ELECTRIC AUTO ASSOCIATION

CURRENT EVENTS

June 1991 | Promoting the Use of Electric Vehicles Since 1967 | Vol. XXIII No. 6

In Search of the 100th Monkey

by Paul Brasch

There's a true story about monkeys that was told on PBS some time ago. It seems that these monkeys found that a sweet potatoe-like root was good to eat. All the monkeys would dig them up and eat them. Of course they were "flavored" with the dirt that clung to them, but what could a monkey do? One female monkey discovered that if she took the root to the water's edge, she could wash it clean. This made the root taste much better. A small few watched her and tried washing their roots and found that they liked them that way. Most of the others could not understand this very strange behavior and they tended to avoid these weird ones. Those who washed roots became outcasts.

Gradually more monkeys learned to wash their roots clean before eating them and the numbers of root-washers grew. Yet they were still the strange outcasts. Then something interesting happened. When the number of root-washers approached 100 monkeys it seemed to all the others that there truly was a lot of root-washing happening. It started to look like a trend. Maybe there was a reason for it.

Soon it seemed that everyone was doing it, whether it made sense or not. Some liked the improved taste; others disliked the extra effort involved—either way, they did it. Who wanted to buck the trend? So, almost overnight, the entire population of monkeys on the island converted to being happier, healthier root-washers. Some even took to washing everything that they ate.

Pretty smart monkeys, huh? If they can learn, maybe mere homo-sapiens can learn too. A hundred monkeys was the magic number to serve as the catalyst for a complete change over. When it comes to learning that electric cars are a better way of traveling, I have no idea what that magic number might be for the S.F. Bay Areas's 5+ million population. But unless we are more visible in what we are doing, we would be like that first monkey if she had washed her roots in hiding. It's pretty hard to start a trend in the dark.

Several people have suggested that we develop some form of identification—window decals or bumper stickers. I just thought of one for your gas car: I'd rather be driving my Electric. In small print below that: Clean, quiet, cheap and reliable—Electric Auto Association. And for your electric: Driving better Electrically, using the same small print. I am sure that we can come up with many more good ideas.

A new member, John Broenen, is working on some ideas for a new, less cluttered look for the EAA logo. He gave a very well-received presentation of various promotional ideas at the April meeting of the Santa Clara chapter. He also has graciously committed to find some time to help with the newsletter. Note the new name and look. I hope that you like it. It has been a real struggle to come this far. We need more help on all aspects of the EAA.

If we are ever going to even approach that 100th monkey, we must be MORE visible to the public than we have been. A good start will be our attendance at the June 23 Palo Alto Concours de Elegance auto show. They tell me that 20 - 25,000 people come to this show. But more important than our attending the Concours is the need to be more visible in our **use** of our electrics. Our own **obvious** use is GREAT free advertising. Bumper stickers, decals, custom plates or anything else that identifies our vehicles as electric and helps to show its practicality to the public.

Smart monkey see, smart monkey do.

Pb 5/15/91 ■

TI Tech Shines in Solar Cell

by Brian Santo
Electronic Engineering Times

DALLAS—New solar-cell technology developed by Texas Instruments promises to slash photovoltaic energy costs in half, which means it could be the breakthrough that finally makes solar energy practical for utility applications.

TI's Spheral Solar cell is created with what is billed as an extremely simple and low-tech process, in which approximately 17,000 spheres of low-purity metallurgical-grade silicon are bonded to a 100 x 100 mm square of aluminum foil.

While the spheres are being created, impurities in the silicon are pushed to the surface, explained Eric Graf, marketing manager of TI's photovoltaic (PV) program. Sphere formation is done in a furnace and depends on a surface tension phenomenon. Impurities are etched from the surface of each sphere.

An aluminum sheet is embossed and etched into a sort of wire frame, and the spheres are bonded to it with a metallurgical

▶ *Continued on page 6*

INSIDE

AUTOWEEK Feb 18, 1991

ZEROING-IN ON THE ULTIMATE CLEAN CAR

California's law requiring 'zero-emission vehicles' on sale by 1998 sparks automakers' charge for a product to plug into the market.

