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**F. V. E. A. A. NEWSLETTER**

**SEPTEMBER 1990**

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**MEETING NOTICE**

The next FVEAA meeting will be  
**SEPTEMBER 21st** at  
College of DuPage Building K  
22nd & Lambert Rd. Glen Ellyn  
Time Meeting 7:30 P.M. sharp.  
We can arrive at 7:00. Guests  
are welcome and need not be  
members to attend the meeting.  
NOTE: Park at WEST end of lot  
and enter at WEST entrance.  
NOTE: We meet in room # 133

**DEADLINE** for newsletter *STUFF* - in my hands  
the Friday before the next meeting. Editor

**THE PREZSEZ**

We have been awarded a 1990 Illinois Energy Innovation Recognition. The FVEAA was one of 10 Illinois organizations honored for their contributions to unique energy developments. I hope to have the Certificate by meeting time.

We have been assigned a new meeting room for September. It will be ROOM 133 in the same building we have held our last meetings. The Campus will be much busier with school opening on the 21st.

We will get a report from John Emde about his appearance at the Wisconsin Alternative Energy Event last month. It was very productive judging from the number of inquiries I have received as a result his presentation. We will also discuss our objectives for the coming winter season, including building an engine-generator package, design of another controller, updating sources for conversion parts, help for our newsletter editor, possible participation in energy-related events this fall, and choice of a future meeting place.

**Bill**



**FOX VALLEY ELECTRIC  
AUTO ASSOCIATION**  
6542 Fairmount Downers Grove Il 60516

**FIRST CLASS**

ADDRESS CORRECTION  
REQUESTED

MINUTES OF THE FOX VALLEY ELECTRIC AUTO ASSOCIATION.....AUGUST 17, 1990

President Shafer called the meeting to order at 7:30 P.M. promptly. The attendance was very sparse...less than 10 members. ( I guess it's the summer doldrums) Treasurer V. Vana gave the following report...Savings account \$908.74..checking NOW acc<sup>o</sup>unt \$1,341.55.. for a total of \$2,250.29.

Because of member Jerry Mitchell giving us a little plug here and there on his radio shows, Pres. Shafer reported that he has received 6 phone calls and 4 letters from people asking about our organization. Incidentally, Jerry will be coming to our meetings as soon as his schedulè permits. Also Pres. Shafer will send a package of info to Dave Baum of radio WBBM to try to get our representatives on the show.

John Emde will try to get V. Vana, D. Ness, K. Myers, Jo Stockberger, P. Harris and Pres. W. Shafer on a cable station on a Saturday in September to tape our Video. Jerry Mitchell to narrate....John Emde to tape a session at the " Location of a car in progress of being assembled "...at Paul Harris's driveway

John Newton (just fresh back from Europe) reported that the price of a gallon of gas in France is equivalent to \$4.35 U.S.. The effect on electric autos is very significant...he predicts \$5.00 per gallon before the year 2000.. the price of gasoline is starting to rise and will continue to do so.

Dick Ness discussed his bike project for the winter...36 volt...3 gel cells..1/2 HP Les Stone to help out.

Ken Myers will go with an A/C motor if and when he decides to build another car. Ken showed a video he made of the 'Stopover at Indianapolis" of the Sun racer and all of the other interesting cars and solar panel arrays there. Ken did an excellent job in narrating the video...( Maybe he's ready for the big time)

Pres. Shafer asked for a volunteer as an understudy for John Emde to help out with half the job of putting the bulletin together. Either the first half..putting the bulletin together...or the second half...addressing, printing and mailing.

Richard Johnson asked questions <sup>on</sup> pulse width..conclusion was that some of our technical experts will again give talks on various technical subjects of interest to the general membership and topical matters.

The meeting was adjourned at 9:06 P.M.

Respectfully submitted,

Paul P. Harris, Secretary

## EDITORS NOTES

Last month I spent 3 days at "The Energy Fair" in Amhurst Wisc. I was invited to display my electric car and give a seminar both sat. & sun. on retrofiting an electric car.

