UC SANTA BARBARA

THE Current

August 6, 2026

Harrison Tasoff

Thinking about trading your car in for an EV? There’s a compelling new reason to do it now

American drivers have felt the pain of rising gas prices in recent months. There’s evidence this may be fueling interest in greener ways of getting around. Electric vehicles can be cheaper to own and operate than internal combustion engine cars, and they offer considerable sustainability benefits. But, just how much better for the planet are EVs, really?

Quite a bit, at least from a carbon emissions standpoint. You’d be better off sending a brand-new gasoline-fueled car to the scrap heap and replacing it with an electric vehicle, keeping one more tailpipe off the road for good. That’s the surprising new finding from researchers at UC Santa Barbara and UC Santa Cruz who explored the carbon footprint trade-offs of vehicle trade-ins.

“Replacing an internal-combustion vehicle with a battery electric vehicle almost always reduces greenhouse gas emissions,” said Roland Geyer, a professor at UCSB’s Bren School of Environmental Science & Management, and co-author of the new study, published in the journal Science.

Now, of course, the research team doesn’t actually recommend scrapping a car you just bought. But for drivers who are already in the process of making a decision

about future transportation, the research makes the sustainability case for EV ownership crystal clear.

“In some ways, I think this is really a definitive study about the carbon emissions benefits of EVs, because it shows that even in such an extreme scenario, the EV is still the obvious winner,” added UC Santa Cruz Environmental Studies Professor Elliott Campbell, lead author of the paper. “So if you’re someone who’s trying to decide whether or not to put money into keeping your gas car going, switching to an EV as soon as a financially viable opportunity comes up is absolutely the right thing to do for the environment.”

High environmental stakes

This study comes at a time when transportation has become the largest source of carbon emissions in the U.S. Personal vehicles, in particular, are responsible for a larger share than all other forms of transportation combined.

Given the scale of carbon emissions from personal vehicles, one of the most effective solutions to addressing climate change is helping drivers switch to battery electric cars. Battery electric cars run on stored electricity and are recharged from the local power grid, like a cellphone or a laptop. The mix of energy sources used to produce that electricity varies by location, and usually involves some amount of fossil fuels. But it can also include a significant amount of renewable energy and cleaner-burning fossil fuels, like natural gas.

Prior studies have shown that manufacturing and driving battery electric vehicles (BEVs) produces substantially less carbon emissions than internal combustion engine vehicles. So for climate-conscious consumers, the case for choosing an electric vehicle over a gasoline vehicle for a new purchase has long been clear. What’s trickier has been figuring out the best timing for retiring existing gas vehicles, in order to maximize the climate benefits.

A question of timing

Campbell first developed the idea for the current study while he was working on a different project, interviewing people about their perceptions of electric vehicles.

“This question of when to retire your current vehicle kept coming up,” he recalled. “Some people said they thought it would be most sustainable to keep driving their current car until the wheels fall off, and others were really unsure what timing was best. But it seemed to be a question on many people’s minds.”

And, surprisingly, there wasn’t existing research-based guidance.

“Personally, I’m someone who repairs and reuses just about everything,” Campbell said. “Keeping gear going makes sense in so many contexts, but not in every context. Sometimes it’s better to just make a shift to a newer, more efficient option, and it wasn’t clear yet which was the case with transitioning to an EV.”

Replacing a functional gasoline vehicle with an EV might seem wasteful from a carbon emissions standpoint. Manufacturing a new EV is energy intensive, producing emissions that could have been avoided by simply keeping the current vehicle in service longer. “However, this is not true for those products where the lion’s share of the impact occurs during their use,” Geyer explained. And getting gasoline vehicles off the road sooner means more mileage driven with fewer emissions.

So the two authors sought to find out when the benefits of driving electric outweigh the drawback of manufacturing a new vehicle.

Comparing carbon emissions

Geyer and Campbell both specialize in finding answers to exactly these types of tricky sustainability questions. Geyer is an industrial ecologist with deep experience in systems of product manufacturing and consumption, while Campbell is an environmental engineer with a background in large-scale computer modeling of ecological impacts.

Together they worked to compare several different timelines for replacing a gasoline vehicle with an EV. They calculated the percent difference in emissions that would result if a gasoline vehicle were driven for its full useful life (about 16 years), or scrapped and replaced at earlier years.