•

By Tom Lankard

The time: Ten years from today. The setting: A house in a California city's suburbs. The scene: A car backing out of the garage on a weekday morning.

Only something's missing: There's been no muted whine of a starter motor spinning a gasoline engine to life. And no telltale wisp of exhaust.

Instead, before opening the door and slipping in behind the wheel, the driver unplugged a cord connecting the car to an outlet in the garage. And as the car drives away, its passage is heralded only by a barely audible hum.

No, this isn't a dreamscape in some Ray Bradburian futuristic fantasy. The California Air Resources Board, a.k.a. CARB, has decided the electric car — a so-called "zero-emission vehicle", or ZEV — is the next logical step in the state's drive for a de-smogged future.

Following through on that decision, CARB — which is to California as EPA is to the nation — adopted in 1990 a regulation that'll make this morning garage scene a real-life film-clip no later than 1998. That's when automakers must begin selling ZEVs in the Golden State.

CARB's not looking at token numbers, either, though it starts out slowly. The planned phase-in requires 2 percent of new-car sales the first year and in each of the next two years to be ZEVs. Assuming, as CARB's computer models are programmed to, that Californians buy about 1 million new cars a year, this comes to only 20,000 ZEVs annualy through the year 2000.

But in 2001 and '02, ZEVs must comprise 5 percent of sales, or some 50,000 per year. And, beginning in 2003, at leat 10 percent of new cars sold must be ZEVs. That's another 100,000 on the road each year.

By "new cars", CARB means passenger cars and light-duty trucks, including vans and multipurpose vehicles, with a gross vehicle weight rating up to 8500 pounds. Makers selling fewer than 5000 cars a year in the state escape the ZEV curse — no doubt a big relief to the likes of Ferrari, Jaguar, Lotus and Maserati.

Even Porsche skates. Although California routinely soaks up about 20 percent of the company's U.S. sales, the last time this topped 5000 cars was in 1986, when Porsches' U.S. sales totaled a tad more than 30,000. In recent years sales have hovered around 10,000, and, a spokeswoman says "That's not in our forecast, to get back up to 30,000 cars in the U.S.".

Peugeot and Saab escape the rule on low-sales grounds too, though both say they hope to change that by exceeding 5000 sales a year in California. Peugeot, since the early 1980s, has been working with Citroen on an electric delivery van. And at Saab, spokesman Steven Rossi says, "We're obviously aware of the regulation, and we're going to deal with the reqiurement" when California sales of the Swedish cars, currently running at fewer than 400 annually, dictate.

Still, more than a quarter of a million ZEVs will be rushing workers to and from their jobs and picking up and delivering packages and products from here to there in the Golden State by 2003.

And while smaller makers might be tempted to limit sales in the state to 4999 cars annually — in fact, the regulation practically invites them to do just that — the larger view says California's law is the beginning, not the end of the story.

If history is any gauge, other states with smoggy cities (and the federal EPA, too) will watch California closely, ready to order up their own ZEVs at the first signs of success. The coalition of Northeastern states that decided a while back to copy CARB's auto emission standards (AW, Aug. 28, 1989) certainly is watching, and thinking about adopting similar regulations.

"Massachusetts probably will," says Alan Van Arsdale, coalition staffer, "and New York is about to change its regulation to reflect the new California program." This being the case, you'd expect the auto industry would be firing up its fleets of lawyers and lobbyists to plot a counterstrike, right?

As true to past form as this may be, reality appears to be otherwise. Automakers seem suprisingly sanguine about the looming mandated injection of ZEVs into their product lines. As might be expected, each principal player takes a slightly different approach, but they nevertheless make sounds strongly redolent of acquiescence to he ZEV requirement as a done deal.

Chrysler spokesman Jason Vines says his employer's commitment is unequivocal, if somewhat reluctant. "We'll definitely meet it," he says, "there's not a lot of choice".