On Fri. morning (Aug. 17th) my wife Arlene and I started out on the 250 mile trip towing our electric car. It rained all the way up there. Arriving about 1 P.M. (fair opening time) our timing was great. The rain stopped and the sun came out. We were greeted by Ken Woods and another fair patron as we pulled in. This man was so excited about the electric car that he helped me unhook the tow bar and escorted me to the display area. There were quite a few people there already and we were soon surrounded. My wife and I were interviewed almost immediately by a woman who said she was with Time Magazine. There were local TV and radio stations also doing interviews. That fri. about 1000 people came thru the gate. Most all of them had an interest in some form of alternative energy. Also on display were all kinds of solar devices (both active and passive) and a lot of photovoltaic panels. There were wind generators of various sizes, solar cookers, an electric boat, another electric car (an Austin sports car) and all kinds of battery operated devices. On sat. about 3000 people came thru and on sun. due to rain in the morning about 1000 more came to the fair. We were busy all day long answering questions about the electric car. I even gave a few rides around the fair grounds. At times when I was busy giving my seminar or answering natures call, Arlene would answer and comment on the electric. Ken Woods also was on hand to talk about the car and also talk about alternative energy. Ken was in his glory.

Not being much of a speaker, I was worried if my slide show, which consists of about 50 slides taken during the conversion of my 1974 Subaru way back in 1980 would be enough to fill the scheduled 1 hour time allotted. Well, the response was so great that my sat. talk lasted an hour & ten minutes and the sun. talk was an hour & a half. Those attending were so interested in learning more about electrics that they asked a lot of questions on how an electric is converted along with some "what if" questions. The seminars seemed to be well taken.

When we left that sunday night we drove about 40 miles to my fishing cabin near Freemont Wisc. Monday morning I went fishing and caught a couple of nice bass. Well worth the trip. We drove home monday afternoon and it rained all the way home. In spite of the weather we had a wonderful time and I would recommend that a F.V.E.A.A representative or two attend next years "Energy Fair".

John Emde

Last month I promised to print a list of "club stuff" for sale. It seems that the stuff is in possession of a now inactive member. We need a volunteer to take over the task of storing - sorting - and pricing this stuff so we can help others in obtaining parts for their electric car projects.

# Electric car stalls on R&D road

DETROIT (Reuters)—Federal legislation demanding better fuel economy and more safety features will cut deeply into U.S. automakers' research and development budgets, making it unlikely they can spend much money for developing an electric car.

Even the Persian Gulf crisis, which has boosted retail gas prices sharply, won't be the catalyst that will let the automakers switch gears and allocate more money to the electric car so it can get to market more quickly, industry analysts say.

"We see nothing in the Middle East crisis that will hasten the production of the electric car," said William Pochiluk, president of Autofacts Inc., a Paoli, Pa.-based automotive research company.

Pochiluk said the automakers are going to have to struggle financially to meet legislation pending in Congress that would require higher average fuel economy and more safety features.

"These issues will require major funding, and that will probably reduce the amount of money available for longer-term technologies," he said.