To do this, they looked at how carbon emissions for more than 400 gasoline and battery electric vehicle models were affected by different vehicle efficiencies, grid

electricity sources, vehicle mileages, and BEV manufacturing emissions and battery sizes.

Their results showed that the climate benefits were generally greatest when gasoline vehicles were retired at year one, resulting in a 58% reduction in carbon emissions over a 16-year period. It typically took about three years for the lower emissions of driving a battery electric vehicle to offset the emissions required to produce it. Then the climate benefits added up quickly from there.

“What it comes down to is just that gas vehicles require so much more energy to operate,” Campbell explained. “Only 20% of the energy in the gasoline that most of our cars burn actually goes toward moving the vehicle—the rest is just lost as heat. So it really puts internal combustion engines in a totally different class than EVs when it comes to efficiency, and that leads to a situation where you want to retire the gas-powered vehicle as soon as you can.”

Diving into the details

The exact benefits of retiring a gasoline vehicle vary based on location and the specific type of vehicle. The authors modeled an array of different scenarios for replacing gasoline or standard hybrid electric vehicles with battery electric vehicles before the end of the vehicle’s useful lifespan. And 92% of the cases achieved at least some overall reduction in carbon emissions.

Plug-in hybrid electric vehicles are a notable exception. Standard hybrids use an electric motor to capture and reuse energy from the gas-powered engine each time the vehicle slows down. Meanwhile, plug-ins have small batteries that can be charged from the electric grid, providing some all-electric driving range. As a result, they’re efficient enough that replacing them early with battery electric models could actually increase emissions in some cases. Similarly, seldom-driven gasoline vehicles — driven annually less than 4,383 miles for cars, 4,248 mi for SUVs, or 6,707 mi for trucks — were not worth replacing, from a carbon emissions standpoint.

Image

Photo Credit
Charles-McClintock Wilson via iStock
Location, vehicle type and usage can affect the benefits of replacing a gasoline vehicle with an EV, but these details rarely favor keeping the gas vehicle on the road.

The energy mix that powers your local electricity grid also affects whether retiring a gasoline vehicle early makes sense. In areas with power grids that are exceptionally reliant on coal or other high-polluting fossil fuels, there’s less of an emissions reduction benefit to driving electric. That makes it harder to offset the emissions cost of producing a new BEV.

For example, if you own a traditional hybrid electric vehicle with class-leading efficiency, you’d want to think twice about replacing it early if your local electricity grid is in the bottom third for efficiency among total U.S. energy generation. To learn more, check whether your local grid has a CO_2 emissions rate exceeding 970 lbs/MWh.

For the majority of the country, though, there are consistent benefits to retiring even the most fuel-efficient gas-powered cars early. And for the most common gasoline

vehicle models sold in the U.S., replacing your car early offers carbon emissions reduction even on the dirtiest power grids.

Implications for policymakers

The study's results show that helping drivers transition from gasoline vehicles to BEVs as quickly as possible is crucial for stemming climate change.

Many states, including California, have vehicle scrap-and-replace programs that offer financial incentives to make trading out vehicles more cost-effective. Increasing the amount of funding available through such programs could help put EV ownership within financial reach for more people. That's especially true when those subsidies can be stacked alongside rebates for purchasing EVs.

The findings also demonstrate the potential benefits of expanding eligibility for scrap-and-replace programs to a wider range of gasoline cars, beyond just the highest-emitting vehicles. And the case for a broader approach could become even stronger in the coming years. As renewable energy expands to provide a larger share of U.S. electricity, the emissions benefits of driving an EV will grow accordingly. And development of a strong EV battery recycling industry could significantly offset the initial carbon emissions associated with producing new electric vehicles.

The sooner we can facilitate these transitions, the better protected our communities will be from the impacts of climate change, the researchers said. "The real puzzle for me, at this point, is why this transition does not proceed any faster," Geyer said. "This is a behavioral question, rather than a technological one, so this is where my research is going."

"The rate of climate change is accelerating, so the rate of climate action needs to accelerate too," Campbell added. "If states want to put more money into programs that encourage people who are on the fence about EVs to make that leap toward a newer, cleaner, more cost-efficient car to own and operate, our results show that certainly makes sense from an emissions reduction point of view."

Tags
Climate Change

Media Contact
Harrison Tasoff
Science Writer
(805) 893-7220
harrisontasoff@ucsb.edu

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.