By way of emphasis, the company displayed at the Los Angeles Auto Show this year a prototype of the vehicle it's developing with the Electric Power Research Institute, of Palo Alto, Calif. (AW, Jan 21). Based on Chrysler's popular T-115 minivan, the TE Van — as the electric version is called — draws power from a 1800-pound nickel/iron battery pack with a potential life of 100,000 miles. At a curb weight topping 2.5 tons, the TE crawls from a stop to 60 mph in 25 seconds, has a 120-mile range and a full recharge takes eight hours.

Assuming EPRI can coax better performance out of the batteries, Vines says, Chrysler expects the TE Van to fill at least the company's initial quota of about 3000 ZEVs a year. Targeted buyers will include businesses and van-poolers.

Ford's on board, too, pledges John Wallace, director of the company's electric vehicles program: "It is Ford's intention to meet all current regulations." He says, however, that Ford hasn't decided yet how to fill its ZEV quota: "We haven't gotten that far".

But he casually adds that he expects "a number of announcements" over the next six months. One of these has since been made: That Chrysler, Ford and GM have formed a consortium with the federal government, battery makers and electric utilities to spend as much as $1 billion over the

next 12 years to advance battery technology.

Ford has done some work with Unique Mobility, a company headquarted in Denver, Colo., on an electric Aerostar powered by a sodium/sulfur battery. But that work has apparently now been brought in-house.

General Motors echoes its Detroit neighbors, but with a degree of confidence not evident at Chrysler and Ford. "We will meet (California's ZEV requirement) with a production version of the Impact." promises Jim Hall, staff project engineer in GM's Advanced Project Engineering unit and a former member of GM's Electric Vehicle Task Force, which developed the Impact.

Importers that make the 5000- unit sales cut join in the affirmative chorus when asked if they have ZEV plans, but only a few offer any specifics, and then without much detail. Honda, for instance, says only vaguely that it has built an electric motorcycle as a test bed for evaluating battery technologies. Nissan and Toyota haven't told their U.S. people any more than that they'll meet the standard.

What may bring salvation from some of the lesser, wannabe nameplates — like, say, Daihatsu and Isuzu — is that CARB will allow companies to sell ZEVs ro ZEV credits to other makers who don't have their own — or enough of their own — to meet their quotas.

Across the Atlantic, VW just showed a second-generation, sodium/sulfur-batteried car based on the Jetta that spokesman Stuart Johnson sees as VW's ZEV. Mercedes is working on an electric 190, "a true 190E" say punster/spokesman A.B. Shuman.

And BMW has plugged a 584-pound sodium/sulfer battery pack into one of its 3-Series cars. The unit delivers a 23-second 0-50 mph clocking and a 90-mile range. But, assures spokesman Chirstoph Huss, "We expect an increase in range in a new generation of battery."

Volvo says only that it intends to meet the standard, but won't say how. The reason behind the equivocation by most makers is the same one that's plagued electric cars ever since gasoline emerged as autodom's drug of choice: Primarily, nobody has yet devised a battery, the "gas tank" for electric cars, that can store as much energy and in as usable a form as can a tank full of the real thing. The Big Three's consortium is dedicated to expanding the limits of this performance envelope farther than any one of them has been able to manage to date working on their own.

But Wallace counsels against betting too much on this or any other development program "I don't think you're going to find the breakthrough that you may be hoping for," he says, collectively dismissing news releases and headlines touting a miracle battery or other magical solution. He believes the road to a successful ZEV lies on "good technical ideas developed over a number of years."

Denver firm's work on a sodium/sulphur battery-powered Aerostar called the 'ETX II' has reportedly been brought in-house at Ford.

Not insignificantly, there's also the power of government to change the way it — and we — think of a car. If a ZEV can't do what current cars can do, then its role must be defined as what it (a ZEV) can do. In other words, the traditional car's role must be broken down into discrete elements with the jobs a ZEV can handle turned over to it.

