Electric Auto Association NEWS

December 1990 Vol. XXIII NO. 12

THE FUTURE OF THE EAA

Why am I talking about the future of the EAA when things are picking up? Attendance is increasing. Interest is growing. So what's the problem?

Since I joined the EAA in 1971 I have seen little in a way of a sense of direction or a cohesive plan to accomplish our stated goal of the promotion of the use of electric cars. Sure, we provide literature, technical aid and education at our monthly chapter meetings. And in 1972, we started a tradition of the Annual Rally which is the single event that contributes to our goal. In the mid-80's we added a symposium the day after the Rally (which didn't happen this year). And in '88-'90 the EAA with a portion of its members contributed to the Hybrid Vehicle Project.

They are all fine promotional accomplishments. But how many of the public at large are reached by them? Perhaps 200 at the last Rally, but many of these already were interested. We tried to interest the press, and with few exceptions they have treated us like missionaries knocking on their doors. We have been enthusiasts trying to convince the public that we have the key to their salvation. People usually look at such things with a jaundiced eye. (Why are they trying to save/help me? What's in it for them?)

We have always been outsiders trying to drag others in to our group. I submit that this is the wrong attitude. I am not saying that we shouldn't try to reach out to the public but that we should provide more services to our members so that we become an "in crowd" that outsiders (the public) want to join.

I have been wondering why many of our longtime pioneer members do not attend meetings. I think it 's because there is little new technical information for them and we offer few/no other services to them than comradarie. Fortunately, we are gaining some new members with fresh enthusiasm and ideas. We have got to nurture this and take advantage of it for our collective benefit. Therefore, I have come up with a list of services that the EAA as a whole and/or the chapters can or should consider providing its members. This is only one afternoon's thoughts and I hope the membership can add others to it.

- Handout of parts sources: electronic, mechanical.
- Tabulation of popular conversions
- Battery purchase coordination
- Coordinate shopping center displays
- Provide free charging at meetings
- Use/rental of test equipment and/or instruments
- Battery testing services
- Equipment/method for testing low speed rolling resistance
- Equipment/method for testing high-speed rolling resistance/drag
- Equipment and car reviews in the newsletter
- Letters column in newsletter
- Motor testing service
- Training symposium on conversions

To do some of these things requires money. Fortunately the Santa Clara chapter has some money as we did not lose money on the Symposium this year (There was no symposium!) This thought struck me. Why should we be losing money on the Symposium and Rally? I think that the Symposium should make us money so that we can provide the above services. And if we need more we plan how to make more.

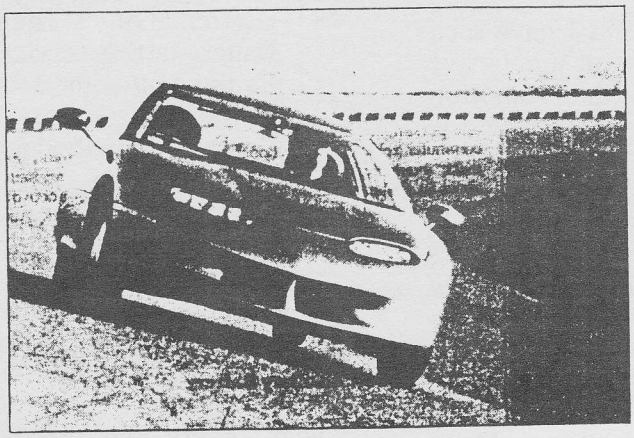
We have always worked from an attitude of limits. What do we have to spend? Little. Therefore, we can do little. I submit that we need to turn that on its head and say, 1) what will it cost to do what we want? 2) how do we raise that amount? I have several thoughts on both the Rally and the Symposium.

First of all, the Rally should be close to self supporting and the Symposium should bring in money. I feel that both can be done if we make it worth while for people to attend. Perhaps, cash prizes in addition or in place of the awards for the Rally. After all it is a lot of work to bring your car to the Rally. Why not offer at least a chance of making it pay off? Why not charge for attendance at the Symposium if the speakers make it worth your while?

I think that these are some possible new directions for the EAA that we should consider. Talk these ideas out at the chapter meetings and amongst yourselves. Then let me hear from you, by letter at 1968 Elden Dr. San Jose, CA 95124 or call me at 408/371-5969. I will try to tally up the responses and report back via the newsletter.

Electrifying thoughts to you,
Pb (Paul Brasch) 11/20/90

by Frank Quaratiello



It's electric

For years, Midpeninsula inventors have been tinkering with electric cars, but with rising gas prices and the plague of pollution, they may be ready to cruise into the limelight at last

Thomas Davenport built the first one in 1834. At the turn of the century, electric car sales outnumbered sales of gasoline-powered autos by 16 percent. Back then, though, steam-powered cars still were number one.

