

**ELECTRIC
AUTO**



NEWS

May 1990

ASSOCIATION

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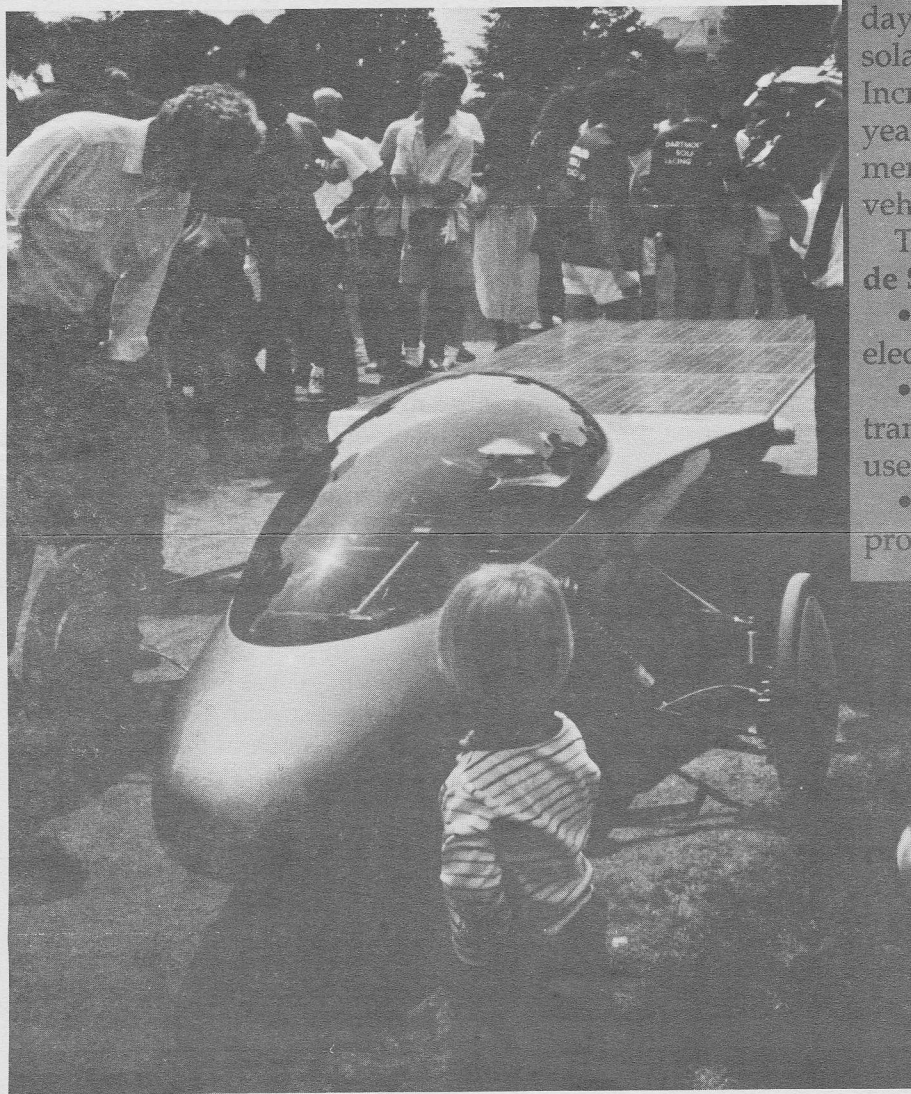
OUR EARTH! It's in your hands.....



The American Tour de Sol



The American Solar Car Championship
May 23 - 27 1990



The American Tour de Sol is a five day race through New England for solar and electric powered vehicles. Increasing air pollution and only 40 years of oil reserves make development of alternatives to conventional vehicles an imperative.

The aims of the American Tour de Sol are:

- To promote solar energy and electric vehicles.
- To provide a vision of future transportation and solar energy use.
- To provide challenging design projects for engineering students.