Nobody, least of all a public offical in car-obsessed California, is saying we have to give up our weekend drives or whimsical cross-country car trips. All that's being asked — or rather, strongly encouraged — is that we leave our fossil-fuel-burning cars in the garage when a ZEV will suffice.

This includes most commutes, which, says GM's Hall, are suprisingly short: most are less than 20 miles, and the average is less than 10. This also embraces a large portion of urban pickup and delivery businesses. And service calls like those the Maytag repairpersons say they don't often make.

Developing a commute or delivery vehicle with a 100-mile range that can recharge overnight "is very straightforward" says Wallace. What concerns him most, he says, is the marketing side: "I worry more about small companies that will bring out vehicles that may not meet customer expectations," which he fears could then taint the public's image of ZEVs in general.

Behind Wallace's concern is his perception that today's car buyer is a sophisticated shopper and expect quality merchandise. "We're talking very high quality levels, and people are going to be expecting those quality levels" in their ZEVs, he says.

Assuming the car companies have ZEVs in showrooms come September '98, then comes what may be the hardest part. As Chrysler's Vines ruefully observes, "There is no mandate to buy these things." Other than the clean-air zealots, many of whom say they'd love a "green" car, who'll want a car that tethered to a 100-mile extension cord?

Fiscal reality will play its part: ZEVs will cost more that their piston-engined stablemates. CARB estimates that the premium will be less than $1,500 (in today's dollars), but that opinion isn't widely shared. GM hasn't priced the Impact, but figures in the $25,000 range have been mentioned.

Wallace says Ford's ZEVs will carry a premium of "several thousand dollars, at least", especially at the initial low production volume, which he puts at around 6000 a year. But perhaps the full cost won't be passed on to buyers. The marketers' task will be to sell enough ZEVs to meet regulations, with little regard to profit (or loss) on each — at least initially: "That's a temporary thing we cound live through", says Wallace.

Eventually, though — and most importantly if buyers are more resistant than the blue-sky crowd expects — car companies could need help stimulating demand. Just in case, CARB has asked for an incentive plan from the Electric Vehicle Task Force, a public/private group created to counsel CARB on practical and policy matters. CARB staffers say the likeliest plan is to recommend tax breaks for ZEV buyers and perhaps direct subsidies to business that pry employees out of gasoline-burning cars into ZEVs. At the local level, city and county governments can already require businesses operating vehicle fleets within their boundaries to use ZEVs.

GM's Hall says he could see government helping in a variety of ways. Boosting the gasoline tax could work as a dis-incentive for non-electric vehicles. ZEVs could also get preferred treatment, like free parking. Central city businesses could offer no-fee, at-

▶ *Continued on Page 4*

Zeroing-In

continued from page 3

work recharging as a (taxpayer subsidized) employee benefit. Single-occupant ZEVs could have access to car-pool facilities, like Diamond Lanes, and discounted or even free use of toll roads and bridges.

Hall also asserts, however, that he's not sure ZEVs will need much help from outside the marketplace. Electric vehicles, he says, "could be just plain, old cheaper" to operate than gasoline-powered cars. Today, recharging a completely dead Impact costs 87 cents. "Where else can you drive 125 miles for that kind of money?" he asks.

Paul MacCready, founder and head of Aero Vironment, the Southern California-based GM affiliate that dreamed up the Impact, shares Hall's optimism. If a company can offer a full line of ZEVs — from a two-passenger commuter to a four- or even six-passenger family car to a multi-use van, for which Hall and MacCready believe the Impact provides a workable platform — MacCready is convinced CARB's ZEV quota can be met. In fact, he says, "I think it's going to be more than achieved." That may be. And if so, it could put GM into the business of selling ZEV credits to other makers, because it's obvious few others are as confident about the market, despite their apparent acceptance of the impending ZEV requirement. More than likely, it'll take a lot more work by a host of scriptwriters, producers, assistants and gaffers to bring the ZEV show to California on schedule. ■

NEWS RELEASE April 18, 1991

Dealership Announces Production Plans

California Electric Cars will be located at 1669 Del Monte Avenue near Heitzinger Plaza Auto Center in Seaside, California. They began production of their new electric vehicle this week. Called "The Monterey", it is the first electric vehicle of original design in the past 10 years to be sold in the United States. Orders Placed today will be filled within 60 to 90 days.