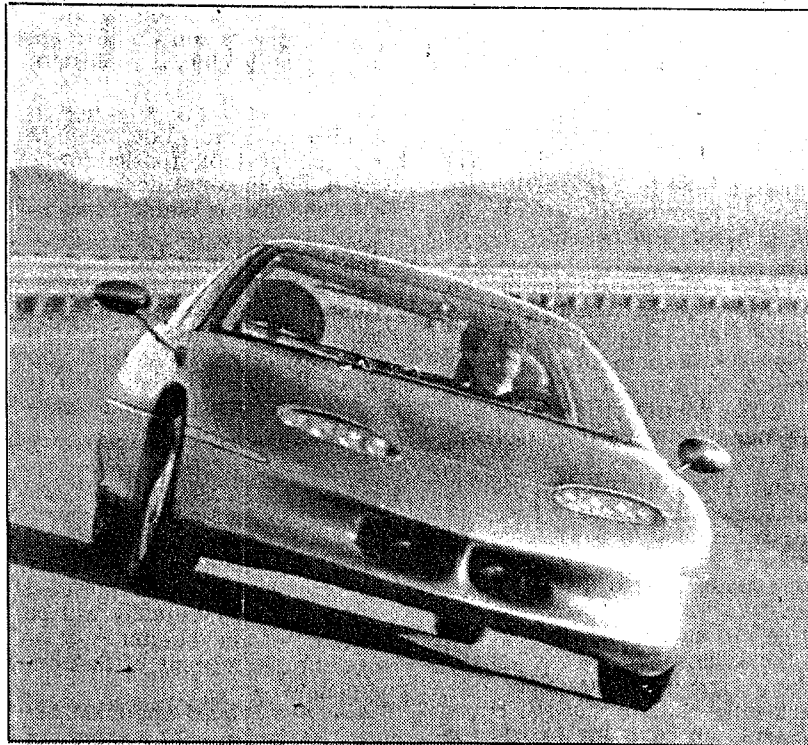
"While some of the domestic car companies are making noises that the electric car could be on the market by the mid-1990s, we think it will be very difficult to meet that goal."

Besides federal legislation, battery technology is not yet ready to put an electric car out for the average consumer, nor does there seem to be much of a demand, Pochiluk said.

Even so, John Ferron of J.D. Powers and Associates in Agoura Hills, Calif., said he expects to see significant progress in electric cars in the United States and Europe in the 1990s, because of a desire to clean up the environment and potentially higher gas prices.

General Motors Corp. currently has the most visible electric car program of the automakers. GM's sporty, electrically powered Impact has stirred public interest since a prototype was unveiled last year.

"We are moving ahead very quickly with the [Impact] program," GM Chairman Robert Stempel said in August. "We have a lot of internal work to do, a lot



General Motors' sporty, electrically powered Impact has stirred public interest since a prototype was unveiled last year.

of technology to solve."

Still, many potential buyers fear the electric car is slow and can't travel very far.

The Impact's lead-acid battery will last 25,000 miles with recharging, but researchers hope to double that within the next few years, according to GM's Delco Remy Division. With today's technology, however, the Impact would cost about twice as much to operate as a comparable gasoline powered car.

"We will only see the electric car in commercial applications in the mid-1990s," Ferron said. "It is unlikely we will get the consumer unless there is a technology breakthrough."

Electric cars are already enjoying some commercial use. The city of Los Angeles, for example, recently selected three companies to supply 10,000 electric vehicles, with first deliveries slated for the end of this year. Of 19 bidders, Canada's Magna Corp., Unique Mobility from Colorado, and Sweden-based Clean Air Technology were chosen.

Better battery technology is the key, Pochiluk said. Until technology improves, batteries will cost too much, recharging will be too expensive, the car won't be able to carry many passengers and it won't go very far or fast.

"One concern we have is that everybody is very enthusiastic about GM Impact and other electric car possibilities. That could result in 'overselling' the customer

before the technology is really caught up," said J.D. Power's Ferron.

"We have counseled everyone not to put on their marketing hats before the engineering hat has solved the problem."

As one marketing technique, GM is considering allowing consumers to lease the Impact or the car's battery pack or both, said former GM Chairman Roger Smith, before he retired in July.

The decision will depend on the advances in battery technology between now and the car's launch date. It is even possible the Impact may someday become a hybrid car with a small gasoline engine that could be used in tandem with battery power.

Because electric cars are stalled on the research and development highway, Autofacts' Pochiluk says the auto and oil companies will spend more time working on alternative fuels.

So far, methanol appears to be the alternative fuel of choice, but reformulated gasoline is gaining strength. Neither will be offered on a widespread basis soon. The oil companies haven't spent the money necessary to produce enough of the additive—methyl tertiary butyl ether—needed for large quantities of the new gasolines.

"We will see more experimentation with methanol and reformulated gasoline," Pochiluk said, "but the electric car does have enormous potential."