Start:

10 am May 23,
Vermont Statehouse,
Montpelier, VT

Stopping at:

May 23 • Fairlee, VT
May 24 • Hanover, NH
 • Canaan, NH
May 25 • Loudon, NH
 • Concord, NH
May 26 • Manchester, NH
 • Lowell, MA
May 27 • Tufts University
 Medford, MA
 • Parade into
 Boston

Organized by the **Northeast Solar Energy Association**

23 Ames Street • Greenfield, MA 01301 • (413) 774-6051

Sponsored by the Solar Energy Research Education Foundation, U.S. Department of Energy
and the New England Electric System

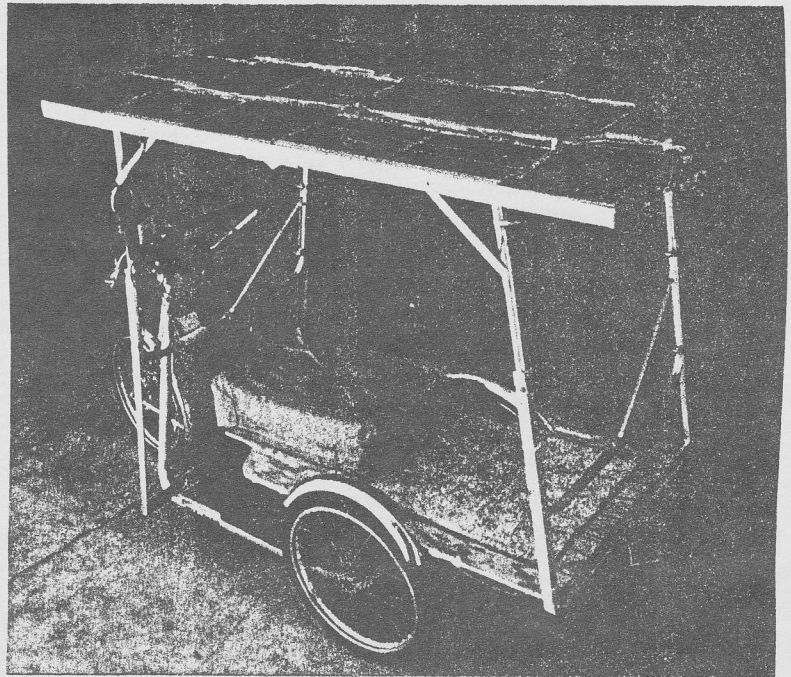
Solar Powered Electric Vehicle

Fully Self Contained Solar Powered EV with
onboard solar panels.

Motor: 1.5 HP Permanent
Magnet

Frame: Welded Aluminum

Speed: Maximum 20 MPH
Cruise 19 MPH



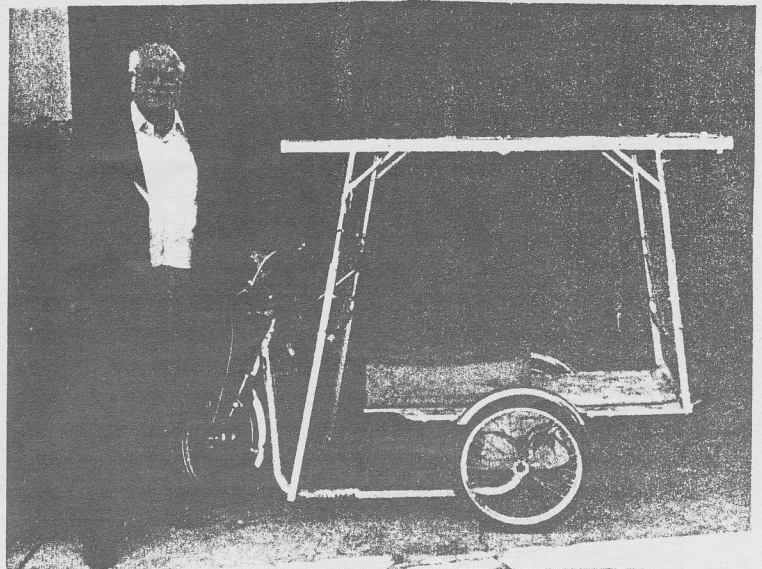
Power: Solar Panels generate 27 Volts at 3 to 5 amps depending on Sun angle and sky clearness. Two batteries act as a flywheel when the vehicle passes through shade and also as a load equalizer charging at stops and giving extra energy for rapid acceleration. Vehicle motion starts with 72 watts. Maximum speed requires 480 watts.

Jeremiah 31:35 "...The lord...giveth the sun..."

Maximum Distance:
Sunlight, no limit.
Without sun, 10 or 100 miles
depending on batteries used.

Gross Vehicle Load: 500 lbs.
Weight 152 lbs.
Pay Load 348 lbs.

Contact: Roy (408) 269-7937



General Motors promises electric car

By David Everett
Knight-Ridder News Service

WASHINGTON — Without revealing details, the chairman of General Motors Corp. pledged Wednesday that the world's largest automaker will build and sell an electric car similar to its highly publicized Impact prototype.