Electric cars had their heyday in 1912, when—with 34,000 registered in the United States—they made up a large part of the fledgling horseless-carriage market. But shortly thereafter, the invention of the electric starter for gasoline-powered cars and the introduction of Henry Ford's inexpensive Model T led to the downfall of the electric-powered vehicle.

Since then, even though electric cars have been overshadowed by their gasoline-powered counterparts, inventors have silently and patiently worked in their garages and workshops on weekends to improve the speed and distance capabilities of these automotive ugly ducklings.

At Palo Alto's Electric Power Institute (EPRI), engineers whose research on electric vehicles was ignored for years by American automakers, suddenly have become the darlings of Detroit.

Stories about Silicon Valley's tinkerers sparking the computer revolution are legendary. In much the same way, local inventors, including EPRI's engineers, are the driving forces for electric-car research in the country today. And with rising gas prices and heightening environmental concerns, the unusual cars may be ready to cruise out of the garage and into the limelight at last.

John Reuyl, a visiting scholar at Stanford University, is working on

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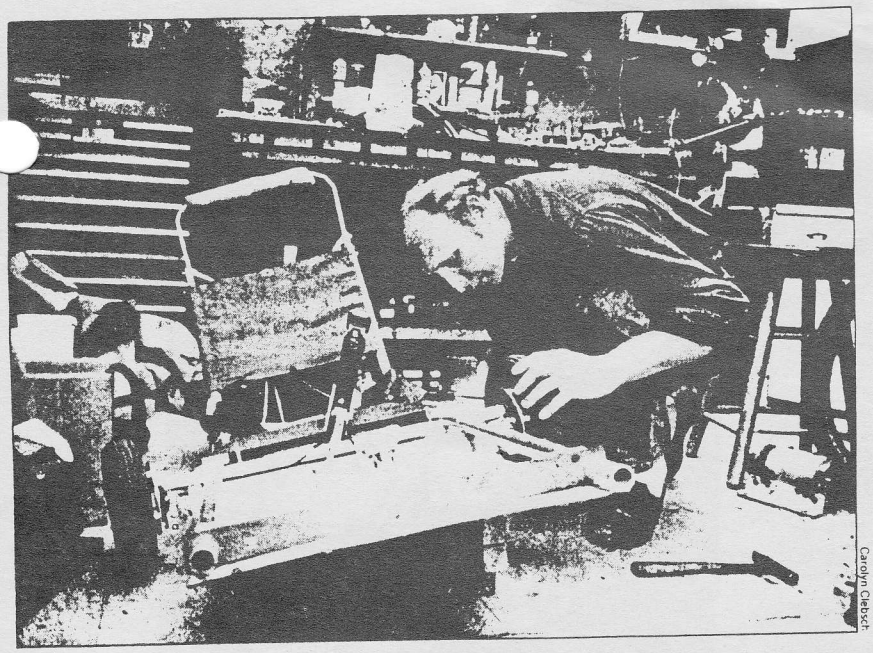

Carolyn Gletsch

Palo Alto inventor Bob Schneeveis adjusts the wheels on his portable, do-it-yourself electric vehicle. He hopes to get high school shop teachers enthused about building them in class.

Electric cars

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a hybrid electric vehicle in an empty warehouse in south Palo Alto. He hopes the car, which is powered both by electricity and gasoline, may soon revolutionize Americans' mode of personal transportation. The car would overcome the distance limitations that hamper most electric vehicles, but runs on gasoline only after the electric charge has run out, thus keeping the environmental benefits in the forefront.

Bob Schneeveis, a science and engineering associate at Stanford Medical School, drives an electric three-wheeler from his home in Palo Alto to work every morning. Schneeveis is currently developing one-person, lightweight electric commuter vehicles that he hopes to make available to consumers for about $1,000 each before long.

Gary Purcell, project manager for EPRI's electric van project with the Chrysler Corp., has been working on electric cars for the last five years. He recently saw his team's work on Chrysler's electric TRVan cited as one of the outstanding developments in automotive technology for 1990 by the editors of Popular Science magazine.

At Stanford, the student-run Stanford Solar Car Project developed a vehicle called the SunsUrfer that placed seventh in last summer's General Motors-sponsored "Sunrayce" from Florida to Detroit. Students are now working on a new design that will incorporate some of the knowledge gleaned from the race.

These local innovators join a long list of California electric car owners and enthusiasts. Although not readily apparent, some 36,000 electric cars are registered in California today, according to the DMV. The Electric Auto Association, founded in the late 1960s, mails out monthly newsletters to 500 members around the globe and has very active chapters in California.

