year, 33 EVs have EPA ratings (this includes multiple

variants of the same vehicle), and the combined-range figures span from 110 miles for the **Mini Cooper Electric** to 373 miles for the **Tesla Model S Long Range**.

There's More than One EPA Range Figure

As with gas vehicles' EPA fuel-economy estimates, there are also separate ratings for EVs' city and highway range, too. Unlike gas-powered vehicles, whose highway efficiency almost always exceeds the city figure, all EVs except the **Porsche Taycan** have higher city range ratings than highway. Part of electric vehicles' magic in low- and variable-speed scenarios is their ability to recapture energy when decelerating by slowing the vehicle using the electric motor (or motors) rather than the traditional brakes.

Another way EVs are different is that range and efficiency aren't directly related. That's because of charging losses; roughly 85 to 90 percent of the total energy that comes from the wall makes it into the battery pack. That's why there are two terms used: efficiency, which can be expressed in MPGe, includes charging losses, while consumption, the energy use while driving, doesn't include them.

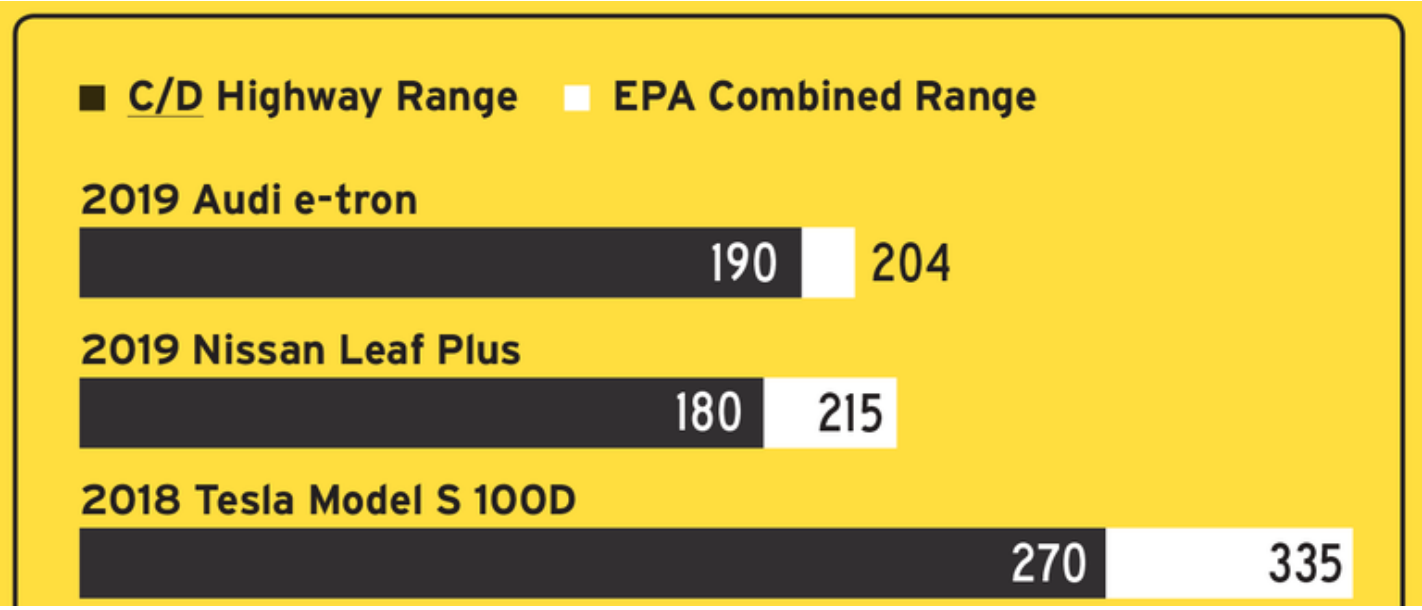
Our EV range test is done at a steady 75 mph, because highway driving is where range matters most. If you're looking to cover 500 or 1000 miles in a day, it necessarily has to be done at high speeds. There's just not enough hours in the day to do otherwise. Even the shortest-range EV can manage more than 7 hours of slogging through city traffic at an average speed of, say, 15 mph. Also, unlike a gas-powered vehicle, an EV's consumption increases dramatically as speeds rise. Of course, as with all cars, aerodynamic drag inflates with the square of speed, but EVs are particularly affected as all but the Porsche Taycan lack multiple gears. So, a higher vehicle speed means the electric motor is spinning at a faster and less-efficient point.

No EV Has Yet to Match or Exceed Its Range Rating in Our 75-MPH Highway Test

Unlike gas- or diesel-powered vehicles, which regularly beat their EPA ratings in our highway testing, every one of the 12 EVs that we've run range tests on to date has fallen short of both its EPA highway and combined figures. We use the combined figure

as the primary point of comparison because the city and highway range figures for EVs are much closer than for gas-powered vehicles, and we want to avoid confusion by using something other than that most-familiar figure.

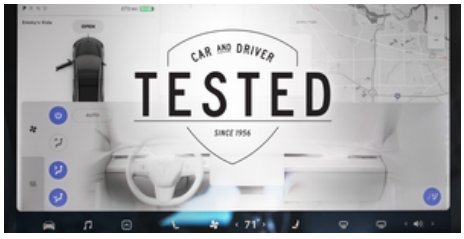
The closest result was achieved by a **2019 Audi e-tron**, which chalked up 190 miles, or 93 percent of its combined rating, while the worst was a **2019 Hyundai Kona Electric**, whose 160-mile result is only 62 percent of its rating.