Roger Smith, speaking to a nationwide radio audience and the National Press Club, disclosed neither price nor schedule for the two-seat Impact, whose prototype has been called a breakthrough because of its quick acceleration and high top speed. It accelerates from 0 to 60 mph in 8 seconds and has a top speed of 110 mph.

If Smith's promise is fulfilled, GM would become the first U.S. automaker in modern times to mass-produce electric cars. The company has made this promise before, but a similar GM plan a decade ago to sell an electric car by 1985 was never realized.

"We've got living proof" that the pledge is genu-

ine this time, Smith said, referring to the Impact prototype displayed outside the National Press Building during and after his speech. "This is literally a different car, . . . with new technology."

Although Smith said he could not discuss even a wide price range because of competitive concerns, one GM representative was later heard telling a passer-by gawking at the Impact that the sticker might be around \$17,000. Others have estimated a higher price.

GM says the Impact will run 120 miles between charges, which are made by plugging the car into an electrical outlet for one to eight hours.

Battery life and replacement cost are still challenges. When Smith unveiled the Impact prototype in January, engineers said the 32-battery power pack would have to be replaced every 20,000 miles, at a cost of about \$1,500. Although low maintenance and electricity costs make electric cars much cheaper to operate than gasoline vehicles, such a battery cost has been prohibitive.

Battery transport



Britain's Transport Secretary Cecil Parkinson poses in London Monday with the first electric sports car designed for everyday use.

ASSOCIATED PRESS

The EVs are Coming!

By Jack Merelman

Federal legislation has been introduced to accelerate the development and demonstration of electric vehicle technology.

Be ye not downcast, ye smog-ridden Californians!

Help may be on the way — and soon. Along about 1995, check your favorite freeway — you just may soon experience the first wave of the invasion of the EVs!

EVs? Not ETs?

No. EVs — electric vehicles!

As a matter of fact, new efforts on Capitol Hill to make it happen are spearheaded by a strong, bipartisan band of California representatives.

Rep. George Brown has introduced HR 3852, the Electric Vehicle Technology and Demonstration Act of 1990. Joining Brown as original co-sponsors — all California colleagues — are Reps. Vic Fazio, Jerry Lewis, Carlos Moorhead, Tom Campbell, Ron Packard, Jim Bates and Henry Waxman. The bill has been referred jointly to the House Committee on Energy and Commerce and to the House Committee on Science, Space and Technology.

The measure requires that the secretary of energy carry out a program for purposes of accelerating the development and demonstration of electric vehicle technology.

It is supported by broad congressional findings that the use of electric vehicles could significantly improve the quality of air in non-attainment areas. "Because the substantial potential envi-

ronmental and domestic energy security benefits that will result from the commercialization of electric vehicles are so great for the United States, it is in the public interest for the United States government to assist in the development, demonstration and commercialization of domestically produced, cost competitive, electric vehicles," the bill says.

"Compared to gasoline-powered vehicles, electric vehicles show a 98 percent reduction of major pollutant emissions."

The real issue facing Congress today is how to move electric vehicles from the drawing boards onto our nation's roads.

A status report on photovoltaics

The article on "Power and energy" [January, p. 44] gave a less than adequate discussion of the status of photovoltaics (PV). Much was devoted to the sale of ARCO Solar, an issue that has little bearing on the industry's future. What is referred to as the entrenched process (single-crystal silicon) is a misnomer because semicrystalline silicon cells occupy nearly one-quarter of the world's sales for terrestrial applications. The work by Boeing should not be confused with one-sun cells, which constitute virtually all of the terrestrial PV market (taking into account single-crystal, semicrystalline, and amorphous silicon cells).

What is absent is where PV fits into utility power; no mention is made of the niche market called peaking power. According to a paper given at an IEEE meeting on photovoltaics in 1988, this market may grow to as much as 1000 megawatts by 1995, a mere 20 times the present total world market for PV! While there has been significant growth in the world market, the utility market holds substantial promise for this industry, one that can eliminate the problems of using fossil and nuclear fuels.

Howard Somberg
Canoga Park, Calif.

It is misleading to describe the single-crystal fabricating process for photovoltaics as "entrenched." However, it seems arguable that the sale of the world's largest photovoltaics company, with its pioneering thin-film technology, has "little bearing on the industry's future." Though many expect photovoltaics to displace fossil-fueled combustion turbines as providers of peak power, this application currently remains restricted to a half-dozen experiments at a few utilities.—Ed.

Electric engine gets Detroit's attention

Alcohol-burning turbine car needs no brakes or transmission

By Jan A. Zverina
UNITED PRESS INTERNATIONAL

DETROIT — The founder of a small California company started two years ago has attracted the interest of two top U.S. automakers with an engine he claims makes extended travel for electric vehicles feasible, while eliminating major components like transmissions or brakes.