The differences among the cars being created by local inventors give an idea of the variety of ways that electric car designers have been trying to overcome design challenges for more than a century. For electric car enthusiasts, major breakthroughs have been few and far between.

A 1901 electric car set a non-stop distance record by traveling 192 miles on a single charge. That record still stands. The speed record for electrics was set on Aug. 23, 1974 by Roger Hedlund, a member of the Santa Clara County chapter of the Electric Auto Association. His electric racing car, the "Battery Box," dispelled the myth that electric cars are slow by clocking in at 175 mph.

Now, the hard work and development by die-hard electric car owners is about to pay off.

Increased concern for the environment, rising gas prices, tougher emission control legislation, and plans by General Motors and other major automakers to introduce electric car models suggest that electric vehicles may once again enjoy their place in the sun in this country. In many urban areas, such as Los Angeles, the problems caused by auto emissions already have reached epic proportions. People are sick and tired of being able to see the air they breathe.

This disgust has led to calls for tougher emission controls in California and around the country, including the California Clean Air Act of 1988 and this year's amendments to the national Clean Air Act of 1970.

With the crisis in the Persian Gulf driving up oil prices, electric vehicles may soon be as attractive economically as they are environmentally.

Some environmentalists argue that electric cars, while emitting zero pollutants, only "push the pollution back to the power plant." But Paul Brasch, president of the Santa Clara County chapter of the Electric Auto Association, calls that "nonsense."

Electric motors are at least five times more efficient than gasoline-powered internal combustion engines at doing work, so they use less energy, he explains. In addition, they make it possible to reduce pollution at one source, the power plant, instead of trying to reduce it from thousands of tailpipes, he adds. Electric cars can run just as easily on wind or solar-generated electricity if power companies decide to use those renewable resources to generate energy or if people put solar collectors up on their roofs, according to Brasch.

Emission controls prescribed in September by the California Air Resources Board may not only make electric cars a reality, but a necessity.

Electric cars are our first baby step into the future of renewable energy-source transportation, with solar car technology following closely on their heels, Brasch notes.

Both electric and solar cars are powered by electric motors. The difference is that electric cars need to be plugged in and recharged, while photovoltaic cells attached to the solar cars provide them with a self-sustaining source of power.

Last summer's General Motors-sponsored "Sunrayce" was not the first solar car race ever held, but it received widespread press coverage that brought solar cars to the attention of the American public. That race came on the heels of General Motors' triumph in the World Solar Challenge with GM's "Sunraycer" vehicle and the company's decision to introduce an electric car model, called the Impact, into the United States market.

General Motors unveiled its prototype for the Impact in Los Angeles last January and, though GM will not say when the car will be available for consumers, it is expected to be at dealerships within a few years.

That may be just in time to capture the market that will be created by California's tougher emission standards.

For decades the revival of electrics has been a dream for American electric car owners. Now, emission controls prescribed in September by the California Air Resources Board may not only make that dream a reality, but a necessity.

The standards demand that new cars cut emissions by 75 percent by the year 2003. The regulations also require that 10 percent of the cars sold in the state in 2003 must not emit any gases. In other words, with current technology, they must be electric-powered.

This new generation of standards will spur industry to move forward, but they should be able to be met technologically, according to Bill Sessa, spokesperson for the board.

In fact, were it not for the California legislation, interest in electric cars probably would still be limited largely to scientists and hobbyists. "The state legislation led the way," confirms Gary Purcell, who heads the electric minivan project at EPRI. "The car companies weren't interested at all (in electric vehicles) at all until this legislation came along."

While the Clean Air Act puts California on the cutting edge of emission controls, Palo Alto already is on the cutting edge when it comes to developing the technology that can meet the new standards.

The city is home to several electric car owners; EPRI has been a pioneer in electric vehicle research; and Stanford University is home to one of only about 32 solar-powered cars in the country.

While electric cars may seem like a new phenomenon here, they're already popular in developed countries outside the United States, said Reuyl, who is working on the combination electric-gasoline car. In Italy, Switzerland and France, it's not uncommon for commuters to drive electric cars to central parking lots, plug them in to recharge and then take electric trains to work, according to Reuyl.

Just having electric cars for those short trips makes a huge difference in terms of pollution reduction, Reuyl noted.

He cited a Volvo study which found that most automobile emissions— about 85 percent—are released during the first five miles of a trip when the engine and the catalytic converter are cold.

But it has taken Americans a long time to come around to accepting the idea that electric cars may be viable, and many Americans are still not convinced.

