The False Promise of Electric Cars

By Eric Peters

In late 1989, California's air quality bureaucracy passed rules effectively requiring the sale of electric cars beginning in 1998. (Though the state does not specifically mention them, electric cars are the only vehicles that currently meet its ultra-strict "zero-emission vehicle" standard.) Eleven Northeast and mid-Atlantic states are considering or have already approved electric vehicle mandates patterned after the California edict.

Some 20% to 33% of the entire U.S. new car market (depending on whether all the interested states pass the necessary legislation) would be covered by these mandates. All told, if the mandates come through, automakers would be required to supply some 70,000 electric vehicles within three years and nearly one million through the year 2003, as requirements call for more electrics.

Consequently, automobile manufacturers have been faced with the daunting prospect of having to design and build a practical, marketable—and safe—electric vehicle (EV) for retail sale by California's 1998 deadline.

Why is the EV mandate "daunting"? Mainly because electric vehicle development is still in its infancy—despite a lot of rosy talk by electric vehicle advocates. Major technical and engineering hurdles remain to be overcome before EVs are expected to be a reasonable alternative to internal combustion automobiles.

Essentially, the available evidence reveals that electric vehicles are being forced into the marketplace before they're anywhere near ready—and that consumers will reject them overwhelmingly. Problems with EVs include limitations of current battery technology and vehicle performance, uncertainty about vehicle safety, and prices significantly higher than comparable conventional cars—all issues that may be disquieting to potential EV owners. In addition, EVs may also represent a new threat to the environment that could turn out worse than anything one could fairly attribute to gasoline-burning automobiles.

Meanwhile, many alternatives to electric cars—natural gas, propane, even super-clean conventional vehicles—might prove more palatable to consumers and less threatening either to the environment or public safety. But they have been shunted to the sidelines while electric-vehicle mandates occupy center stage.

Obviously, the effort to build a viable electric car must be successful—or it will be a disaster both for the industry and consumers. Millions of dollars have already been spent in research and development—to say nothing of eventual tooling and other related production costs—by each of the automobile manufacturers. When all is said and done, the total industry commitment to electric vehicles is likely to exceed several billion dollars. To put this in perspective, $1 billion is about what Chrysler spent on bringing the Neon, the company's hugely successful new economy car, from the designer's sketchpad to dealer showrooms. In other words, for the money being spent on EVs, the manufacturers could have designed, built, and sold several entirely new conventional car models.

If electric cars don't sell—or more importantly, *if they can't be sold at prices which reflect their true cost to manufacture*—the automobile industry will be faced with two equally unpalatable choices: The car companies will have to subsidize the "sale" of electric vehicles—selling the cars below cost and raising prices of conventional cars—to make them more attractive to consumers. Or, manufacturers may simply unload fleets of the unsaleable electrics to commercial users (mainly utilities) at tremendous discounts. Either way, the money lost will have to be made up from purchasers of conventional, gasoline-burning cars and trucks.

In other words, you and me.

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According to informal conversations with industry representatives of all the major domestic automobile manufacturers (none want to speak out publicly against electric cars at this juncture, for obvious reasons), buyers of gasoline-powered cars can expect to see sticker prices of conventional vehicles escalate anywhere from $500 to $1,000 or more should the EV mandate stay in place.

Call it an "electric vehicle surcharge," if you like. Such a significant and dramatic price increase could easily push many buyers out of the market. Ironically, air quality could actually worsen as people cling to their older—and higher polluting—cars and trucks in lieu of buying the newer models, which they can no longer afford.

All of the electric vehicles being evaluated for eventual production—the GM Impact, Ford Ecostar/Ranger pick-up truck, Chrysler TEV electric minivan—are expected to have retail prices in excess of $20,000 when they hit the market. (That figure represents an estimate of what a mass-produced EV is likely to cost—and includes cost savings attributable to economies of scale, etc.)

However, according to a recent report by the U.S. General Accounting Office (GAO), "he initial purchase price of vehicles that meet the reasonable demands of consumers will most likely remain at least two and three times higher than comparable internal combustion engine vehicle prices in the near term."

If these figures can't be brought down considerably, it's doubtful any but a few zealots will find electric cars attractive given their limitations—and consumers will have to subsidize their sale.

Advanced Technology?

So what's wrong with electric cars? Aren't they the promising new technology of tomorrow that will liberate us from dirty and unhealthful internal combustion? Sadly, they are not.

Electric cars have a number of serious liabilities that haven't yet been overcome, despite nearly a century of trying. Chief among these are poor and unreliable performance.