The Monterey will retail for $19,995.00 and will be available in two-door sports coupe and eventually four-door family sedan. The Monterey will travel from 45 to 65 miles per hour which makes it ideal for local commuting. C.E.C. will also perform electric conversions on pre-existing cars. Research and development plans include incorporating Hi-Tech batteries for longer distance running cars.

Founder and CEO of California Electric Cars, Inc., Craig Campbell has been interested in electric vehicles since the 1970's. "Prototypes were very flimsy as conversions were being done on Volkswagen Bug chassis which couldn't accommodate the weight of the batteries," recalls Campbell.

Last year Campbell met Herb Adams of Carmel, reputable auto design engineer for championship auto racing vehicles, who did the design and engineering for the prototype to be sold at the Seaside location. Herb made sure the models were built so that the weight of the batteries will be more evenly distributed and the frame had structural integrity."

"We are very pleased to play our part in promoting a cleaner, healthier environment," commented Campbell. "since the cars use electricity as fuel, they are pollution free; they are the cleanest form of transportation available."

The establishment of C.E.C. on the Monterey Peninsula coincides with the emission control standards recently passed in California. At the end of 1990 the California Air Resources Board mandated that by 1998 two percent of all new vehicles sold in the state must be zero emission. By the year 2003, ten percent, or 500,000 electric or alternative fueled vehicles must be on the roads in California.

For more information call 408/899-2012. ■

California Electric Cars, Inc.