Reuyl, who has been working with his team on the Hybrid Electric Vehicle Project since February 1989, said he decided to concentrate on hybrids because informal surveys he did showed that American consumers were not interested in cars with limits.

"People we talked to said they would not buy a car that would only go 20 miles or 50 miles or even 100 miles on a charge," Reuyl says. "What about that 101st mile? they asked. That last mile is a long push."

Reuyl's project receives funding

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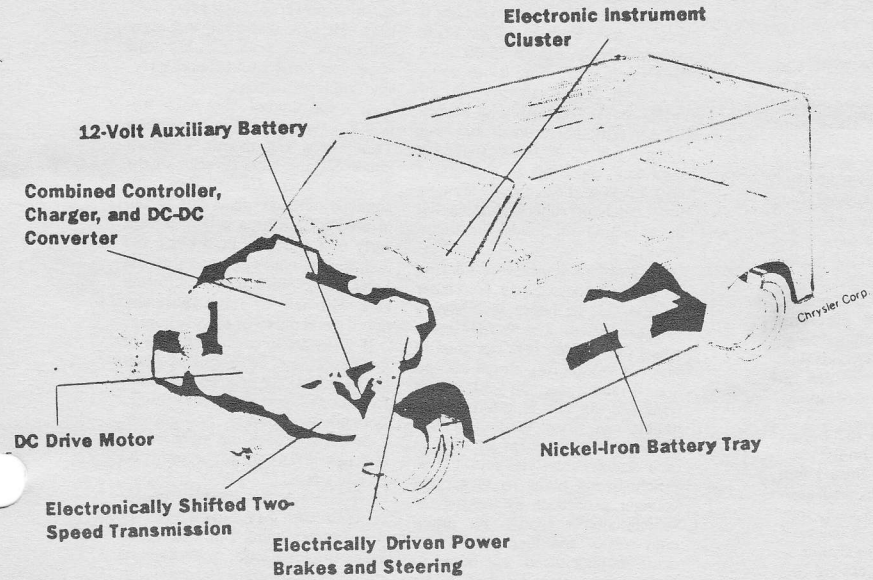
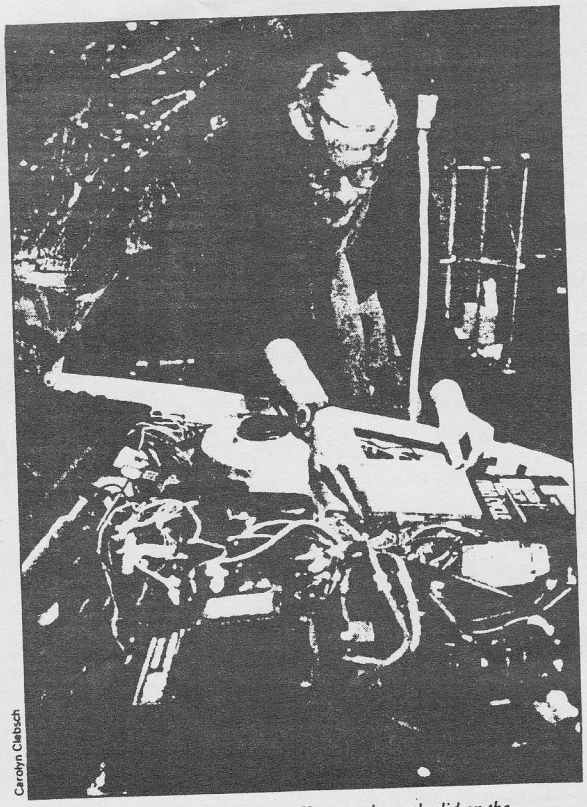


The Chrysler TEVan is a high-performance electric minivan created as a joint effort by Chrysler and Palo Alto's Electric Power Research Institute (EPRI).

Carolyn Clebsch

Bob Schneeveis drives off in his converted electric 1965 BMW motorcycle. He's been driving electric vehicles since the gas crisis of 1972-3.



Carolyn Clebsch

Stanford graduate student Niki von Huetz replaces the lid on the computerized monitoring system in this hybrid gasoline/electric car. Von Huetz helped develop this system as student coordinator for the Hybrid Electric Vehicle Project.

Electric cars

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from the California Energy Commission's Energy Technology Advancement Program and from Chevron Corporation. Reuyl and his team have spent $205,000 and 10,000 person-hours to convert a 1988 Chevrolet Corsica so that it can be powered either by electricity or gasoline. The car is a working prototype that Reuyl has already used in demonstrations and that served as a chase car for the GM Sunrayce. Currently, Reuyl and his team are testing different batteries and different internal combustion engines to find out which ones will work best.

