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EVs Could Last Nearly Forever—If Car Companies Let Them

An electric car capable of running for 1 million miles is within reach.

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In April, a group of people in a red Tesla driving through the Moroccan desert were glued to the odometer on the car's giant touch screen. "Two million, Hans! Two million," exclaimed the front-seat passenger to the owner and driver, Hansjörg von Gemmingen-Hornberg. His 2014 Model S had become likely the first electric vehicle to drive 2 million kilometers, or more than 1.2 million miles. The car could have traveled from the Earth to the moon and back, twice, then circled the equator 11 times.

The journey wasn't entirely seamless. The car has had its share of repairs, including several battery and motor replacements. A handful of gas-powered cars have driven farther, most of all a 1966 Volvo that racked up some 3 million miles over five decades. But such fantastic mileages are becoming far easier to accomplish for

ordinary commuters with electric cars. On a technological level, it's possible that we're not far from a time when nobody would flinch at an EV with as much mileage as von Gemmingen-Hornberg's—that is, unless car companies themselves get in the way.

Unlike gas-powered engines—which are made up of thousands of parts that shift against one other—a typical EV has only a few dozen moving parts. That means less damage and maintenance, making it easier and cheaper to keep a car on the road well past the approximately 200,000-mile average lifespan of a gas-powered vehicle. And EVs are only getting better. “There are certain technologies that are coming down the pipeline that will get us toward that million-mile EV,” Scott Moura, a civil and environmental engineer at UC Berkeley, told me. That many miles would cover the average American driver for *74 years*. The first EV you buy could be the last car you ever need to purchase.

Gas cars are already astonishingly durable. In theory, they can just keep getting repaired (that's how you get classic cars). But after they get to be about 12 to 15 years old, major problems such as a shot engine or a broken transmission are frequently not worth the cost of repair. Even without problems, a newer car is likely to have much better gas mileage than an older one, making a trade-in appealing. EVs are still so new that few of them are a decade old, meaning we have yet to figure out the exact limit of their life span. The ones that do exist give us some sense. Several older Teslas and Nissan Leafs have topped 300,000 miles—as did the first three batteries in von

Gemmingen-Hornberg's million-miler. His first Tesla, a Roadster purchased in 2009, has itself traveled more than 400,000 miles.

The biggest factor in EV longevity is the batteries. Just like those in a smartphone, they degrade over time. A battery might lose 1 or 2 percent of its maximum range each year, depending on how it is charged and used—meaning that after 15 years, a car's range might have slipped from 300 miles to 210 miles per charge. Repairing a car's battery is difficult, if not impossible, and replacements are expensive, Ed Kim, the chief analyst at the consulting firm AutoPacific, told me. Many EV warranties today will cover replacements to a battery for either eight years or 100,000 miles of driving, and they are considered due for replacement once they've dipped below 70 percent of their initial capacity, according to the National Renewable Energy Laboratory. Batteries today are expected to take far longer to lose that much of their maximum charge—potentially 300,000 miles, or about 15 to 20 years.

The life span should only improve. Batteries are “one of the most active areas in EV development,” Kim said. Prices are plummeting, which will make battery replacement more feasible. And as the range of new EV batteries keeps going up, longevity will also benefit. Some EV batteries, including the one in the Tesla Model 3 Standard Range, can already last for some 500,000 miles on the road, Moura said. One Chinese manufacturer recently announced a battery warranted for nearly 1 million miles. And even more durable battery designs, Moura said, are in the works. A researcher at Tesla

has tested a battery that he claims could drive for 4 million miles, or roughly 100 years, under the right conditions.

Of course, how long a car can keep running is not necessarily the same as how long somebody wants to drive it. EVs are more high-tech than gas cars, and standard improvements—longer range, faster charging, a better touch screen and infotainment system, improved autopilot features—would compel people to buy new models, just as they do for any tech gadget today. But at some point, each successive model won't be all that much better than the last. "Do I need a slightly better sensor so that the windshield wipers work better when it rains?" as Loren McDonald, an EV consultant, put it to me. "Maybe I don't." With continued battery improvements, more drivers may opt to stick with an older car rather than buy a new one. A decade-old EV that can go 400 miles on a single charge, instead of its initial 500 miles, will be more than sufficient for most drivers.

The longevity of EVs, and any appetite for new cars, might help address one of the primary complaints with these cars: that their sticker prices are too high for the typical American household. Used cars, which will continue to work well while requiring fewer repairs, will open up the EV revolution to much of the country. A used Tesla can already be purchased for roughly \$20,000. "We have to think about how we design these vehicles, not for the first owner, but for the third, the fourth, the fifth owner," Moura said.

Even if many people are content with driving the same EV for decades, car companies may try to stop them. Tesla, Ford, and other auto manufacturers will need people to buy new EVs, and may well create incentives for us to do so. In the EV age, car companies are acting more like tech companies and bringing more software to their cars than ever before. The entire auto industry could follow an adoption-and-replacement cycle a lot like that of the iPhone: It used to be common to buy a new iPhone every couple of years for a faster processor, better camera, and larger screen. Now the iPhone 15 isn't *that* different from the iPhone 11. But people do, of course, constantly buy new phones from Apple. The old ones are expensive or difficult to repair and, with every software update, seem to slow down just a bit more until the devices are no longer eligible for updates at all.

Whereas Apple commands a ton of brand loyalty and a dominant hold on smartphone sales, causing a car's battery or motor to degrade faster is a great strategy for losing customers. Carmakers' approach may not resemble planned obsolescence so much as "planned improvements," McDonald said—making older hardware incompatible with software updates or other new functions. Tesla's Autopilot, for instance, is only compatible with vehicles built after September 2014, and newer updates to the feature don't work with older cars that lack more advanced sensors and cameras. Car companies may be able to ensnare people in software-and-gadget ecosystems, just as Apple does. As Ford, GM, Tesla, and other automakers sell home-charging systems and other energy products, car owners might have to upgrade their

vehicles to keep up. It's a sort of capture akin to how, even if you don't want to buy the new iPhone, you might pay for upgraded iCloud storage so you don't run out of memory, or buy an Apple Watch to easily check your iMessages.

The bigger concern is that the same battles over the “right to repair” an iPhone are also coming to cars. Even though EVs require fewer repairs, they aren't maintenance free. And right now, most EV repairs can be done only by manufacturers and their retailers. Any mechanic can fix pretty much any traditional car, but EVs require specialized parts and training that are hard to come by. Whether automakers will make the spare parts and technical knowledge needed to fix EVs available to independent repair shops is uncertain. Tesla has already faced multiple class-action antitrust lawsuits alleging that the company maintains an unlawful monopoly over maintenance and replacement parts. (A judge dismissed the suits in November, although the ruling did not weigh in on the monopoly question.) “What I foresee is that [with] newer vehicles, the ability for an individual to repair it themselves is becoming less,” Moura said.

Longevity is not just a bonus to EVs; it's central to their promise. Cars that spend more years on the road means less carbon from the manufacturing process, less mining for battery minerals, and less scrap metal. More used vehicles that cycle through more owners will mean the same. If car companies continue to act more like

tech companies as their products become more like tech gadgets, an entire avenue of their green potential could be closed off.

Matteo Wong is a staff writer at *The Atlantic*.