The Electric Turbine engine was shown in Detroit Friday by Dan McGee, head of American Motion Systems Inc. and inventor of the engine he began work on seven years ago.

AMS is a subsidiary of Magnetics Research International Corp. of Fairfield, Iowa.

"Pure electric vehicles have a range of only about 120 miles because we do not have lightweight battery technology," McGee said in an interview.

"But with an electric turbine, which would most likely be powered by grain alcohol, we could see a range of between 400 and 500 miles," said McGee, whose Camarillo company specializes in the design and engineering of electric motor replacements for elevators, washing machines and automotive fans.

The main issue is how to meet federal emission standards proposed by the Environmental Protection Agency for 1997 that seeks to reduce hydrocarbons to one quarter per gram per mile, he said.

"The two main choices seem to be grain alcohol-burning turbines or a motorcycle engine as an alternative for automobiles," McGee

said, calling the electric turbine "a technical advance of the magnitude of the jet motor."

The electric turbines produce safe speeds of rotation about five times greater than present electric motor technologies. It is expected to replace electric motors over a broad range of applications because it also has a 60 percent reduction in materials requirements.

AMS, which employs only about a dozen workers, will have an electric turbine engine installed in a car later this year because there is still between six and eight months of development left to overcome, mostly in computer software development.

"The overall issue is that with computer links, many things can be done," McGee said. "The primary thing is the total displacement of other components, because a computer can actually control the transmission, anti-lock brakes, and power-assisted steering. Friction brakes would also be replaced because of the motor's braking mechanism."

That could cut the weight of a typical mid-sized sedan down by nearly a third to about 2,000 pounds, while retaining the current power, fuel economy and handling characteristics, he said.

While McGee would not disclose which U.S. carmakers are interested in his engine, he said two foreign automakers have already been willing to fund future development and possible production.

"We're very interested in American companies as our name might suggest," he said, adding that a joint association would involve work on a hybrid electric car that would meet 1997 EPA standards.

"Our general feeling is that this can be a make-it or break-it technology," he said.

Global warming: a plethora of options

In the 1990s, the United States and the entire world face a crisis of great consequence. We must now contend with the environmental implications of our energy choices—namely, the global warming associated with the greenhouse effect, the phenomenon caused by the concentration of carbon dioxide and other trace gases in the atmosphere.

Global warming will dramatically change the world's climate, turning prime farmland into deserts, making northern areas now unsuited for agriculture into farmlands, and increasing the frequency of droughts in some areas while causing floods in others.

Global warming is a complicated problem that does not lend itself to a single, simple solution. The desire to reduce or eliminate "greenhouse gas" emissions is complicated by the nation's continuing dependence on fossil fuels. Any attempt to restrict use of those fuels without providing alternative energy sources to meet rising demand for electricity will have profound social and economic consequences.

To prevent such a scenario, a variety of energy strategies have been developed for the short (to the year 2000), medium (to 2020), and long (to 2050) terms.

Some types of nuclear power, a non-greenhouse polluter, may prove viable. In the short term, conventional light-water reactors could supply a limited amount of U.S. energy for several generations.

For the long term, fusion power represents an energy alternative that produces no greenhouse gases. Programs in both magnetic and inertial confinement fusion have made significant progress recently.

Little can be done in the short term to minimize carbon dioxide emissions from coal efficiently or cost-effectively. Low cost, high efficiency, and low emissions make electrical generation from natural gas an attractive option for the short run, but inexpensive supplies will become depleted over time.

Fuel cells, both phosphoric acid and carbonate types, will likely bridge the transition period from fossil fuels to renewables and fusion energy. Meanwhile, investment in renewable-energy systems is constrained by frequent regulatory uncertainties and the inherent risk of the investments.

Perhaps the greatest return on investment and easiest way to reduce carbon dioxide emissions is to use less energy. Consequently, Federal, state, and local governments are actively setting standards for improved energy efficiency.

The threat posed by global warming requires a coordinated effort across all segments of society to reduce greenhouse gas emissions. That will require a consistent U.S. energy policy to set priorities for development and use of environmentally advantageous fuels while ensuring adequate supply. In the short and medium terms, no single source of clean energy can totally displace continuing reliance on fossil fuels to meet energy demand.

—Charles W. Lawrence

Charles W. Lawrence (M) has his own public-policy consultancy, based in Teaneck, N.J. This Speakout was adapted from a white paper, "Global Warming—Energy Options for Electric Power Generation," prepared by the Energy Policy Committee of the IEEE United States Activities Board.