ALL THE EVS WE'VE TESTED, IN ORDER OF THE SMALLEST TO THE LARGEST PERCENTAGE GAP BETWEEN EPA COMBINED RANGE AND OUR REAL-WORLD HIGHWAY TEST.
| CAR AND DRIVER

We don't (yet) control the weather, so the worst-performing examples, including a 2018 Model 3 that only managed 65 percent of its range rating, took place with outside temperatures hovering around freezing. Which brings up another way EVs are different: cold weather affects range dramatically. One of the many reasons for that is that using the heater to warm the cabin—particularly on EVs that have resistive heaters—sucks a lot of juice. In a test with our long-term Model 3 we found that using the heat can increase consumption by as much as 35 percent and kill 60 miles of range, a significant chunk of the Model 3's 310-mile EPA rating.

MORE ON EV RANGE



How Much Does Climate Control Affect EV Range?

How Cold Weather Affects EV Range

Range Anxiety in Death Valley in a Chevy Bolt

Also, you should consider our range figures the absolute maximum possible and, as with our 0-to-60-mph times, it will be difficult to achieve them with any regularity. That's because it involves charging the battery all the way to 100 percent, which is not the EV norm. Topping off the last 10–15 percent is when the rate of charging slows considerably, and it also leads to increased degradation in battery capacity over time. For example, Tesla recommends limiting charging to 90 percent for daily use. Even on long-distance trips, the stops are determined more by the charging infrastructure than anything else, and the most expeditious method is to top up the battery just far enough—to maybe 80 or 90 percent, keeping it in the speedy part of the charge-rate curve—to get to the next charger.

Range is critical, range is complicated. And if you want to drive an EV long distances and you live in a place where it gets cold, plan on a large buffer between the EPA combined rating and what you actually will be able to use.

lli1998

20 April, 2021

BEVs have to overcome lack of range, long charging times, and lack of infrastructure before consumers will be willing to buy. Innovation in battery technology will in time overcome these hurdles, but not sure of time frame.

Reply

ste8773

5 April, 2021

The results for the Kona seem way out of line with results from other sources. EPA highway mileage estimate (50-60 mph) is 226 miles, InsideEVs highway test at 70 mph showed 238 miles. Surely an additional 5 mph wouldn't decrease the mileage by over 30%? What temperatures were these tests conducted at? The Kona is affected by cold more than most since it has no heat pump, perhaps that explains the discrepancy?

Reply

hvi2237

17 April, 2021

REAL EFFICIENCY OF Electrical Vehicles vs GAS-poewered. H.VIVAT P.Eng. M.Sc. Auto-transport & mobile equipment. GLOBAL" feasibility study.

December,2020

That article discusses efficiency of Electric car (EV)
Electric vehicle market share globally is 2.65%. (2020)
Energy to power EV comes from an Electrical Grid. So far, most of the world energy is converted from fossil fuel, nuclear and renewable. Next, I will find the Total Efficiency of EV and gas-powered vehicles by "Apple to Apple approach". "Well to tank" for gas-powered and well to "oil power plant" for EV are identical source.
The Total Efficiency of EV is a sum of two components: EV car efficiency plus the efficiency of energy supplied by Electrical Greed: "Power plant-to-wheels"
-Total efficiency for gasoline-engine car has only one component: "Gas tank – to -wheels".
On average, gasoline is producing 124000 BTU per gallon , when #4 fuel oil is producing 141000 BTU per gallon A Coefficient of 141000/124000 = 1.137 will be added in EV efficiency calculation.. The cost of those two products are taken as equivalent as both are by-product of refinery process.
Power plant efficiency running on oil is 0.39; it happened to be about the same value as the average world efficiency of power generation (coefficient of 0.40)...**See more**

Reply

lasvegascolonel

23 May, 2020

Of the five people I know who have EVs (including me) none of us has ever been clueless enough to run out of power...with gasoline engines that can happen but with EVs there is no excuse since you can start out with a full tank each morning if you want. I guess if a person is silly enough to try to go on a long road trip, he is going to run out of EV power, but then he likely doesn't understand EVs

and shouldn't be driving one. For the 5% of driving EVs don't do well, you can still rent a gas car or go back to the gas/electric PHEV option.

Reply 1

Tyler F.907

27 May, 2020

One reason no EV has ever met or exceeded it's EPA stated highway range in C&D's test is because you're going too fast. The EPA highway range estimate is based on cruising at 60 mph. Not 75 mph. Also, driving a EV is more like flying an airplane than driving a ICE vehicle. Headwinds, temperature, terrain and even variations in load weight show up quickly at any speed in a EV. Because of the higher energy density of petrol fuel, the effects of these factors are far less noticeable. To get anywhere near an accurate estimate it would be necessary to run multiple highway tests in all kinds of weather and on all kinds of terrain with a static load. That said, I'm sure there are at least some EVs (Tesla?) tuned to work well closer to ICE highway cruising speeds. After almost nine years of driving Nissan Leafs I've noticed our optimal highway range is at 62 mph (100 kph). This speed tends to reward us with between 80% and 90% of the EPA number depending on the other factors I've mentioned. The reality is the AVERAGE range number is about the best you can expect at highway speeds.

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1 reply

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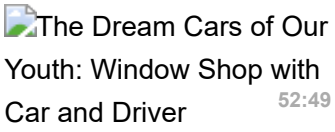

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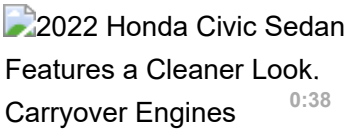

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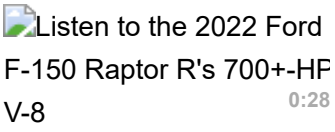

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