Reuyl, who became interested in alternative transportation while working for the Jet Propulsion Laboratory in the 1960s developing NASA's solar-powered lunar rover, plans to form a corporation that will convert gasoline-powered cars into hybrids. He says that carmakers can't afford to do this until they have a guaranteed market and, in the meantime, his company could make great strides.

There are several popular car models that are particularly conducive to hybrid conversion, Reuyl says. He deliberately converted a popular model, General Motors' largest seller, the Corsica, to dispel the myth that electric vehicles have to be "small, underpowered and funny-shaped."

"The technology to resolve issues like metropolitan air pollution, worldwide environmental degradation because of greenhouse gases and the need for a transfer to renewable energy sources is much closer than most people know," Reuyl says.

EPRI's Purcell agrees. "They are here and you'll see a lot of them toward the end of the decade," he says. The EPRI-Chrysler vehicle, although still in the development stage, is a six-passenger, half-ton minivan that can go up to 120 miles on a single charge using advanced nickel-iron batteries.

There seem to be as many ideas about electric-powered vehicles as there are inventors and owners.

"The biggest obstacle to electric car use is not distance limits or speed," says Brasch of the Electric Auto Association. "With current technology, electric cars can do everything we need them to do. The biggest obstacle is changing the mindset of the public."

The decision by companies such as General Motors to come out with an electric car model will help do just that, Brasch explains.

"We are at the same point now with electric cars that we were at in 1980 with personal computers," according to Brasch. "There were personal computers around in 1980, but many were just being used for games. As soon as IBM put its initials on personal computers, it legitimized the whole industry. GM will do the same thing with electric cars. The GM Impact can remove the 'golf cart' stigma associated with electric cars now."

The Impact is an electric-powered two-seater designed to go from 0 to 60 mph in 8 seconds with a range of 120 miles between recharges, according to GM spokesperson Dave Sloan.

But Schneeveis says the Impact will have a bad impact on the electric car industry. The Impact is a sports car, he contends, and electric cars are not sports cars, they are commuter cars. In Schneeveis' opinion, electric vehicles should be small and light. Most cars are driven only 20-25 miles a day, he notes.

Schneeveis has been driving electric vehicles since the gasoline crisis of 1972-73.

"I was waiting in a gas line in my big, old Lincoln and a guy drove by the line in an electric car with a big grin on his face," Schneeveis remembers. "I decided right then that I wasn't going to buy any more gas until the price went down. I designed my first electric vehicle while I was sitting in that Lincoln waiting in the gas line and I had it built in six weeks."

Schneeveis' first electric vehicle was a converted motorcycle. Unlike many electric vehicle owners who just want a car that runs on electric power, Schneeveis favors vehicles that are light and small.

His latest electric vehicle is a converted 1965 BMW motorcycle. It's actually a hybrid, with both an electric motor and a small gasoline engine. The EV, which looks like a mobile desk because of its white Masonite body, can go 55-60 miles on a single charge and it can travel at 75 mph, Schneeveis said.

"It cooks," he says with a grin. "I don't usually drive it fast, but when I pull up at a stop sign or a light and people tell me they heard EVs are slow, I don't mind laying a little patch of rubber and leaving them behind to decide for themselves."

Currently, Schneeveis is working on a 93-pound electric commuter vehicle that he hopes will have a 30-mile range and a maximum speed of 60 mph. It is designed to seat one person in a closed cockpit and is small enough—30 inches wide and six feet long—that commuters can wheel them into their offices and plug them in next to their desks, Schneeveis says.

Schneeveis plans to target the younger generation by making the vehicle simple enough for junior high school and high school students to understand. He hopes to interest shop class teachers in his creation.

"Junior high school and high school students can build these in shop classes," he explains. "Then, on weekends, they can hold races in the school parking lots and this will stir up their competitive interest and raise their awareness."

Mike Brown, another member of the Electric Auto Association, has put together a do-it-yourself guide detailing how to convert your gasoline-powered car into an electric-powered vehicle. The guide uses Larry Burrieschi's 1977 Plymouth Arrow as a conversion model. Burrieschi, an employee at Lockheed in Palo Alto, drives his electric Arrow to work every morning.

Brown has been more than just a fan of electric cars for some time. In 1979, he formed Electro Automotive, a company that supplies parts and technical support for individuals who want to convert their gasoline-powered cars into electrics. He's served as a volunteer consultant for both the Stanford Solar Car Project and Reuyl's Hybrid Vehicle Project.