Cars will get a real charge from electrified L.A. road

Utilities to build road that gives vehicles juice

New York Times

Electric cars could keep going indefinitely without stopping to recharge under a radical program announced Wednesday by Southern California Edison Co. and the Los Angeles Department of Water.

The utilities say they will spend \$2 million to build a road that transfers electric power from underground cables to cars and buses on the surface, without physical contact.

The idea is to demonstrate how to make electric vehicles commercially feasible and thereby cut air pollution.

The technology could make the range of electric cars almost infinite, the sponsors say, even if only big highways were energized.

On the electrified highway, electric power could be used not only to run the motor but also to recharge small batteries that would power cars between electrified segments. The road could also be used by gasoline-powered cars.

GM says it will build electric car. Back Page

The \$2 million demonstration project would have cables buried in the concrete in 1,000 feet of road that would create a magnetic field. Metal plates on the bottom of electric vehicles would convert the magnetic field back into electricity.

The vehicles would run on ordinary rubber tires and would not look much different from standard gasoline-powered models. One of the first two vehicles, in fact, will be in the body of a GM Rally van. But the vehicles' metal plates that would descend to 1½ to 3 inches off the road surface, depending on the type of vehicle, when power was available.

"The vision is that, as you get up in the morning and go to work, you would travel a few miles on batteries to get to the powered roadway," said Joseph N. Reeves, research manager at Southern California Edison.

"Then, on the freeway, the cables would recharge your battery and provide motive power."

In the Los Angeles area, the sponsors said, freeways make up about 3 percent of the roads, but 51 percent of trips involve some freeway travel. The average distance to the freeway network is two

miles, a distance easily covered by existing battery technology.

If the technology caught on, parking spaces at the curb or in garages might be electrified as well as principal roads, so vehicles could be recharged, the company said.

The process, called magnetic induction, delivers over 90 percent of the energy across the gap between the pavement and the car.

Reeves said one purpose of the demonstration program is to measure the intensity of the electromagnetic field in the passenger compartment.

In recent months, some studies have raised questions about whether exposure to electromagnetic fields has adverse health effects, but Reeves said he does not believe the fields would be a big factor for drivers or passengers.

The road, in a new residential development called Playa Vista, is

supposed to be finished by the end of the year. Two vans and a bus are to be modified to use it, but if the demonstration is successful, electrification would be extended over two miles of roads in the development, to power service vehicles.

The system has been shown to work on a smaller scale at the Institute of Transportation Studies at the University of California, Berkeley.

Electric vehicles are of special interest in Southern California because of severe air pollution problems. The South Coast Air Quality Management District voted in March 1989 to require all cars to run on electricity or other clean fuels by 2007.

The Los Angeles basin has more than 7 million vehicles and the worst air pollution in the nation.

The electric generating stations that would make power to run electric cars also cause air pollution, but generally at far lower levels than what comes from tailpipes.

The technology does not yet exist for electric vehicles for general use. The biggest problem is that their range is sharply limited. Few people are expected to choose electric vehicles until that problem is solved. Electric vehicles now in production can go less than 100 miles without being recharged.

Southern California Edison said the Los Angeles-San Diego region has about 1,700 freeway miles, comprising 12,000 miles of traffic lanes, and the cost of electrifying them would be \$18 billion. While the sum is large, the vehicles in the region travel 100 billion miles a year.

The cost to lay the cable would come to about \$200 per vehicle per year, the company added, and electric cars would have lower operating and maintenance costs. Basic details, like how customers would be billed, have not yet been addressed.

* * *

Automakers have trumpeted their alternative fuel vehicle research with gusto in recent weeks, but President George Bush's stated goal of 500,000 such cars on the road by 1995 would require a much larger commitment than they appear ready to make.

General Motors Corp. has promised to deliver 2,200 variable- or flexible-fuel Chevrolet Corsicas and Luminas to the California Energy Commission by 1992. These cars will run on gasoline, methanol or any combination of the two.

Ford Motor Co. has about 600 methanol-fueled cars in experimental use in California and is planning to ship another 2,000 by the end of 1991. And later this year, Chrysler Motors Corp. will ship 10 Chrysler LeBaron GTC convertibles equipped to burn a mixture of 85 percent methanol and 15 percent gasoline for yet another demonstration program in California.

* * *

At a time when Detroit seems disenchanted with the two-seater car, the Japanese attitude can be summed up in one word:

"Banzai!"