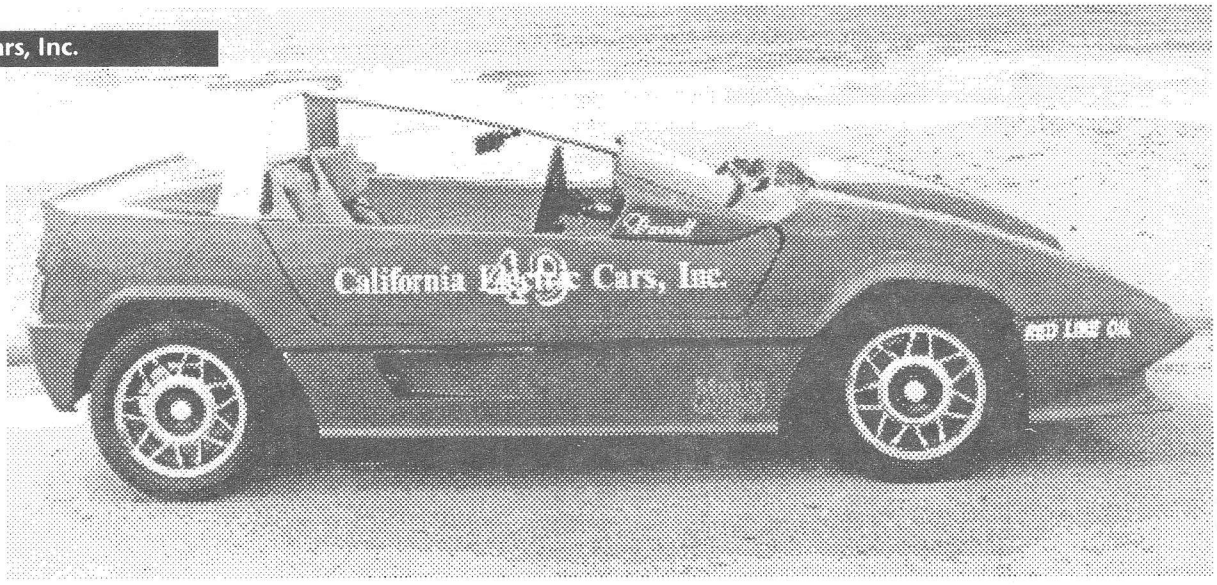
Weight:
2,500 pounds with
16 batteries

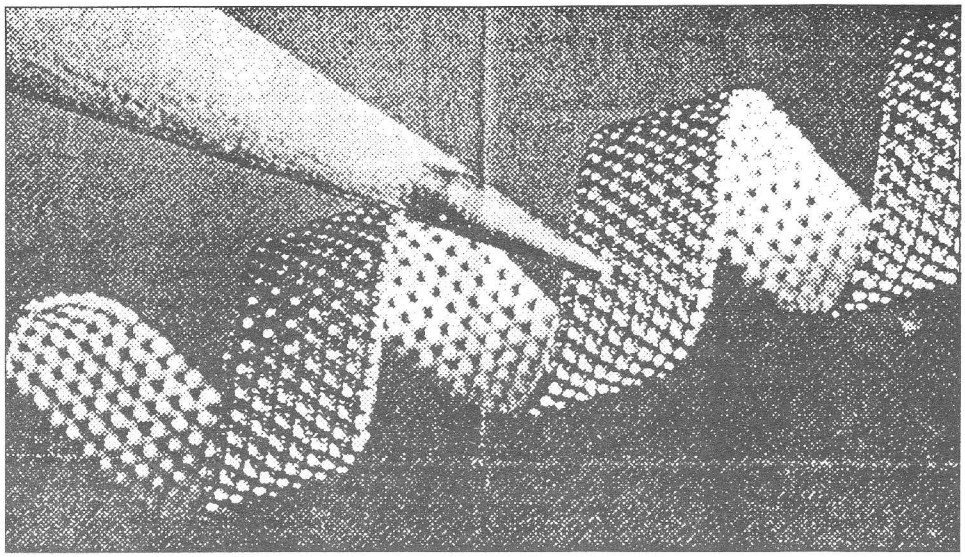
Top Speed:
70 miles per hour

Mile range:
60 – 100 miles

Battery Pack:
16 – 6 volt lead-acid

Power:
96 volt D.C.





New Solar Technique May Halve Cost

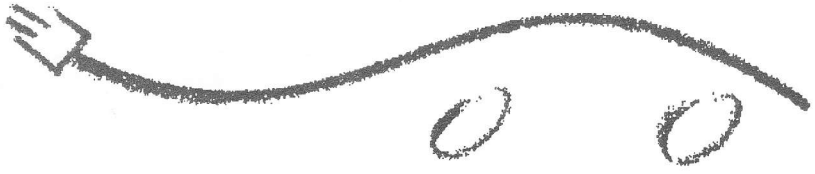
By EVAN RAMSTAD
Associated Press

DALLAS—Texas Instruments Inc. and Southern California Edison Co. announced on Wednesday a potential breakthrough in technology that could halve the cost of solar-generated electricity. Six years of research have yielded a way to use inexpensive, low-purity silicon in solar cells that convert sunlight into electricity, the companies said. "This has the potential to be the type of breakthrough technology we've all been working for in the solar industry," said Rober Dietric, a vice president for Southern California Edison. Texas Instruments is building a lab in one of its Dallas facilities to develop a manufacturing process for the new photovoltaic cell. The company hopes to perfect a manufacturing process by the end of next year and will then determine whether commercial production is viable, spokesman Ted Jernigan said. Some field trials will be made later this year also. "They have a unique and bold idea," said Scott Sklar, executive director of the solar Energy Industries Association in Washington, D.C. "It should be one of the many technological paths that make photovoltaics commonplace," he said. The use of expensive pure silicon in photovoltaic cels now makes them economical only in remote areas where the cost of running utility lines is very high. The pure silicon costs up to $75 per kilogram as compared with $1 to $2 per kilogram for so-called metallurgical-grade material. "So you have an incredible savings on just raw materials," said Nick Patapoff, senior research engineer who works exclusively on solar projects for Southern California Edison. The companies said they believe the production process will save money too. In the process, heat causes impurities to be distinguished from tiny silicon spheres. The spheres, smaller than a pencil point, are then fashioned onto a strong, flexible aluminum foil four inches square. ■

Charge your Electric Vehicle for only 3.5 cents/kwhr!