## Isuzu's new "battery"

Isuzu Motors and Fuji Electrochemical Co. jolted the automotive world recently with the announcement of a revolutionary new type of battery. Touted as not only smaller and more powerful than existing batteries, it was claimed to be rechargeable in just 30 seconds. The device could be formed into just about any shape, making it suitable for a variety of uses, from flashlight batteries to the battery bank for an electric car. It is also said to be cheaper than battery products made by existing technology.

Isuzu's stock soared on the Tokyo Stock Exchange. Rumors flew that this was the secret to making General Motors' Impact electric vehicle a reality. (Isuzu is 38.2 percent owned by GM). Isuzu was swamped by requests for information about this seemingly amazing breakthrough. But as the details were revealed, the edge quickly came off the excitement. Although all the claims eventually may be proven true, there are a host of technical problems to overcome.

The main drawback is that the battery discharges as quickly as it charges—about 40 times faster than a conventional lead-acid battery. Isuzu and Fuji Electrochemical prefer to call it an electric power storage device. Unlike conventional batteries, which produce electricity chemically, the new device physically stores the electric charge much like a condenser. This, an Isuzu spokesman says, is what allows

the device to recharge so quickly. Unfortunately, engineers have not yet found a way to deliver the stored power slowly over an extended period of time. Therefore, for the immediate future, the Isuzu electric storage device will be limited to applications where a relatively short discharge is followed by a recharging cycle—as in automotive batteries.

But even here there are some potential snags. The storage unit would be fine for starting the car, but if you shut off the engine and listen to the stereo or put on the emergency flashers, it will run down quickly. One possibility the company is considering is combining a conventional battery with the electric storage device to give the best of both worlds.

Isuzu is a bit cagey about divulging details of what makes it work, but disclosed that the device uses solid electrodes of highly concentrated activated carbon immersed in an electrolyte. The next hurdle is developing the production technology required to manufacture this innovative device. The first products are likely to be batteries for motorcycles and cars, which Isuzu and Fuji Electrochemical hope to have on the market within two years. As for use in an electric car: "This is something to discuss for the twenty-first century," the Isuzu spokesman says. Say it isn't so, Joe.