In the past year or so Pontiac has killed the Fiero and Ford has stopped building the EXP. Sales of the Cadillac Allante and Buick Reatta have sagged far below initial projections. And Chrysler's TC by Maserati, which like the Allante is an Italian-American

THE BATTERY MAN/JANUARY 1990

Alternate Energy Transportation

The Newsletter of Technology in Motion
Incorporating Chopper Noise

DECEMBER, 1989
VOLUME 11, NO. 5

BRIEFLY NOTED: The January issue of *Popular Science* covers "Clean Air Fuels for the '90's," but the article is mostly about methanol which it says is "the most likely one to make the trip from the labs to the highways." That's the good news; then they go on to tell all the things that are wrong with methanol, and how they may be dealt with. Global warming, *PS* points out, is only slightly affected by the use of methanol as an alternative fuel. "Of the alternative fuels under consideration, only hydrogen does not produce heat-trapping carbon dioxide when burned." It's an interesting and rather thorough article which we'd recommend you read if you're an alternative nut.

AT LAST, A PRACTICAL ELECTRIC VEHICLE ? The question was posed by the *New York Times* in their report on the national conference conducted by the Electric Power Research Institute (EPRI) in Teaneck, New Jersey, right across the river from New York City, November 13-15. The reporters (and, of course, the attendees) got to look at and ride in two examples of the state of the art of electric vehicles: the "G-Van," based on the GM Vandura, converted by Vehma (about whom more later on) using electrical components supplied by Chloride EV Systems; and the Chrysler Pentastar developed TEVAN, a cooperative effort between the Dept. of Energy (DOE) and EPRI. The G-Van has tubular lead-acid Chloride lead-acid batteries and rear-drive while the TEVAN has nickel-iron batteries (the latest "high energy" version from Eagle-Picher) and front wheel drive. The *TIMES* spotted the Chrysler van as the "higher technology" of the two vehicles on display at the EPRI gathering in Teaneck; but the G-Van is for sale now (albeit for 32 big ones--\$32,000--a copy) while the TEVAN is looked for in three years. The *NYT* says the \$32,000 is "roughly double the cost of a four-cylinder gasoline model."

STATE OF THE ART EV'S is how we described these two vans (above), but actually they are much less sophisticated than the DOE AC vehicles, ETX-II (AET Dec '88) and DSEP (Dual shaft electric propulsion; the ETX-II is single shaft). The selection process for a battery for an improved version of DSEP was described in AET October '89.

AS EXPLAINED IN THE ARTICLE ON Teaneck, air quality and global warming are beginning to take precedence over performance and price in

the consideration of the electric alternative to gasoline (admittedly, EV's don't rank too high in those two categories). In connection with the Teaneck meeting, EPRI released some figures which show how three alternatives shape up in comparison to gasoline. Figures for EV's represent power plant emissions, based on the mix of coal, oil, hydro and nuclear plants in current use. Gasoline figures assume 17 mpg.

	<u>EMISSIONS IN GRAMS/MILE</u>			
	<u>Electric Vehicle</u>	<u>Natural Gas</u>	<u>Methanol</u>	<u>Gasoline</u>
HC	0.01	0.19	0.56	0.70
CO	0.01	0.10	1.50	9.00
NO _x	0.08	0.44	0.48	1.10
CO ₂	200.00	500.00	750.00	700.00

It can be seen that EV's have a much better case, even when you count in the emissions from the power plant whose energy charges the batteries. Actually, EV's produce no pollution at the point of use, and power plants are not running around by the millions on the city streets.

EPRI, WITH THE HELP OF EVDC, HOPES TO SELL 500 G-Vans next year. Nowhere near so modest, the Los Angeles Electric Vehicle Initiative is looking at thousands. "10,000 electric cars slated for S.Calif. in next 5 years," said a headline in the trade journal *Automotive News* for November 20,1989. The Los Angeles group has selected three companies to supply these vehicles. We reported in last month's AET that the French automaker, Peugeot,S.A., was the only automobile manufacturer to respond to the L.A. initiative. Well, friends, Peugeot was not one of the three selected, who were: Vehma International, Troy, Michigan, a subsidiary of the Canadian auto parts giant, Magna International; Unique Mobility of Englewood, Colorado, and Clean Air Transport (CAT) of Goteborg, Sweden. You'll recall we mentioned Vehma on page one as turning Vandura's into G-Vans, using components from Chloride EV Systems (once known as Lucas Chloride EV Systems, or LCEVS). Vehma is expected to supply 3000 G-Vans to the L.A.program.

