

Tesla Versus Prius and The Carbon Crisis Long-Game

Toyota has been criticized as a laggard when it comes to electric cars but the world's biggest automaker says a blended strategy of EVs, plug-in hybrids and Prius-like hybrids can have a bigger impact on curbing carbon emissions in the near term.



By
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Gill Pratt kicked off his talk at last month's World Economic Forum with a concern shared around the globe: what's the best way to stop the rapid build-up of planet-warming carbon dioxide? The solution Toyota's chief scientist suggested runs a bit counter to calls to electrify autos as rapidly as possible to wean the world off of oil.

"We should electrify vehicles as much as possible, but we don't have to electrify them in only one way," the lanky, bearded Pratt told his audience in Davos, Switzerland. Vehicles powered solely by batteries generate less carbon pollution over their lifetime, but each requires thousands of lithium-ion cells made with costly metals including lithium, cobalt and nickel. And right now, there's just not enough to go around, according to research outfits like Benchmark Mineral Intelligence.

Battery-only vehicles need a lot of those materials, plug-in hybrids need significantly less and hybrids like the Prius require just a fraction. A 100-kilowatt-hour battery pack like the one used by the Tesla Model S or Ford's F-150 Lightning pickup contains enough material to power more than 90 Priuses.

A hybrid car "puts out 200 grams of CO₂ per kilometer, so not nearly as good—in fact twice as bad—as the EV but we're replacing 90 because the batteries in each of them is smaller," Pratt said. "We're not proposing that we switch entirely to using hybrid cars. ... But we think that in



Gill Pratt, Toyota chief scientist and CEO of Toyota Research Institute.

certain parts of the world where the charging infrastructure is not as green as it is here, where there are actually people that don't have easy access to the charging network, some of these other options may be better.”

His argument, not popular with environmentalists, is the adage about not making the perfect the enemy of the good: the biggest near-term societal benefit in terms of curbing CO2 pollution is to get people to switch to EVs, plug-in hybrids, which operate as EVs for limited distances, and gasoline-sipping hybrids that don't need to be plugged in. And given that the base price for a boring Prius is in the high \$20,000s (or \$23,000 for a hybrid Toyota Corolla that gets 53 miles per gallon) versus \$43,000 for the cheapest Tesla Model 3 (before taxes and a \$7,500 federal tax credit) the number of people who can afford one is dramatically bigger.

Transportation is the top source of carbon emissions at 27% of the U.S. total so shifting to electric propulsion after more than a century of gasoline- and diesel-powered cars and trucks is the

right move. But it's a complicated and costly one. Batteries are expensive, making the vehicles unattainable for many buyers (the average new EV cost \$59,000 in January, according to Kelley Blue Book); the mined metals EVs need also have environmental and social downsides (like child labor); and access to public charging stations is limited or poor in much of the U.S.

Because EVs require more raw materials and different manufacturing procedures they're more carbon-intensive to make than gasoline-powered cars, hybrids and plug-in hybrids, according to Argonne National Laboratory, which created the GREET model to measure all aspects of a vehicle's greenhouse gas emissions. Still, most of the pollution associated with them occurs from on-road use over many years. And on that basis, the EV wins.

A driver who replaces a small gasoline-powered car with a similar-sized EV with a 60-kilowatt battery pack (about the size of an entry-level Tesla Model 3 or Chevrolet Bolt), has lower total carbon emissions from the vehicle (including manufacturing) at about 18,000 miles of driving, according to Argonne. A generic hybrid car around the same size, not specifically the Prius, spews less carbon for the first 45,000 miles of driving, at which point the EV becomes greener. A small plug-in hybrid car, with electric driving range of about 25 miles from a 9-kWh battery, is the greenest choice for 68,000 miles before the EV beats it.

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CEO, Toyota Research
Institute*

The average American drives 13,000 miles a year, so on that basis an EV is greener than a hybrid after about three and a half years of driving and better than the plug-in after about five years. The benefit comes faster for heavier drivers and considerably slower for people who don't rack up lots of commuting miles or take long road trips. At least for now.

Argonne's estimates are based on the current average U.S. electric grid, but in the years ahead they'll keep getting better for EVs and less so for hybrids, said Jarod Kelly, a principal analyst at Argonne, near Chicago.

"You increase fuel economy with the hybrid and that's good," he said. "But once you can start coupling to the electrical grid, whether that be with a plug-in hybrid or electric vehicle, you're going to take advantage not only of the grid today but the grid that's going to be in the U.S. in the future, which is reducing CO2 emissions dramatically with the increase in wind and solar."

So Toyota's argument about the broader carbon-reduction impact that can happen with a dramatic increase in hybrid sales, though true now, may not hold up for much longer. It also doesn't speed a societal shift away from oil.

"We have to think about a long-term pathway to net-zero" carbon emissions, said Amol Phadke, a staff scientist at Lawrence Berkeley National Laboratory. "The question is if a solution is working today, and it may be the maximum-benefit solution, does it take us on the pathway to net zero? And is that solution the long-term, cost-effective solution?"

Based on his research, Phadke is convinced that not only will the grid keep getting cleaner but that over time tight supplies of battery materials will ease and prices for EVs will drop. "In terms of long-term affordability, battery prices, in the long run, are likely to come down," he said. Still, he doesn't know exactly when.

Pratt says a potential shortage of lithium in the coming years may keep the EV market from expanding as rapidly as governments and environmentalists hope it might.

"There won't be enough lithium and the reason is mines take 10 to 15 years ... to get established, and battery factories only two to three years," he said. "There's going to be this huge supply crunch."

Toyota's argument for an approach that relies heavily on hybrids looks self-serving since it's dominated that technology for a quarter century. And though the company is selling an electric crossover, the troubled bZ4X, and may accelerate EV plans under a new CEO, hybrids will remain a big part of its strategy throughout this decade. A restyled 2023 Prius just went on sale priced from about \$27,000 and getting up to 57 miles per gallon. Surprisingly, the new model is also a sleek, attractive car, shedding the orthopedic shoe looks of its predecessors. A plug-in



Vehicle cost, access to charging infrastructure and the availability of battery metals are challenges for growth of the electric vehicle market.

version that comes later this year may offer up to 40 miles of all-electric driving before the gas engine kicks in, a big improvement over the 2022 Prius Prime's 25-mile EV range.

Slowing global carbon accumulation means every available tool is needed, Pratt told Forbes. He compares rapidly rising global CO₂ to pouring water into a bathtub with a slow drain that's getting close to overflowing.

"The CO₂ that we're putting out right now, in excess of what's being absorbed by plants and the ocean, will be around for a really long time, more than a century in fact," he said. "The tub's getting fuller and fuller, and the higher that CO₂ level gets the more the temperature on Earth is going to keep climbing."

"The total amount of global CO₂ will be reduced more with a blended approach than it would be with a single type of vehicle, the all EV approach."

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