At a meeting of Bay Area Action's Alternative Transportation Task Force last month, Stanford junior Stefan Heck, director of the Stanford Solar Car Project, announced tentative plans last month to hold a California solar car race early next summer. Both Heck and Schneeveis, who also works on the Solar Car Project, feel a California race will help to raise awareness about the viability of electric cars.

If you want to catch a glimpse of the future, ask for a look at Stanford's SunsUrfer or keep a lookout for Schneeveis' electric vehicle. Both are hard to miss.

Schneeveis says the sight of his EV never fails to put a smile on people's faces.

"I don't know whether people smile because they think it's neat or because they think I'm crazy," he says. In either case, Schneeveis is in good company. Before long, many more environmentally-minded, gas price-conscious commuters may be joining the ranks of those who plug their cars in instead of filling them up. ■

FYI: Bill Wason of Environmental Solutions in Berkeley, CA has recently contacted the EAA. We are printing excerpts from his letter. If you find this interesting, feel free to contact Bill directly.

Enclosed is a draft study proposal to examine how incentives to businesses and coordinated government planning could lead to major purchases of zero emission carpool vehicles in LA Basin in 1996-99. The study would consider a package of incentives (offsets, tax credits, rule waivers) that could be developed in considering mobile and stationary source control requirements in a given year (1995) that would be offered to businesses in return for a commitment to purchase zero (or ultra-low) emission vehicles for carpool or fleet use. If 100,000 vehicles annually could be pre-sold to businesses based on these incentives, the District could seek competitive bids from major automakers to enter into full scale production of these vehicles. If commitments were obtained in 1991, automakers could design and begin tooling up for large scale production based on a defined market need and purchase commitment. This momentum would allow the CA Air Resources Board to accelerate zero emission vehicle sales requirements. It would also provide businesses with an alternate air quality control strategy that might be less expensive and more effective in both maintaining economic development and reducing overall air pollution in the Basin.

The study would also consider how to account for increased emissions from electric power plants if a major effort is made to use electric vehicles in commuter transportation. The study would evaluate how existing demand side management efforts could be doubled or tripled or renewable supplies used to offset new load growth from electric vehicle introduction. A system of conservation offsets for businesses might also be incorporated as an option to increase end use efficiency and account for additional electric use.

The study would require comprehensive multi-agency coordination to consider numerous issues that are now under discussion. Problems with allowing mobile source offsets to be applied to stationary source emissions would have to be addressed (i.e. verifiability, sustainability). Problems with discounting of emission credits over time would have to be considered. There are also numerous SCAQMD Rules and Regulations (Rule 1601, Regulation 13 and 15) that would have to be incorporated into a comprehensive emissions reduction package.

The intent of this approach is not to just complete a study that sits on a shelf. The idea is to have a package of incentives and a vehicle identified and go to businesses after the study and obtain preliminary purchase commitments. It would also be a tool for evaluating rule changes and considering a comprehensive planning strategy to get various agencies to work together to achieve a specific air quality objective. It is an ambitious project that might require at least a year of coardinated efforts of agency personel and various consultants. The project is in a preliminary phase of discussion and evaluation. I am seeking comments from various agencies and organizations to further refine the project and pursue project funding. Your input and assistance would be very much appreciated. If you have questions or comments you can reach me at (415) 658-4686.

Bill Wason
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The Last Big Problem With Electric Cars

By Charles Petit
Chronicle Science Writer

Richard Hongisto, San Francisco's newly elected assessor, loves his electric sports car, a $12,000 fiberglass coupe that can hit 65 miles an hour on the freeway.

"I really got it charged up one day and ran it out to the Golden Gate Bridge, then out to Army and Valencia, then back to City Hall, then to the bank at Sacramento and Van Ness, and then I went home," he said.

But when Hongisto went to an assessors' meeting in Modesto the other day — the sort of long drive that car-loving American drivers occasionally take — he drove his giant four-door Lincoln Town Car, which floats along at about 10 miles to the gallon. His electric car has only a 60-mile range before its batteries run down.

Hongisto is a one-man summary of the challenge to electric cars, which are drawing attention from car makers, smog regulators and drivers — all looking for a way to cut down on tailpipe exhausts without ending the nation's love affair with the open road.

"Zero emission vehicle" standards adopted by the state Air Resources Board on September 29 demand a 70 percent decrease in emissions of hydrocarbons and other smog-causing chemicals by all cars by 2003.

The board also required that nonpolluting cars and trucks account for 2 percent of sales in 1998 and 10 percent by 2003. California's laws may start a national trend.

But despite such powerful directives, researchers say it will probably be well into the next century before electric vehicles approach the performance, reliability and low cost of conventional fuel-burning vehicles.