To understand the engineering problems with electric cars, you have to get at their basic flaw—the power source. After an extensive review of the topic, the GAO report notes that "limitations in the range, power, recharging capabilities, and life of batteries remain the largest technical obstacles for the commercialization of EVs."

All electric vehicles currently being readied for production rely on primitive (and gigantic) lead-acid battery packs for power. These cumbersome units, weighing 800 pounds and up, store only enough power for a very limited range as compared to conventional vehicles. To travel 100 miles, GM's Impact would require 5.67 liters of gasoline weighing 10 pounds under conventional power *or* 880 pounds of a lead-acid battery, the GAO notes.

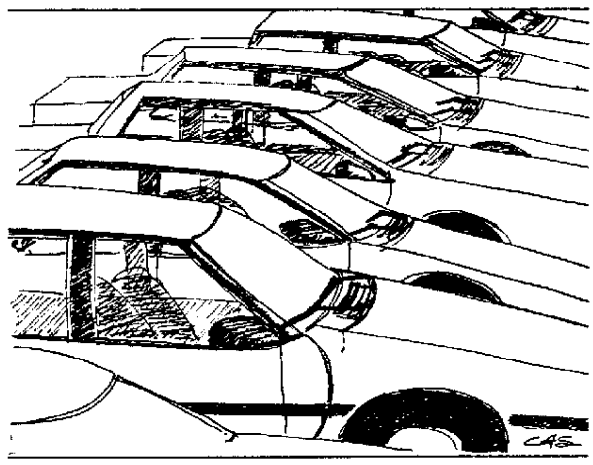
Technologically speaking, these batteries are essentially the same as the battery packs that powered early electric vehicles—like the 1908 Baker Electric—90 years ago. As a result, the over-the-road performance of today's "high tech" electric cars is only slightly better than the electric cars back then.

The Baker, for example, ran about 30 miles before it needed to be recharged; the typical "model" electric car nowadays has a real-world range of 70 to 100 miles—and, like the Baker, needs eight or more hours to juice back up. Even in 1908, when internal combustion automobiles were in their infancy, this limited range was unacceptable and cars like the Baker soon went out of production.

On today's electric vehicles, use of even basic accessories such as the air conditioner, headlights, windshield wipers, etc., draws power from the battery pack and can decrease the usable range by 25% to 50% or more depending on conditions. City driving also shortens the driving range (30 to 50 miles in current vehicles).

Cold weather hurts battery performance even more. When the outside temperature falls below freezing, usable range plummets to 20 miles or less—making EVs practically unusable in colder regions during winter. (While frigid weather isn't generally a problem for Californians, it is a fact of life in the Northeast, where many EV mandates are being pondered.)

Electric-vehicle advocates dismiss concerns about lead-acid batteries, stating they are only an "interim" technology. Indeed, news reports frequently highlight one or another advanced battery design that promises to overcome range and performance problems. But these more



advanced batteries being tested (e.g., sodium sulfur, lithium, nickel-cadmium) are extremely expensive (Ford's Ecostar prototype uses a sodium sulfur battery, which cost tens of thousands of dollars all by itself), are often hazardous, and are not likely to be ready for commercial use for many years. According to the GAO, "each battery type has its individual positive and negative attributes." For example, lead acid, with its performance limitations, is plentiful and relatively cheap; nickel cadmium has high power, which is good for acceleration, but both nickel and cadmium are expensive. Cadmium, moreover, is quite toxic. Lithium is considered among the most promising designs for performance and cost, but there are safety and recharging questions and its development is not expected before 2010.

Even as future research improves batteries, electric vehicles will most likely always have shorter ranges and longer refueling times than comparable gasoline-powered vehicles.

The limitations imposed by battery technology are probably sufficient to sink the electric car as a practical alternative form of transportation. The GAO notes, for example, that even as future research improves battery design, vehicles powered by batteries "will most likely always have shorter ranges and longer refueling times than comparable" gasoline-powered vehicles. But poor battery performance is just one of the electric car's many weaknesses.

Take maintenance costs. Though electric-vehicle advocates like to point out that EVs require no periodic oil changes or tuneups, they frequently neglect to mention the issue of battery pack replacement. Like the small 12-volt battery which starts your conventional car in the morning, an electric vehicle's battery pack must be replaced every three years or so because it is no longer able to hold a charge. The cost of replacing the battery pack is expected to be in the several thousand dollar range for the cheap lead-acid units; much more for the "advanced" battery pack designs. For electric car owners, this is the equivalent in expense and hassle of having to replace the engine and transmission in a conventional vehicle after three years of service.