POPULAR SCIENCE SEPTEMBER 1990

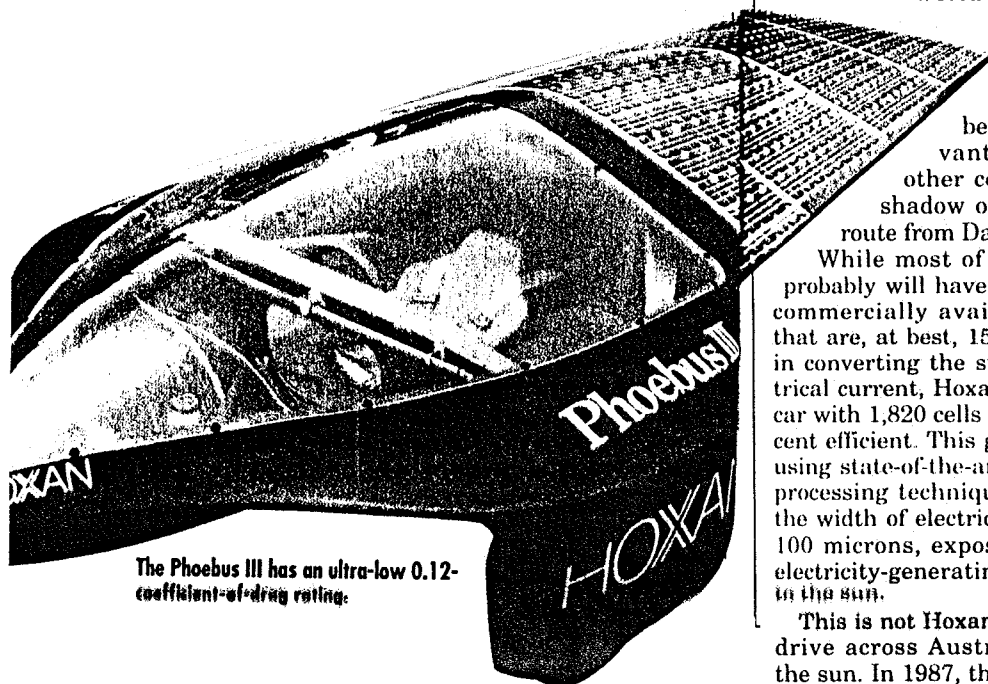
## Solar Challenge first peek

With the Sunrayce solar car extravaganza ["Sun Racers," Aug.] a fading memory, and the top three finishers prepping their vehicles for November's World Solar Challenge across Australia, we now get our first glimpse of what the competition will be like. The Phoebus III shown here is the product of a joint development project by two Japanese industrial giants—Hoxan Corp. and Autech Japan—and Japan's Ministry of International Trade and Industry. The car appears to be modeled after the General Motors Sunraycer, which dominated the field in the last trans-Australia solar car race in 1987 ["Chasing Sunraycer Across Australia," Feb. '88]. With a chassis and body made entirely of composites, it weighs in at a mere 336 pounds, some 60 pounds lighter than Sunraycer. The three-wheeled Phoebus III has an ultra-sleek 0.12-coefficient-of-drag rating, which allows it to achieve a cruising speed of more than 62 mph, according to a Hoxan representative. The Phoebus's driving force is provided by an 11-pound brushless direct-current motor rated at a mere 2.7 horsepower; energy is stored in silver-zinc batteries.

The Phoebus is powered by the world's most efficient production solar cells, according to Hoxan. This could be enough of an advantage to keep the other competitors in its shadow on the 1,900-mile route from Darwin to Adelaide.

While most of the competitors probably will have to make do with commercially available solar cells that are, at best, 15 percent efficient in converting the sun's rays to electrical current, Hoxan has covered its car with 1,820 cells that are 19.3 percent efficient. This gain is a result of using state-of-the-art microelectronic processing techniques and reducing the width of electrical connections to 100 microns, exposing more of the electricity-generating silicon surface to the sun.

This is not Hoxan's first attempt to drive across Australia powered by the sun. In 1987, the company's team finished 11th overall in the World Solar Challenge, the highest-placing Japanese entry.



The Phoebus III has an ultra-low 0.12-coefficient-of-drag rating.

# Former owner of electric car recalls passer-by double-takes

by Tony Zoubek

From the first time he parked it in town during the middle '70s, until he sold it six years later, Wood Dale resident Larry Dunn's car drew people's attention.

No one passed it without a double-take.

Some people snickered. Others referred to it as a refugee from an amusement park. Some shook their heads. But, to most, it was the first, and possibly last, electric car they would see.

Dunn heard about the car back when the Arab oil crunch was picking up steam. Then he saw one in a newspaper ad. A small car dealer on Lake Street was going out of business; he had 10 of the cars left and was closing them out at what Dunn considered a ridiculous price — \$1,900. Dunn looked at one, liked what he saw and bought it.

The car seated two comfortably, three if necessary. Behind the seat was a compartment large enough to hold four bags of groceries. Once he and his wife, Barbara, took their two sons with them in the car, and one of the boys sat back in the grocery compartment.

The car was powered by eight storage batteries which fit under the seat. It took 12 hours to recharge them, so

he'd plug it in when he got home at the end of the day, and be ready to go again the next day. He estimates he used about a quarter's worth of electricity each time.

With a maximum range of 20-25 miles on a battery charge, Dunn knew its purpose was for running errands and commuting. When he bought the car, he worked only 10 miles from home. Ten miles there and 10 back; he had some reserve power to spare. He also learned that if the engine stopped, he could let the car sit 15 minutes, and then squeeze an extra 2 minutes out of it.

The car didn't come with a heater; Dunn never had one installed. Using a heater would have cut his range to 15 miles. But the ease of starting in cold weather made up for it. "Just turn the key, and away we go," grinned Dunn.

As most people do with a new car, Dunn pushed it to the limit to see just what it could do. Its top speed was rated at 35 miles per hour, but Dunn wanted to see if he could get it to do better. He succeeded — once.