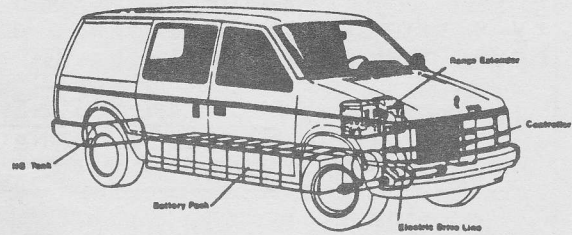
UNIQUE MOBILITY, WHOM we have known for several years as the supplier of EV's to the DOE's "demonstration" program, the ElecTrek, which was the only vehicle in that program which was designed and made from the ground up as an EV (the rest were converted gasoline cars)--Unique Mobility is expected to supply about 3000 minivans to the L.A.program, using a Dodge Caravan as a base. This van will have an ICE-powered generator to extend range between recharges, described on page 3.

CLEAN AIR TRANSPORT (CAT) of Goteborg,Sweden (about whom we know nothing at this time) is expected to sell about 4000 commuter-type passenger cars. CAT builds its own bodies.

LOS ANGELES, ACCORDING TO THIS LATEST NEWS ARTICLE, "will not directly buy, sell or market" the electric vehicles. Rather, the role of the city initiative is to get makers and customers together, and to coordinate subsidies to make electric vehicles economically attractive (Ed.

Note: What subsidies ?). So this program goes soaring ahead without, as the old saying goes, any visible means of support.

UNIQUE MOBILITY'S VAN for the L.A. program, designated UNIQ Model M-90 (prototype), is a Chrysler T-115 minivan converted to battery electric drive with a 5 kW liquid propane fueled range extender. The batteries are Johnson Controls (JCI) GC12V100 gelled electrolyte lead acid abd there are two packs (108v. each) of nine 12v modules. The system voltage is 108. Maximum speed is stated to be 70 mph, 0-30 in 8.5 seconds, range on the J227a cycle: 100+ miles with range extender. The engine generator (Honda model GX360KI) is a 12 hp 4-cycle water-cooled ICE driving a UNIQ alternator which has a nominal 5 kW rating. It typically operates less than one-half of normal driv ing time except when the air conditioner is running.



LAST MONTH WE DESCRIBED A 1973 hydrogen powered car which we said had two humongus hydrogen tanks on the roof. We were wrong. There

were SIX tanks of compressed gas which the developer said weighed 175 lbs (doesn't sound like enough to us). The tanks contained 600 cubic feet of hydrogen, said to be equivalent to 33 kWh. The automobile was originally an Austin A-40. The story of this car operated on compressed gas