EVs are also poor performers. Compared to even the slowest and least powerful current-year economy cars, electric cars are so feeble they border on being dangerous. A vehicle with a 0–60 time of more than 15 seconds, for example, will have trouble merging safely with faster traffic—or pulling out from an intersection. Most modern cars—even the real dogs—can accelerate from a stop to 60 mph in under 12 seconds; the best electric cars can take as long as 30 seconds. Ford's Ecostar, for instance, does 0–50 in 12 seconds. The GM Impact is slightly faster—but not by much. And the Chrysler TEV van needs almost 30 seconds to hit 60 mph.

On the highway, most electric cars have top speeds (with a full charge) of 70 mph or less. While it's true that is more than the national speed limit, it leaves little in terms of reserve power for passing or maintaining speed on hilly terrain. And when the battery begins to lose its charge, this already marginal performance often diminishes to the point of being genuinely hazardous.

Only by drastically cutting weight, size, and carrying capacity have engineers managed to get decent performance out of an electric vehicle. That's why most of them are so small. They usually seat only two and have no extra room for luggage or cargo.

When you compare the performance of EVs costing $20,000 plus to conventional new cars in the $10,000 to $15,000 range, the magnitude of the looming electric car fiasco becomes apparent. For $15,000, one can buy a nicely loaded Ford Taurus, Chevy Lumina, or dozens of similar models that don't need half a day to recharge, can carry a family and its stuff, have decent performance, and go hundreds of miles before refueling. Even $10,000 will get you a Geo Metro, Hyundai Accent, Ford Aspire, or several other models that offer performance superior to any electric car likely to be on the market by 1998.

There are problems with traveling far from home. The major impediment to electrics after batteries, according to the GAO review, is infrastructure support. That is, how do you charge your battery when traveling? A 1993 survey found that 76% of respondents wouldn't buy an EV until quick-recharging stations became widely and publicly available. Little has been done in terms of establishing roadside chargers, setting standards, addressing safety concerns (i.e., which standards for plugs and which system is safest to charge in the rain?), and the like.

Given all these limitations and uncertainties, and barring a major technological breakthrough, consumers are not apt to respond favorably to electric vehicles. As John B. Heywood, of Massachusetts Institute of Technology's Sloan Automotive Laboratory, comments: "Most auto buyers do not care what propulsion system is under their hood so long as it is the cheapest avail-

Real World Comparison

To put the electric car in better perspective, consider the real-world performance of the Ford Ecostar—which I had the opportunity to test drive for a week recently.

The Ecostar is among the most technologically advanced and best-performing prototype electric vehicles out there. It features a state-of-the-art battery pack, direct-drive motor, and the latest electronics to back it all up.

The Ecostar is the working prototype upon which Ford Motor Company's eventual production model electric vehicle—very likely a converted Ranger pick-up truck—will be based. When that vehicle reaches showrooms, it is expected to have a price in excess of $20,000.

I put the Ecostar—which is based on Ford's European Escort—up against my second car, a "parts chaser" 1974 VW Beetle—which I purchased for $900.

What did I find? A twenty-year-old, $900 used VW is superior in every category of meaningful performance save braking distance to the "advanced" Ecostar. (My primitive four-wheel drum brakes are no match for the Ford's modern disks.)

• Range. The Bug can go about 200 miles on a full tank and takes maybe three minutes to refuel at any gas station. The Ecostar, with its 75 hp AC motor, has a "safe" range of about 60 miles (you don't want to push it), and takes eight hours or more to recharge on 220 volt current. On household 110 volt current, recharge time doubles or triples.

• Acceleration and Top Speed. Shifting hard, the Bug can make it to 60 in about 10 seconds; top speed is around 95 mph at redline with the wind at your back. Passing tractor trailers isn't easy, but it's possible. With a fresh charge, the Ecostar does 0–50 mph in 12 seconds; top speed is about 70 mph. As the battery loses its charge, however, the Ecostar slows down appreciably. Slight inclines become challenging; passing anything is out of the question.

• Passenger and Luggage Capacity. The Bug seats four tightly, with a little room left for stuff in the trunk; Ecostar is a two-seater, but has a rated payload capacity of 880 to 1,021 lbs. The Ecostar does have air conditioning (but that draws power away from the battery and eats into the range), a nicer ride, and even handles better. But the point here is a decades-old used car that was considered "bottom of the barrel" even when new can do most of the important things better—and for a lot less money—than an allegedly "state of the art" electric vehicle.