"I was going east on Irving Park and there was quite a wind. The damn thing got up to 46 miles per hour! I never got it that high after that."

Maintenance was no prob-

lem. With an electric motor there were no tuneups, no oil change, no antifreeze to replace. The body was fiberglass; there was nothing to rust. During the six years he owned the car, he replaced the batteries once. They cost him \$80 each.

Getting stuck was no problem. The car was light enough to pick up and move; it could easily be pushed out of a ditch. With its light weight and rubber bumpers, if it was involved in an accident, it was more likely to bounce than crumble. And it came equipped with roll bars just in case they were needed.

Barbara Dunn chuckles, remembering a call she got from stranded friends. Their car had run out of gas, and they asked her to bring some so they could get to a gas station. "Imagine how embarrassed they must have felt when Larry came driving up with a can of gas in his electric car!"

When Dunn changed jobs and the commute was too far for the car, he had no more use for it. "I sold it to a guy in Bellwood who bought it to deliver dry cleaning in. He thought it would be good advertising for him."

"And the best part was that I sold it to him for only \$200 less than I paid for it!"

## FOR SALE

1976 Chevette Electric  
2 door hatchback. Very good condition. 4 speed rear wheel drive. 8 new 12 v batteries for 48 volt system. EAC 400 amp controller upgraded to 48 volts. 400 amp starter generator. Car was a hybrid and is still wired for such. \$2500 or best offer.

Carl Swick  
7550 Willowood Ct.  
Orland Park, IL 60462  
708 429-4955



"It's time we consider solar energy! Somebody go out and buy a Popular Mechanics magazine!"

## Rising solar cars

The typical automobile spends far more of its life inching along in bumper-to-bumper traffic than cruising down the highway. That may provide an opening for the Solar Commuter Vehicle—SCV-0—being developed by Japan's Kyocera Corp. The prototype shown in Japan is basically an electric car covered with solar cells that extend the car's range by recharging its batteries. Kyocera says it plans to have a commercial version of the SCV-0 on the market in as little as five years.

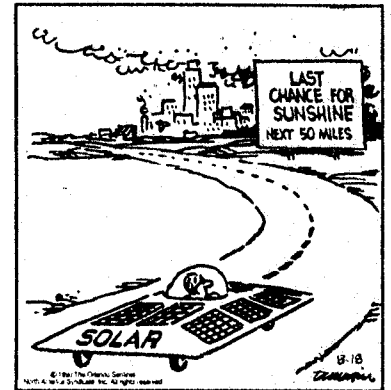
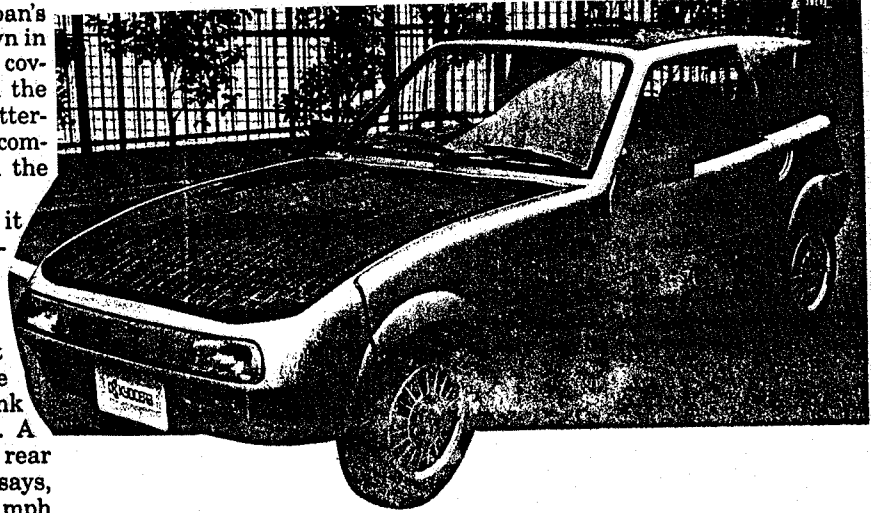
Designers and engineers say it will be a no-frills car for commuting, shopping, and running errands. The diminutive two-seat hatchback is only 130 inches long, 55 inches wide, and weighs just 1,200 pounds. More than 23 square feet of solar cells will charge a bank of sealed nickel-zinc batteries. A direct-current motor drives the rear wheels. Fully charged, Kyocera says, the SCV-0 has a top speed of 40 mph and a range of 70 miles. On a sunny day, extra current from the photovoltaic solar cells will recharge the batteries while on the go, stretching the range to about 100 miles. For driving at night or on overcast days, the SCV-0 can be charged by a household electric current.