WAKE UP PG&E! Instead of promoting Natural gas-burning vehicles as your recent TV ads have been doing, you should be promoting the concept and use of electric vehicles. Since most of these cars would be charged during off-peak hours, they would increase your operating efficiency. EPRI knows this. The Los Angeles Department of Water and Power (LADWP) is already offering special incentives to EV owners. They are so convinced that EV charging will help them that they will allow up to 800 kilowatt-hours per month to be billed at the rate of 3.5 cents a kwhr for off-peak charging of your EVs. Their on-peak non-EV rate is about 12.5 cents/kwhr. LADWP and Southern California Edison which has worked with Texas Instruments to develop cheap solar cells, now seem to be leading the state on alternative energies. PG&E has been at the forefront in this area in the past, but now seems to be lagging behind.

—Pb ■



Solar Cells Shine

continued from front page

heat/pressure bond. An insulator is applied, and another sheet of aluminum, so that each sphere becomes a p-n junction between the two metal layers. The cell is considered extremely robust—if any sphere fails, the output diminishes by only 1/17,000th.

TI said more than 40 patents related to the process have been issued, are pending, or have been applied for. The company was cautious about releasing details, saying only that "no vacuum sputtering technology, lasers, or other high-cost processes are used." A TI spokesman said the company has no current plans to license the technology.

Since the cells are flexible, they are significantly more damage-resistant than previous solar cells, which are usually made on wafers or out of thin films of semiconductor-grade silicon. The low-purity silicon costs only about $1 a pound, whereas semiconductor silicon costs 10 times that, according to TI.

Spheral Solar cell prototypes are fully functional, and TI expects that once in production, the cells will have conversion efficiencies of 8 to 10 percent, about par with solar panels available today.

TI and its partner Southern California Edison (SCE), which over the last six years kicked in half of the $10 million development cost, would like to drive the cost of energy generated from Spheral Solar generators down to about 10 to 20 cents per kilowatt-hour, or alternatively, cut the cost of spheal Solar modules to $1.50 to $2 per watt. Today, solar energy at its cheapest costs approximately 25 to 30 cents per kilowatt-hour, or in modules about $8 per watt.

SCE is a good partner for TI, said Bob Johnson, of PV market research firm Stratigies Unlimited (Mountain View, Calif.). One reason is the utility is locted in a very sunny area, he said, and "also because of its rate structure—one of the most expensive in the country." SCE is said to charge as much as 14 to 15 cents per kilowatt-hour. "It may be able to use TI's entire output right from the beginning," Johnson said.

TI said modules will be available for field test later this year. In mid-1992, TI and SCE will decide whether to go ahead with a pilot production line, which would be set up here. SCE would then conduct tests, and if all goes smoothely, it could begin installing rooftop modules at its customers' homes as early as 1995, according to an SCE spokesman.

One hundred square feet of the cells could produce about 2,000 kilowatt-hour per year, TI estimates. Photovoltaic power is usually envisioned as providing peaking power—in other words, it would kick in at the times of peak electrical demand, in the afternoon, which would alleviate the heavy draw on the power grid at those time.

"The prospect of low-cost, versatile photovoltaic modules is very exciting in today's environmental arena," said Robert Dietch, SCE vice president of engineering, research, and envirnoment. "This has the potential to be the type of breakthrough technology we've all been working for in the solar industry."

It may be the greatest thing since sliced silicon, but Johnson cautions that the commerical market won't see any Spheral Solar product before 1995. "You can't write the rest of the PV industry off. In the next five years, they will be scaling costs." ■

Also see article pg. 5

HELP!