—*E.P.*

able and requires minimum compromises in vehicle comfort, performance, and aesthetics. It is the cost, weight, and bulk size of the total propulsion system that are the critical issues. The gasoline-fueled engine now dominates auto use because it is much better than its competitors in these areas."

Safety Questions

Safety of electric vehicles is a matter of critical importance for consumers. Though EVs are fundamentally different in their basic design from conventional vehicles, with large quantities of caustic materials on board (e.g., sulfuric acid), as yet no special safety or crashworthiness standards have been issued by the National Highway Traffic Safety Administration (NHTSA).

EVs merely have to meet the standards which apply to *conventional vehicles* that are in place at the time of their manufacture—and waivers may be granted by the government under a loophole in the existing law. "In all likelihood," the GAO notes, "new or revised regulations will be required to ensure EV crashworthiness." For example, EVs made of more light-weight materials may be "less able to absorb and direct the energy of a collision," which could result in less protection for occupants. Battery fasteners and enclosures "are likely to require special attention to minimize hazards associated with high voltage and reactive chemicals."

Leaks in the battery pack—and the possibility for the release of explosive hydrogen gas (a byproduct of all lead-acid batteries)—are a particular concern. All EV batteries present some safety hazards. The advanced sodium sulfur batteries appear to present the "most serious hazard," the GAO reports, threatening high voltage electric shock, fire and toxic gases. Ford parked its entire sodium sulfur fleet last summer to investigate two fires in the battery packs.

Interestingly, consumer advocacy groups haven't been vocal on the issue. Clarence Ditlow of the Center for Auto Safety observes that some of the smaller, independent electric car companies (those not affiliated with the Big Three) have put their prototypes through crashworthiness testing. But consumers should be concerned about the electric vehicles to be produced by the major man-

ufacturers—the vehicles they will see in showrooms in a few years.

Ford and GM have put their respective electric vehicle prototypes through informal crash testing and claim their EVs will meet 1998 NHTSA standards for conventional passenger cars. However, the fact remains that no specific standards which address the unique safety issues associated with electric cars have yet been promulgated by the federal government—and consequently we have no objective way of determining how safe electric vehicles really are. The real point here is whether safety standards written for conventional cars have any applicability to electric vehicles.

Bruce Zemke, a staff development engineer with GM, says that discussions are under way between NHTSA, the Society of Automotive Engineers (SAE), and car industry representatives to ascertain whether special crashworthiness/safety standards should be issued for electric cars.

"We need to engineer the product so that safety is not an issue," he explains. "We have to think about how electric vehicles should be evaluated—and whether they should be judged on an equivalent basis with internal combustion cars."

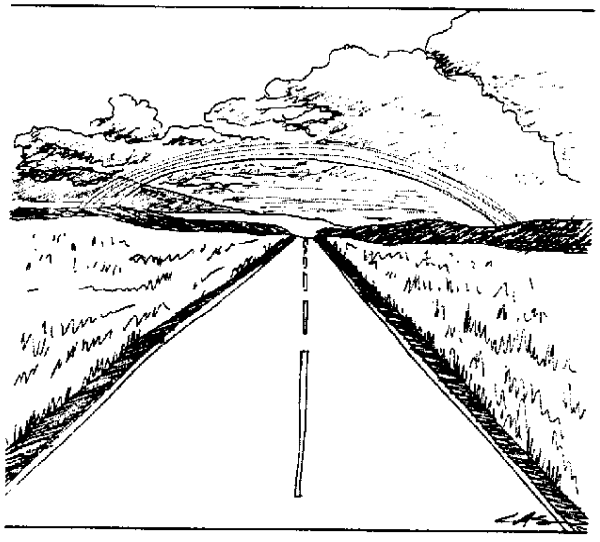
The manufacturers are doing what they can, but they don't have very much time to work with and are under the gun to have electric cars ready for sale by 1998.

Pollution Problems

Of course, the issue behind all the mandates is whether EVs do, in fact, represent the "environmentally sound" technology advocates have claimed. If they do represent a way to clean up the air, perhaps these burdens are worth shouldering. But if not, then why should Americans have to pay for them?

Those unfamiliar with the subject tend to view the electric car issue as a contest between "zero emissions" (i.e., environmentally responsible energy) and irresponsible, outdated, and "dirty" internal combustion engine technology. But the fact is that electric cars produce pollution, too—it's just in a different form and sometimes originates in a different place.

