Hurdle to Broad Adoption of E.V.s: The Misperception They're Unsafe

Fully electric vehicles have fewer fires than gasoline-powered and hybrid cars, and their crash protection is at least equivalent.

By Paul Stenquist

May 5, 2022

Electric vehicles, lots of them, are coming whether we're ready or not. The looming Corporate Average Fuel Economy standards and the need for manufacturers to standardize production have made a switch to electric inevitable. But while the E.V. fleet is accelerating rapidly into our future, there are bumps in the road, including, most notably, a lack of ready buyers.

Price is one obstacle to consumer acceptance of E.V.s, but that is likely to become less of a concern as increased production leads to economies of scale and as advancing technology reduces costs. Another obstacle that may not be easily overcome is perceived vehicle safety.

E.V.s have not benefited from good press. In March, a Tesla caught fire and burned for hours after running off a road near Fillmore, Calif. And last year, General Motors had to warn Bolt buyers that they couldn't park their cars indoors after some vehicles caught fire while charging.

Though these fires generated headlines, E.V. angst appears to be unwarranted. AutoInsuranceEZ studied the frequency of fires — from all causes, including collisions — in automobiles in 2021. It found that hybrid vehicles, which have an internal combustion engine and an electric motor, had the most fires per 100,000 vehicles (3,475), while vehicles with just an internal combustion engine placed second (1,530 per 100,000). Fully electric vehicles had the fewest: 25 per 100,000. These findings were based on data from the National Transportation Safety Board and the Bureau of Transportation Statistics.

When E.V.s do burn, the battery is usually the culprit. Today's typical E.V. battery pack consists of thousands of lithium ion cells mounted in modules — the number dependent on the type of cell used and the kilowatt-hour capacity of the pack. The Lucid Air Dream, for example, achieves 520 miles of Environmental Protection Agency-rated range with 6,600 cells mounted in 22 modules, all encased within a strong pack.

Mounted below the floor, a typical E.V.'s battery pack in its armor-like container contributes to vehicle rigidity while keeping the center of gravity as low as possible for excellent handling and rollover protection.

The high-voltage direct current of most E.V. battery packs is routed to an inverter that converts it to alternating current. From there the current is delivered to one or more motors. Because the high voltage extends beyond the battery pack, cabling must be protected.

The high-voltage system on the Mercedes-Benz EQS immediately disconnects from the battery in the event of a crash. Lena Mucha for The New York Times

Alexandros Mitropoulos, a spokesman for Mercedes-Benz, said analysis of crash data indicated that the safest position for mounting the battery is under the passenger compartment. High-voltage cables for the Mercedes EQS are routed through the center of the car, removed from possible intrusion, he added. In a crash, the high-voltage system disconnects from the battery.

The crash-sensing system of the vehicle, Mr. Mitropoulos said, remains awake even when the car is parked and turned off.

In addition to systems that automatically isolate high-voltage components in a collision, manual disconnects are provided for emergency workers to ensure that the battery has been isolated.

Side-impact protection is crucial to E.V. safety, to protect both the battery pack and occupants. The pack's housing, blanketing the underside of the car between the front and rear wheels, is heavily armored, and an energy dissipation network is built into the vehicle's door sills, frames, B-pillar and cross members, as well as into the pack itself.

The Lucid's door sills are crash-absorption structures, and high-strength aluminum reinforces the door enclosures, said Eric Bach, chief engineer for Lucid Motors. In a collision, energy is transferred to the other side of the vehicle rather than to the battery modules or passenger cabin. In a side impact test, he added, there was less passenger cabin intrusion in the Lucid than in a conventional vehicle.

Much work has been devoted to making E.V. batteries less likely to short and overheat. Any battery can fail in an extremely violent collision, but manufacturers have tried to ensure that thermal failure is unlikely in normal use and less severe collisions.

The Lucid's door sills are crash-absorption structures, and high-strength aluminum reinforces the door enclosures. Bryan Derballa for The New York Times

Mr. Bach said the cells in Lucid's 118-kilowatt-hour and 112-kilowatt-hour battery packs are encased in stainless-steel tubes and incorporate a venting system and fuse to prevent overheating. Another fuse protects each cell at the point where it is mounted within the module. Each liquid-cooled module is mounted separately in the battery pack. The pack is monitored at various points right down to the cell level, so temperature and charge are always known.

While side-impact protection is crucial in E.V.s, the most common collisions occur when one car slams into the rear of a stopped or slow vehicle. One might think that since a rigid engine is no longer part of the equation, engineers could design a more efficient front crumple zone. But because most carmakers must still sell traditional vehicles, too, it's hard to get them to commit to an E.V. safety advantage.

In an E.V., the longitudinal beams — the components that determine the stiffness of the vehicle in front of the cowl and windshield — offer more design freedom, Mr. Mitropoulos explained. While longer beams are fortuitous regarding the way the front end crumples in a collision, he added, there is no difference in crashworthiness.

But Mr. Bach of Lucid extols the front-impact protection afforded by a well-engineered clean-sheet E.V. "The huge front trunk area is a perfect crumple zone," he said. "We can minimize the pulse, dissipate the energy over a beautiful, harmonious crumple zone."

Some E.V.s, including the Volvo C40 Recharge, share a platform with a traditional car. While a re-engineered gas-powered vehicle may appear to be inferior to a clean-sheet E.V., that isn't necessarily the case. In reworking the C40 platform for electrification, Volvo added elements to the structure to get the same kind of energy loading as in the internal-combustion version and therefore the same level of impact protection, said Thomas Broberg, the carmaker's senior technical adviser.

Volvo's all-electric C40 Recharge, unveiled in March last year, shares a platform with a traditional car. Tt News Agency, via Reuters

The lack of a high, hard engine block in the E.V. front structure offers pedestrian safety advantages as well. With more distance in the car's front end to dissipate energy, a struck pedestrian would theoretically fare better. But engineers agree that the best protection for pedestrians from both E.V. and traditional vehicles lies in avoidance technology.

While ensuring E.V. safety is in the best interest of carmakers, there are regulations they must meet. The National Highway Traffic Safety Administration first published Standard 305 for electric vehicles in 2008. The rule, which applies to vehicles with batteries of 48 volts or more, added protection standards for battery and high-voltage components to the crashworthiness regulations already in place for vehicles sold in the United States.

Nissan had experience with the 305 standard early on, when the Leaf E.V. was brought to market in 2010. Testing under the new standard was and is similar to the norm for traditional vehicles, said Jeff Dix, senior principal engineer at Nissan. For example, he said, rather than looking for fuel leakage in a 50-miles-per-hour rear-impact test, you're looking for any indication that high-voltage components weren't isolated.

A version of this article appears in print on , Section B, Page 7 of the New York edition with the headline: A Perception Problem for E.V.s