The main obstacle is the electric battery, which is heavy, expensive and quick to lose its power. Hongisto's fiberglass two-seater, which comes with 16 lead-acid batteries, cannot go much more than 60 miles before it needs an eight-hour recharge. To accomplish that during the night, he has draped a 110-volt extension cord over a tree branch above his parking spot.

Storage Is the Problem

"Tooling up to make electric vehicles is not a problem," said Albert Chilenskas, a physicist and battery researcher at the Argonne National Laboratory near Chicago. "Most of the components such as suspension and controls are right off the shelf.

"Electric motors are no big deal. The stumbling block is simply finding a way to store the energy."

Even the smallest electric cars may carry 800 pounds of lead-acid batteries, and van-sized vehicles have a ton of them slung under their chassis in trays as big as box mattresses.

"My feeling is that there will always be some sort of premium price to be paid for an electric versus a gas car," said Gary Purcell, manager of electric vehicle research at the Electric Power Research Institute in Palo Alto, a facility maintained by the electric utility industry.

"The place to start a market for them is with vehicles where a long range is not important and that don't need to be refueled instantly," he said.

Delivery Vans

Purcell's utility-supported institute is deep into a partnership with several manufacturers to build and sell urban delivery vans, based either on full-sized General Motors vans or Chrysler Corporation mini-vans.

The modified General Motors vans cost about $32,000 each and have a range of 60 miles. They expect to sell 1,500 by the end of next year.

Purcell cites a study that concluded that of the 428,000 delivery vans sold each year, nearly 40 percent go less than 60 miles a day and that 80 percent go less than 90 miles daily.

Similar considerations lie behind the unveiling by General Motors earlier this year of its "Impact" electric car. The company says it hopes to put a version of the streamlined coupe on sale for $20,000 by the mid-1990s and asserts that it can go 125 miles between charges, can be re-charged in two hours, and will go up to 110 miles an hour.

Many American experts fear that the people to invent, produce, and profit from advanced batteries will be the Germans, the Japanese or the British because their countries forged ahead in the 1980s while the Reagan administration slashed government support for alternative transportation.

"I'm not confident the U.S. will lead in batteries unless we see more executive leadership in government," said Gerald H. Mader, president of the Electric Vehicle Development Corp., a utility-financed consulting company in Cupertino.

"And I don't think there will be any bona fide mass-produced car for five years or so," he said. "We're a long way, as an industry, from really becoming mature."

The cars available now, he said, are just one step up from what hobbyists build in their garages.

Two Waves

No matter who makes the batteries, experts such as Chilenskas and Robert Swaroop, head of battery development at the Electric Power Research Institute, see two waves of new devices coming.

They expect them to culminate with affordable and fast-charging "super batteries" that can store several times as much energy as batteries today.

The names of battery types reflect their main ingredients. Lead-acid batteries, similar to those now used to start a gas or diesel car, offer the only immediate practical route to full-time electric cars.

Nickel-iron batteries, which store about 30 percent more energy, are apparently a few years off and will not make a dramatic difference. Nickel-cadmium batteries are also close to ready, but the high cost of cadmium may make them too expensive for wide use.

Another candidate is the "molten salt" battery, which must be kept at more than 700 degrees Fahrenheit. Potential varieties include sodium-sulfur batteries and lithium-iron sulfide batteries, the latter a favorite of Chilenskas at Argonne, where he has worked on them for 20 years.

"It won't work unless it is hot," Chilenskas said. "So you have to insulate it." He thinks a molten salt battery pack could be surrounded by a sort of thermos bottle that would keep it hot for weeks.

Although recharging may always take much longer than filling a tank, scientists and engineers ponder alternatives. Perhaps service stations workers could simply remove a tray of exhausted batteries and insert fresh ones.

"You wouldn't own your batteries, you'd lease them from the power company," Chilenskas said.

Further down the road by 10 or 15 years may be the real super batteries, said Swaroop's report at the Electric Power Research Institute. One is something called a lithium-polymer battery, under development and patented at the University of California's Lawrence Berkeley Laboratory.

They could store even more energy than molten salt batteries but would work at room temperature and would weigh far less.

"I have no doubt that some kind of battery is going to make electric cars fully practical," said Frank McLarnon, an electrical engineer at the Lawrence Berkeley lab. "We don't know which it will be, but it will come."

OVER HALF OF AUTO TRIPS ARE LESS THAN 5 MILES

It is staggering to imagine the number of trips the nation's 118 million licensed drivers make in their vehicles each year. It numbers in the billions since Americans depend almost exclusively on automobiles for transportation.