It turns out that more and more studies are coming to the conclusion that electric cars may not be all that "earth friendly" after all. The most recent of these, published in the journal *Science*, concludes that lead-based electric cars actually would *increase* the threat to public health and the environment. The analysis by researchers at Carnegie-Mellon (with funding from the National Science Foundation) finds that the mass production of electric cars using lead-acid battery packs



would exponentially increase the public's exposure to lead pollution. According to the study, electric cars would create more than 60 times the amount of lead pollution as comparable vehicle burning *leaded* gasoline.

"These lead discharges would damage ecology as well as human health," the researchers write. "Even with incremental improvements in lead-acid battery technology and tighter controls on lead reprocessors, producing and recycling these batteries would discharge large quantities of lead into the environment."

Lead is a more serious environmental threat than urban smog, which is why it was gradually removed as an octane-enhancing agent from motor vehicle fuels beginning in 1975.

"Electric vehicles will not be in the public interest until they pose no greater threat to public health and the environment than do alternative technologies, such as vehicles using low-emissions gasoline," the researchers conclude, adding that nickel-cadmium and nickel metal hydride batteries also "do not appear to offer environmental advantages."

John Undeland of the American Automobile Association (AAA) expresses concern that if the Carnegie study is correct in its conclusions, it could mean the introduction of electric cars might negate all the air quality gains which have been made through the elimination of leaded gasoline.

"This would put us back at square one. We've done a lot of work to remove lead from the environment, and now we're faced with something that might undo all our efforts. This is just another indication that we haven't got to the point where electric cars are viable," he says. "Electric cars are not 'zero emissions' cars—they're 'elsewhere emissions' cars."

In point of fact, studies suggest that the added demand for electricity from coal-fired util-

ity plants will result in a manifold increase in so-called "stationary source" pollution. This is especially true in the Northeast, where the coal burned is of the high-sulfur type that is by nature the most polluting.

Estimates of the increase in sulfur dioxide emissions—which cause acid rain—vary from 17% to 2,100%, according to figures compiled by the National Conference of State Legislatures.

Yet big electric utilities—which hope to find a captive audience for their excess generating capacity—continue to advocate EVs and EV mandates. And for the most part, "environmentalist" groups have been strangely silent on the question of electric vehicles' potential for contributing to worsening air quality.

The clincher is that electric cars probably aren't necessary to improve the quality of the air we breathe anyway. Advances in emissions control technology for gasoline-fueled cars have come within a hair of making them free of harmful pollutants. "Zero emissions" electrics, in this respect, make only small improvements over current "low emission" vehicles. And while electrics totally eliminate certain smog-causing emissions from tailpipes, most of these emissions will continue to come from the stationary sources—factories and such.

"The proportional contribution of stationary source emissions has been getting larger and larger over the past three decades while the contribution of mobile source [cars and light trucks] has been getting smaller and smaller, despite a substantial increase in the total number of miles driven each year," says AAA's William Berman.

Overall, the car industry has managed to eliminate 90% to 98% of the harmful emissions coming from the tailpipes of their new cars. Catalytic converters and computer-controlled engine management systems that precisely regulate what's happening under the hood are to be credited for these improvements.

AAA's 1994 study, "Clearing the Air," for instance, states that conventional cars and light trucks contribute less than one third of the contaminants that combine to form urban smog—and that passenger cars and light trucks are no longer the single biggest contributor to regional air quality problems. By 1996, according to the study, just 24% of the total output of Volatile Organic Compounds (VOCs)—precursors to urban smog—will come from passenger vehicles, down from 71% in 1970. A similar and equally dramatic decline in nitrogen oxide emissions is expected to occur as well, with 1996 vehicles estimated to produce just 20% of this pollutant.

The study concludes: "While ground-level ozone continues to be a pervasive problem in many U.S. cities, automobiles and light trucks are no longer the primary or even secondary cause of summertime ozone 'smog' in the 10 cities studied."

There may be a glimmer of hope for car buyers, however. According to Reuters, "Officials from the California Air Resources Board (CARB) and Gov. Pete Wilson's office say they are still not convinced that a commercially viable electric vehicle will be available by the 1998 deadline set by the state." Similar concerns have been raised recently by officials in Massachusetts and New York, raising the possibility that the mandates may at least be delayed.

But given the inertia behind the EV mandates—and the commitments that have been made by politicians and bureaucrats—it's doubtful the "zero-emissions vehicle" mandates will be modified. Consumers, meantime, may have to get used to continued false promises. CR