

## Electric cars of the 1990s—small companies lead the way, but the “big three” have entered the race

By Norma Gurovich

In 1990, General Motors announced a remarkable electric car which offered performance far above any other electric vehicle. The sleek and sporty “Impact” could accelerate from 1 to 60 mph in 8.5 seconds—faster than 95 percent of all cars on the road. It also offered a range of 120 miles between battery charges when most electric cars could travel only 40 to 70 miles between charges.

Although the “Impact” will not be available for sale until the mid 1990s, it marks a significant change in electric vehicle development. This car shows that electric automobiles can perform as well as combustion-engine cars. It also shows that at least one major auto manufacturer finally intends to build electric vehicles for sale to the public.

Until quite recently, progress in electric vehicles has been cautious and confined to research departments. Car manufacturers have waited for a public willing to buy these vehicles while car buyers have waited for a high performance electric vehicle with an affordable price tag. Auto manufacturers and the public may finally be forced to resolve this dilemma because of another issue—air pollution.

California’s Air Resources Board (CARB) issued an important mandate in 1990. It declared that two percent of all new cars sold in California must emit no air pollutants beginning in 1998. By 2003, about 200,000 or 10 percent of all cars sold would have to be zero-emissions. Since electric cars are the only zero-emissions vehicle available today, this mandate provides an incentive for auto manufacturers to produce electric cars. Cities across the country are considering similar regulations.



*GM Impact*

### New cars with unique features

Nearly every major automobile manufacturer and numerous entrepreneurs are researching and developing electric vehicles with an eye on mass production. Passenger cars, pickups and niche-market vehicles have appeared around the globe. The van, however, has received particular attention in America.

A 1983 study by the Electric Power Research Institute determined that vans were ideal candidates for replacement by electric vehicles. They are often used as delivery vehicles, taking short trips in urban areas where pollution is highest. Also, they are used mostly during daytime hours so can easily be parked at night for battery recharging.

The G-Van, produced by Vehma Corporation of Canada, is perhaps the most widely known electric van because it is already operating in many utility company fleets. Using a GMC van body, it has a city traffic range of 40 to 60 miles between bat-

tery charges and a top speed of about 55 mph. Other up-and-coming vans promise even better performance.

The Chrysler TEVan, for example, offers a range exceeding 120 miles per charge and a top speed of 65 mph. It can move from zero to 60 mph in 25 seconds. Unlike the G-van, which uses conventional lead-acid batteries, the TEVan is powered by nickel-iron batteries which store more electric energy and last longer. Unfortunately, these batteries are not mass-produced for vehicles and consequently cost a good deal more than the lead-acid type. Chrysler expects, however, to build a battery plant as its electric vehicle program progresses.

General Motors has created its own version of the electric van in which to test various electric vehicle technologies. The extremely aerodynamic HX3 features two AC induction motors that deliver considerable power to the front wheels - 120 horsepower. A solar panel on the roof creates electricity for an interior ventilation system while even more electricity is created by a

small gasoline powered engine. Electricity created when the engine is switched on is used to recharge the batteries and extend the van's range.

The HX3 also includes another range-extending feature found in many electric vehicles -regenerative braking. When the driver steps on the brake pedal, the electric motor acts like a generator and actually directs electricity back into the batteries. In a car without regenerative braking all that energy is wasted while the car slows from traffic speed to a stop.



*Electric "Festiva" by Solar Car Corporation of Florida*

Like the HX3, cars being developed by Clean Air Transport of Great Britain and Sweden feature a hybrid system. A computer- controlled auxiliary power unit, which operates on liquid fuel, is activated when the car travels consistently above a certain speed. Cars caught in highway traffic jams or stop-and-go city traffic where pollution is highest will thus operate only on electric power.

The CAT. program includes a four-seat passenger vehicle, a two-seat compact mini van and a two-seat pickup. Company literature predicts top speeds around 70 mph and a range of 60 miles from a single battery charge. The range will increase to more than 150 miles with additional electricity from the APU. Clean Air Transport was selected through the "LA Electric Vehicle Initiative" to build 10,000

electric vehicles for sale by 1995 in the Los Angeles area.

General Motors and Clean Air Transport have announced the most aggressive near-term plans for electric vehicle production but many other manufacturers could emerge with a showroom car.

Ford Motor Company plans to build 100 test vehicles by 1993 and place them in public and private fleets for research. The van is based on the European Escort Van and will employ sodium-sulfur batteries. These batteries

feature twice as much energy per pound as the lead-acid type giving this Ford a range of about 100 miles and a top speed of 70 mph. Like Chrysler's nickel-iron, sodium-sulfur batteries are not mass produced for vehicles so their cost is extremely high. Another difficulty is that they operate only at temperatures exceeding 500 degrees Fahrenheit.