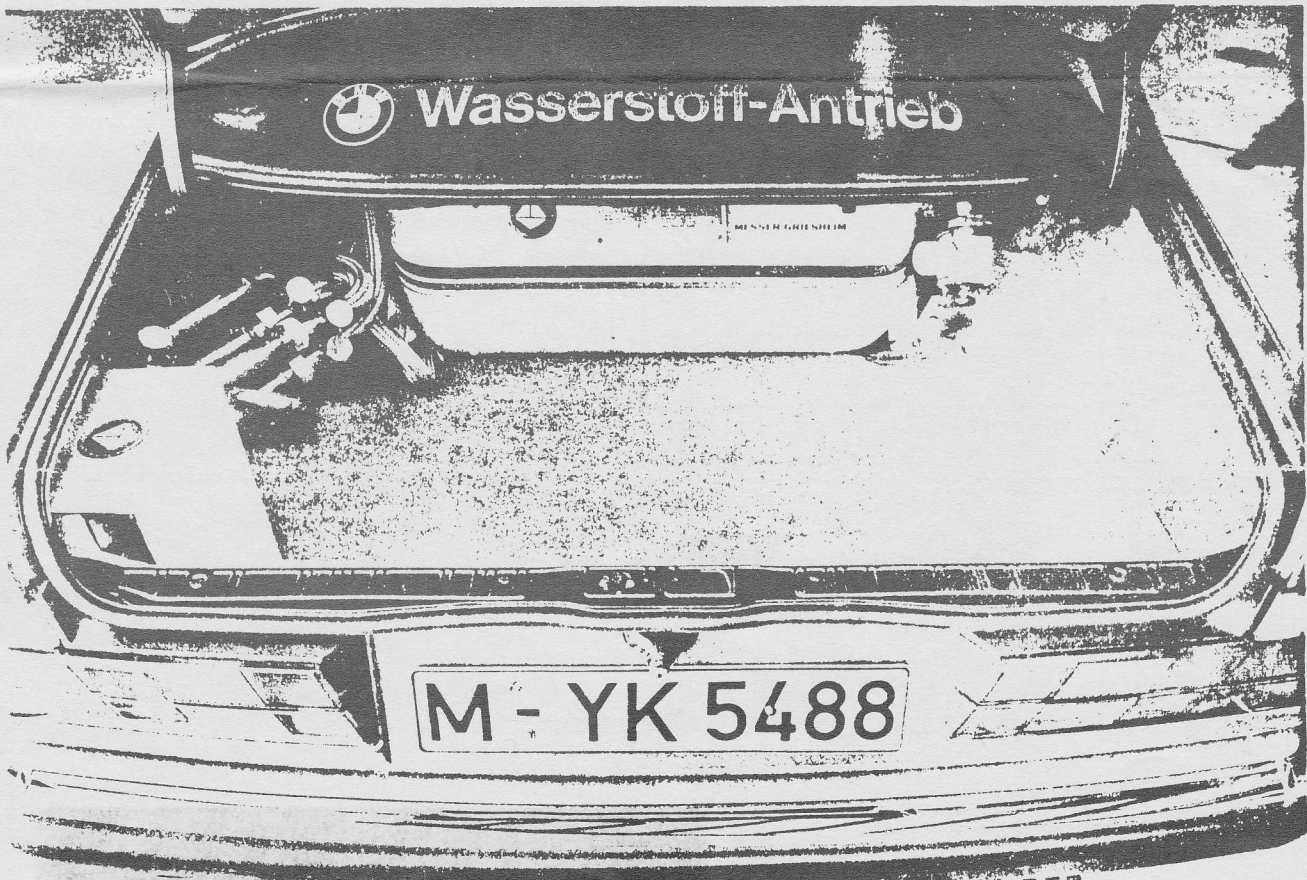


(hydrogen) can serve as an introduction to an up-to-date story on a BMW developed to run on liquid hydrogen.

THE BMW STORY IS IN THE October, 1989 issue of *Mechanical Engineering*, the magazine of the American Society of Mechanical Engineers (ASME) in an article called "R&D in the Fast Lane." Fossil fuels which are used in the conventional internal combustion automobile engine have an adverse effect on air quality and produce greenhouse gases (see table on page 2 of this AET Newsletter). In addition, they may also soon become scarce. Hydrogen, on the other hand, is solar-derived and burns cleanly without emitting carbon dioxide or volatile organic compounds. As we (AET) said last month, "it produces almost

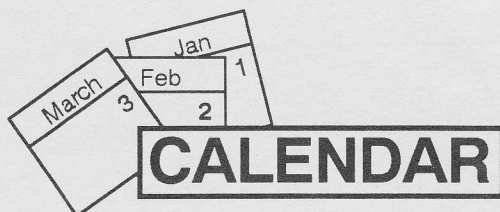
nothing but a gentle puff of steam." In its research, BMW has converted several of its 735iL sedans with 3.5 liter six-cylinder engines, top operate on either hydrogen or gasoline. A flip of a switch accesses either gas, or hydrogen from a specially built cylindrical, superinsulated tank installed in the trunk of the test car (see illustration below). Cryogenic hydrogen is used in the test car because it performs best in a reciprocating engine and is less hazardous than hydrogen in gaseous form (*Ed. Note:* No mention is made of the method of bringing hydrogen down to the cryogenic state, nor of the cost of doing so). The cryogenic hydrogen is injected directly into the combustion chamber, where it mixes with air. Many steps have been taken to manage cryogenic requirements and the safety hazards of hydrogen.

A SPARK IS NEEDED FOR IGNITION as in gasoline engines. BMW uses a mechanically driven centrifugal supercharger to make up for the hydrogen engine's lower power output. Nevertheless, power is about 30 percent less than in the standard 735iL six cylinder. Paradoxically, hydrogen has the highest power-to-weight ratio of any fuel but because it is the lightest element (the least dense) it requires approximately four times the space for an equal amount of energy. Also paradoxically, although it is the most abundant material on earth, the cost of producing it in isolated form by presently used methods is very high. Significantly, perhaps, BMW is not waiting for production methods to mature before it tests H₂ as an auto fuel.



Hydrogen tank in the trunk of the 735iL. The tank's 25 gallons of hydrogen provide a range of about 300 km. (*Chemical Engineering*)

Alternate Energy Transportation



AMERICAN TOUR de SOL May 23-27 1990 5 Day race through New England

June 25-30 Tour de Sol '90 SWITZERLAND

JULY 8-19,1990 GM SUNRACE USA, Orlando,FL to Detroit, MI

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