Kyocera engineers admit they face challenges in transforming the \$70,000 prototype into a \$14,000 commercially viable car. The chances for SCV-0's success will depend on Kyocera's ability to optimize efficiency by shaving weight with the use of advanced body

materials and lightweight batteries.

I watched as a Kyocera engineer put the SCV-0 through its paces in the cramped parking lot of the company's Tokyo office. The SCV-0 started, stopped, and drove like a conventional car, although without the noise and exhaust encountered in gasoline-powered vehicles. While it lacks high performance, it is no golf cart. If this solar vehicle never gets out of Kyocera's parking lot, it won't be for lack of talent or effort.

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## All-weather racers

The Montpelier, Vt., start of the 234-mile American Tour de Sol was overcast and rainy, hardly ideal weather for the first leg of a solar car race. In fact, it was a grim beginning for an event that organizers hope will demonstrate that solar car technology is ready for commercialization. On the other hand, the finish line in Medford, Mass., five days later was blessed with a perfect, cloudless spring day. And, based on the enthusiastic crowd present, the public appears ready to embrace this nonpolluting alternative to the internal combustion engine.

The winner of the Tour de Sol was Lightspeed, a softly rounded gull-wing two-seater made of composite materials by Solectria Corp., of Arlington, Mass. The brilliant-red car's entire roof is covered with a photovoltaic solar array, which generates a maximum of 200 watts. Current is fed into the car's

two 30-hp electric motors, which allow the 850-pound car to accelerate to 60 mph in 8.5 seconds, according to Solectria. This puts Lightspeed solidly in the range of many of today's mainstream gasoline-powered cars and on par with General Motors' proposed Impact electric vehicle.

Unlike Impact, which relies on lead-acid batteries and doesn't use solar cells, Lightspeed contains a bank of lightweight nickel-cadmium batteries that store electricity for a 150-mile range on a sunny day. Top speed is said to be 85 mph, but during the race, driver Anita Rajan said she never went above 65 mph to conserve battery power for a sprint to the finish line. As it turned out, the Lightspeed prototype needed that extra push to beat Solectria's other entry, the Sunrise, barely.

Rajan, a Massachusetts Institute of Technology student who works part time for Solectria, says, "The Light-

speed proves the concept that an electric car doesn't have to be slow and boring. It's a lot peppier than my gas-powered station wagon." Solectria, a small engineering company composed mostly of former and present MIT students, plans to begin production of the solar sports car within two years. But along the way many serious hurdles remain, not the least of which are encasing the fragile solar cells in Lexan polycarbonate plastic and perfecting the car's regenerative braking system that recharges the battery pack when the car slows. But the most daunting challenge is meeting government crash-protection standards with such a lightweight vehicle. If all goes well, Rajan says a \$15,000 solar-powered sports car could soon be found on the streets.

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# New Fuels Report

Formerly  
Alcohol Week

reporting worldwide on oxygenates, alcohols, and other alternative fuels

Vol. 11 No. 36 - September 6, 1990

## BRITISH FIRM TO PRODUCE ELECTRIC VEHICLE BATTERY THAT CAN DOUBLE DRIVING RANGE

A British battery manufacturer is expected to produce an electric vehicle battery this January that would more than double the driving range provided by the lead-acid battery, moving electric vehicle commercialization closer to reality. Chloride Silent Power, Ltd plans to produce five sodium-sulfur batteries a week upon completion of a \$16-million manufacturing plant slated for this fall. These units would be sold to the world's major automakers for use in electric vehicle demonstrations. DOE granted \$1-million to Chloride to develop this technology for mass-production, according to a source. Ford Motor Co. used Chloride's sodium-sulfur batteries in vehicles in the first two phases of its electric vehicle program and is expected to use more in the next phase.