European auto manufacturers have also joined the race to build electric vehicles. Bavarian Motor Works of Germany is testing eight electric-powered 325i models and is part of a study to restrict combustion engine vehicles in some parts of Germany. Mercedes recently unveiled a flexible-fuel prototype, Peugeot is developing a small 2-seater electric, and Volkswagen is studying an Audi hybrid. Fiat is already selling the electric Larel Wil 202 in Europe. Priced around

\$28,000, it offers an average speed of 28 mph and a 33.2 mile range.

Many eyes in the electric vehicle industry are focused on the Japanese. Honda, for example, is slightly involved in a battery project with Dreisbach Electromotive of southern California. Using zinc-air batteries, a CRX traveled 108 miles in two hours to win the Electric 200 in April in Phoenix. Honda supplied the chassis and some mechanical parts. The company also sponsored a solar racer employing the basic components of an electric car which placed second in the 1990 Australian World Solar Challenge. Toyota has constructed a solar racer as well, to compete in a Japanese solar car event last October.

Daihatsu is rumored to be developing a lightweight pickup and Mazda is developing a solar cell rooftop system to power ventilating fans or recharge electric car batteries. An article in the June 10 edition of Automotive News stated that Nissan would have an electric car in showrooms by 1997.

### **Small companies ready to sell cars**

A few entrepreneurial companies are already selling electric automobiles. The Electric Motor Car Co. of California offers late-model cars such as Ford's "Escort" converted to run on electricity. One of their vehicles, purchased by Hollywood producer David Zucker, will appear in an upcoming movie.

The Solar Car Corp. of Florida also converts combustion- engine vehicles and adds solar cells to furnish some of the cars' electricity. This company recently completed two production prototypes using a Ford "Festiva" chassis. Top speeds exceed 60 mph and an optional APU will extend the range to more than 100 miles. During opening ceremonies for the last stretch of Interstate-10 last summer in Phoenix, then Arizona Gov. Rose Mofford rode in a solar-electric Honda "Civic" provided by Solar Car Corp.

Another promising small company is the Solectria Corporation of

Massachusetts. Using a Geo Metro body, Solectria's "Force" cars offer a range of 60-80 miles for a four-seat model and 90-120 miles for a two-seat edition. Options include air conditioning, solar cells and \* high power density nickel-cadmium batteries to extend the range. A "Force" placed second in the Electric 200, traveling more than 80 miles in two hours on a single battery charge.

The Solectria Corp. has also built several lightweight prototypes from scratch. The sporty "Lightspeed" weighs less than 800 pounds and, according to Solectria, can accelerate to 60 mph in 8.5 seconds. The "Lightspeed" incorporates a solar array which generates up to 200 watts and contributes to the car's 150-mile range on a sunny day.

Many small companies in Switzerland have developed similar vehicles. Often weighing less than a thousand pounds, such cars show better acceleration, range and speed than most of their heavier counterparts. But because such cars weigh so little, it is doubtful they will pass rigorous U.S. safety standards anytime soon.

## Converting to electric

An alternative is to convert, or "recycle", a gas car. For the hobbyist, this involves about \$5,000 in parts and 200 hours of time. The leading retailer of components and kits is Electro Automotive, of Felton, California.

In addition to parts, they offer a step-by-step photo-illustrated manual called "Convert It." It includes a chapter on choosing a car to convert, as well as troubleshooting, driving, and maintenance. Electro Automotive also offers a conversion training program for professional mechanics.

## Solar assistance

None of the major American manufacturers appear to be using solar cells to extend an electric car's range. The HX3 prototype, for example, uses solar for interior ventilation but not to furnish electricity to the batteries or electric motor. These companies are probably not using solar because of questions about whether the added cost of the cells is balanced by an actual increase in range.

On a solar racer, which can travel more than 180 miles on a sunny day, as much as 13 square meters of the vehicle is covered in solar cells. That large surface area allows for considerable production of electricity. A commuter car, on the other hand, may only have two or three meters of available surface area for solar cells and much less electricity can be produced. The limited data shows that a commuter car may be able to draw two to eight miles of added daily range from average-grade solar cells mounted on the vehicle.

Even though the range increase is not large, Phoenix resident Dick Stadler found it valuable. Stadler bought an electric car for his 42-mile

round trip commute to work but quickly discovered that the car's range was only 35 miles. He added a solar array on the car's roof and because of the additional electricity provided, he was able to make the full commute.

In addition to extending the range, solar cells may offer another benefit to the electric vehicle owner. A 1990 computer model study sponsored by the U.S. Department of Energy found that the steady supply of electricity from solar cells keeps batteries at a higher charge level. When batteries are not discharged to low levels they last longer and the owner doesn't have to pay as often to replace them.

Solar cells also provide an environmental benefit. Most electric cars are recharged at night, plugged-in to a wall socket. That electricity often comes from distant power plants which emit pollutants. Solar cells convert the sun's energy into electrical energy without emitting any pollutants whatsoever.

For more information about electric vehicles, contact companies mentioned in this article, an electric utility company, or the Arizona Energy Office, 602-280-1402.

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