Surveys indicate that 54 percent of trips are less than five miles and over 70 percent less than ten miles. Less than one percent of trips by car involve one-way travel of 100 miles or more, yet account for 17 percent of total vehicle travel.

Of all passenger car trips, nearly 37 percent are made in earning a living, including 32.3 percent traveling to and from work and another 4.4 percent for business related to work. Visits for medical and dental treatment and shopping trips, account for more than 31 percent while social and recreational use is responsible for 22 percent.

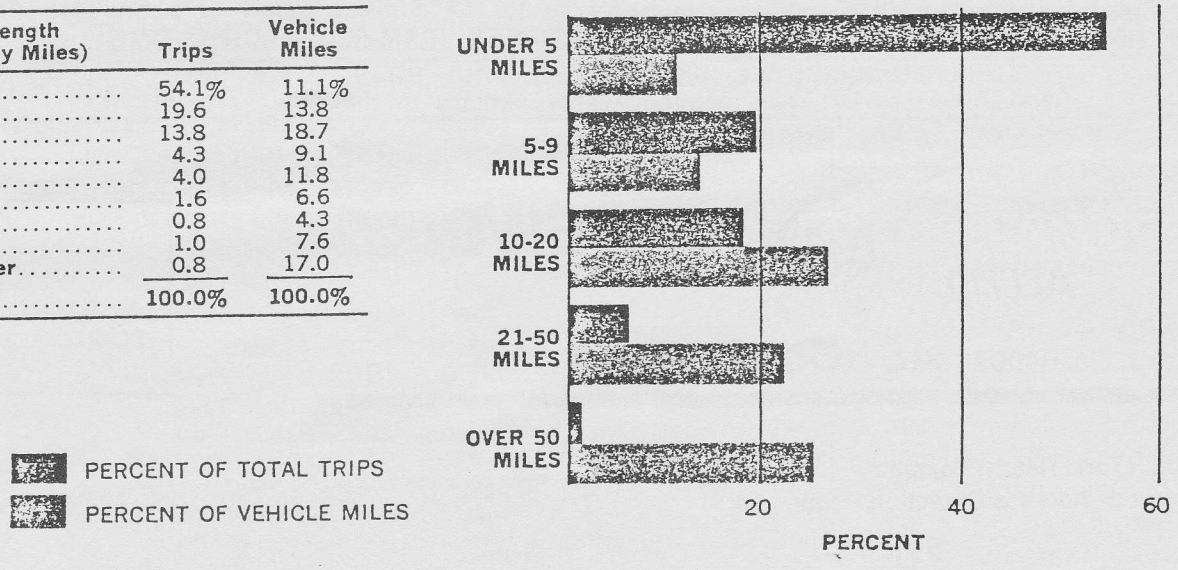
Studies of auto fuel economy indicate that a short trip rates low in gasoline efficiency. During one test, a vehicle started cold and driven 4 miles got an average of 8 miles per gallon; when warmed up fuel economy rose to 12.8 m.p.g.

PASSENGER CAR USE

Purpose of Travel	Percentage Distribution Trips	Travel	Average Trip Length One-Way (Miles)	Average Occupants Per Car
Earning a living:				
To and from work	32.3%	34.1%	9.4	1.4
Business related to work	4.4	8.0	16.1	1.6
Total	36.7	42.1	10.2	1.4
Family business:				
Medical and dental	1.7	1.6	8.4	2.1
Shopping	15.4	7.6	4.4	2.0
Other	14.1	10.3	6.5	1.9
Total	31.3	19.6	5.6	2.0
Educational, civic or religious	9.4	5.0	4.7	2.5
Social and recreational:				
Vacations	0.1	2.6	160.0	3.4
Visit friends or relatives	9.1	12.2	12.0	2.2
Pleasure rides	1.4	3.1	20.0	2.7
Other	12.0	15.4	11.4	2.6
Total	22.6	33.4	13.1	2.5
All purposes	100.0%	100.0%	8.9	1.9

LENGTH OF TRIPS

Trip Length (One-Way Miles)	Trips	Vehicle Miles
Under 5	54.1%	11.1%
5-9	19.6	13.8
10-15	13.8	18.7
16-20	4.3	9.1
21-30	4.0	11.8
31-40	1.6	6.6
41-50	0.8	4.3
51-99	1.0	7.6
100 and over	0.8	17.0
Total	100.0%	100.0%



SOURCE: U.S. Department of Transportation, Federal Highway Administration, *Nationwide Personal Transportation Study* (1969), Reports No. 1 and 7.

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December 3-5,1990. 10th International Electric Vehicle Symposium. BDG Mgmt, Ltd. Ste 705, East Town Bldg., 41, Lockhart Rd., Hong Kong

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