Sodium-sulfur battery development is regarded as the most promising battery technology. A source at Chloride said that the company's battery provides four times the energy density of the electric vehicle lead-acid battery at 60% of the weight.

The sodium-sulfur battery is also capable of supplying enough power to accelerate a mini-van such as the electric version of the Ford Aerostar from 0-60 miles per hour in 20 seconds. The driving range of the vehicle was found to be as high as 150 miles. A source concluded the battery had the capability of extending the driving range to as much as 300 miles but said that limit has not been tested in a vehicle yet.

The battery, encased in a double-insulated steel cube, is made up of 1,000 one cubic inch "mini-battery" cells. Each cell consists of a small 15-gram molten sodium core surrounded by liquid sulfur. The sodium and sulfur act as electrodes and are separated by a ceramic medium called an electrolyte. The medium selectively allows only positively charged sodium ions to migrate towards the negatively charged sulfur ions. The resulting chemical reaction between the sodium and sulfur ions provides the electrical energy needed to propel the vehicle. Recharge of the battery reverses the process. As an electric current is applied, the electrolyte lets only sulfur ions through as they migrate towards sodium ions. The chemical reaction re-captures the electrical energy for future use. According to a source, this reduces the buildup of other ions on the electrodes, increasing the efficiency of the cell.

In a related matter, the Senate last month passed the National Energy Policy Act of 1990, which authorizes a total of \$30-million for electric vehicle and battery research. The bill designates another \$50-million from FY-92 to FY-97 to promote electric vehicle commercialization. The House Energy & Commerce Committee in late September is expected to take up an identical bill that was introduced by Rep. Phil Sharp (D-IN). The bill was approved by the Energy & Commerce energy & power subcommittee in August. But it is uncertain whether the proposed legislation will make it to the President's desk by December.

## Sun rises on Japan's electric-car drive

TOKYO (Reuters)—Japan, sensing growing environmental pressures, is accelerating efforts to develop practical models of electric cars.

"Electric vehicles have a clean image. They have no direct emissions," said Hisakata Sato, an official of Japan's Moonlight Project, which is developing electric storage technologies.

Japanese carmakers trail U.S. and European competitors in electric car development and are keen to narrow the gap. The government plans to launch a major research consortium to develop new batteries, which are critical to making such cars practical.

There are only a few tens of thousands of electric vehicles on the road in Japan, said Seiichi Mochizuki of the government-affiliated Japan Electric Vehicle Association.

Electric cars are mainly used as newspaper delivery and service vehicles, competitive in urban areas where traffic speed is low.

Japan's biggest carmaker, Toyota Motor, said in May it would jointly produce an electric vehicle with a regional power company. There are no plans to mass market the vehicle, which will use a nickel-cadmium battery.

Perhaps Japan's most innovative electric car was developed by the world's biggest steel maker, Nippon Steel. The Next Generation Advanced Electric Vehicle uses off-the-shelf lead-acid batteries and achieves a range of 150 miles and a top speed of 69 miles per hour.

Its high performance stems from a lightweight carbon-fiber body and novel direct-drive motors that use powerful rare-earth magnets mounted on all four wheels. Nip-

pon Steel has yet to find a major carmaker as a partner.

Isuzu Motors made headlines in April with a new lightweight, compact and high-energy condenser. So far the storage device is merely a source of quick, short bursts of energy to help engines ignite.

Honda Motor and Kyocera are building solar energy-powered cars for the 1,878-mile, 1990 World Solar Challenge race in Australia in November. Hoxan will supply the batteries.

Despite these developments, analysts said a practical electric car depends on a breakthrough in battery technology. The three main types now in use all have shortcomings.

A Japanese research consortium could start work in 1993 on new nickel battery combinations using cadmium and zinc, Mochizuki said.