

Electric Vehicles Need More Study, Less Emotion

If you've never touched a live wire, try writing about plug-in electric cars

Our latest such shock came from last month's cover story, *Unclean at Any Speed*, as evidenced in the astounding volume of comments it elicited. As author Ozzie Zehner notes, "the seemingly simple question 'Are electric cars indeed green?' quickly gets complicated." • The question is twofold: How much carbon does a car emit in operation, and how much carbon is emitted in making the car—and its materials?

The first problem involves the well-to-wheel carbon footprint—the carbon emitted by obtaining fossil fuels, converting them into electricity, and using that electricity to produce motive force. Two U.S. reports have compared electric and gasoline cars on that basis, the more recent one coming from the Union of Concerned Scientists.

The study finds that in all U.S. states, plug-in electric vehicles are at least as fuel-efficient as the best gasoline cars. In many states, plug-in EVs are as good as the best gasoline-electric hybrids. And in some, they're better than the best hybrids. Gasoline hybrids beat pure electrics only in parts of the country that generate most of their power from coal.

An earlier, more comprehensive study was issued jointly by the Electric Power Research Institute (EPRI) and the Natural Resources Defense Council (NRDC) in 2007. The conclusion: Electrifying transportation would reduce greenhouse gases, and as the grid gets cleaner, the benefits increase. So score one for the electric car.

The next place to look is at materials and manufacturing. That's where last month's cover story comes in. It argues that making lithium-ion battery packs, electric motors, ultralight materials, and power electronics releases more carbon into the atmosphere than the vehicle saves in operation. But just how important are materials and manufacturing? According to a 2000 study by the Energy Laboratory at MIT, extraction of the raw materials to build the vehicle makes up just 4 percent of a vehicle's lifetime carbon footprint, and building it adds another 2 percent. Zehner relies instead on a 2010 study by the National Research Council of the National Academies of Sciences, whose numbers differ greatly from MIT's. The NAS concluded that the lifetime health

and environmental damages from electric cars exceed those from gasoline cars. If nothing else, this highlights the urgent need for more studies on the environmental impacts of materials and manufacturing.

But the important thing to remember is that expensive new things usually get cheaper as the volume of production rises. So the carbon burden of making electric cars will likely fall in the future—even as it rises for conventional cars. Carmakers are working hard to use less of the costly metals, and even eliminate rare earth metals. Already Tesla Motors uses none of those metals in its motor or battery. In any case, manufacturers of electric cars are not alone in their use of lighter materials—conventional cars will increasingly have them too. One example: A Tesla Model S is mostly made of aluminum, but so are the current Audi A8, Jaguar XJ, and Range Rover.

The media coverage, gnashing of teeth, shrieking about conspiracies, and activism by advocates might lead readers to believe that electric cars are either the solution to many of our ills or a boondoggle on wheels. Zehner notes this polarization; I would add that the extremes often seem to emanate from politically partisan sources.

But the more optimistic view would be that such vituperation merely indicates that we are in the early stages of the "change curve," based on work by the psychiatrist Elisabeth Kübler-Ross. It starts with denial, progresses to anger, moves into exploring, and finally reaches acceptance. Already, with more than 100 000 electric cars on U.S. roads, we've moved from denial to anger. Now it's time to go into the labs and explore. —JOHN VOELCKER



John Voelcker is editor of *Green Car Reports* and a senior editor at High Gear Media. He covers auto technologies for both consumer and industry outlets.

Because of the great interest in this topic, we've created a special section online. There you'll find additional commentary on EV research from Mark Duvall, director of electric transportation and energy storage at the EPRI, the IEEE Transportation Electrification Initiative Steering Committee, and others (<http://spectrum.ieee.org/evcars0813>).

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