We need help on this newsletter. We need articles, reports, how-to stories, etc. We would especially enjoy getting how-I-did-it stories about any member's recent conversion experiences. Don't worry about your writing ability, —send in the facts and your phone number and I will turn them into an article for us all to enjoy and learn from.

Pb—
1968 Elden Dr.
San Jose, CA
95124-1313 ■

Detroit is Serious!

This want ad appears in the May 20 issue of Electronic Engineering Times.

Calendar

June 14 – 23, 1991 LightWheels Festival 1991 Trade Show, Ride, Conference; NYC to Wash. DC; 49 E. Houston St., NYC, NY 10012 212/431-0600.
June 17 – 23, 1991 Save California Drive Sacramento – LA.
June 23, 1991 Concours d'Elegance Palo Alto, CA; EAA is participating.
July 13, 1991 East Bay (CA) chapter meeting RALLY.
August 3 – 9, 1991 Intersociety Energy Conversion Engineering Conference Boston, MA 708/352-6611.
August 4 – 5, 1991 Clean Air Revival Solar Expo and Motor Sports Show **Info:** 55 New Montgomery St., San Francisco, CA 94608 415/495-0494. **Location: Pacifica**
August 9 – 11, 1991 SEER 1991, Willits, CA (Final Round Electrathon Champ Trail).
August 18 – 22, 1991 '91 ASME Int'l. Computers in Engineering Conference Marriott Hotel, Santa Clara, CA.

Want Ads

FREE TO GOOD HOME: 1969 Mazda R-100. Good for electrification. New fr. end, braking sys., tires. Many body part interchangeable w/ Datsun & Mazda 1200. No major dents or rust, but paint and int. vinyl are definitely 22 yrs. old. Mark Smith (H)415/573-7648 or (W)415/857-7105.

WHY WAIT FOR DETROIT? Just published! Articles by EV pioneers: Mike Brown, Bob Batson, Ken Koch, Jim Tervort, et al. Edited by Steve McCrea, So. FL EAA. $10.00 Available at EAA chapters or direct from Steve McCrea, P.O. Box 030003, Ft. Lauderdale, FL 33303. Profits from the book benefit EV research.

The EAA is not responsible for the accuracy of ads.

EAA Chapters

ARIZONA
■ *Phoenix*
Lee Clouse 602/943-7950
P.O. Box 11371, Phoenix, AZ 85061

CALIFORNIA
■ *East Bay*
Jim Danaher 415/339-1984
1986 Gouldin Rd., Oakland, CA 94611
■ *North Bay*
Bob Wing 415/669-7402
P.O. Box 277, Inverness, CA 94937
■ *Peninsula*
Jean Bardon 415/355-3060
540 Moana Way, Pacifica, CA 94044
■ *Santa Clara*
Lee Hemstreet 415/493-5892
787 Florales Dr., Palo Alto, CA 94306
■ *San Jose*
Don Gillis 408/225-5446
5820 Herma, San Jose, CA 95123
■ *Los Angeles*
I.L. Wiess 818/841-5994
2034 N. Brighton "C", Burbank, CA 91504
■ *So. California*
Ken Koch 714/639-9799
12531 Breezy Way, Orange, CA 92669

NEVADA
■ *Las Vegas*
Gail Lucas 702/736-1910
Desert Research institute
2505 Chandler Ave. Ste. 1
Las Vegas, NV 89120

TEXAS
■ *Houston*
Ken Bancroft 713/729-8668
4301 Kingfisher, Houston, TX 77035

WASHINGTON
■ *Seattle*
Ray Nadreau 206/542-5612
19547 23rd N.W., Seattle, WA 98177

WISCONSIN
■ *Milwaukee*
Dave Pares 414/481-9655
3251 S. Illinois, Milwaukee, Wi 53207

NEW JERSEY
■ *Hackensack*
Kasimir Wysocki 201/342-3684
293 Hudson St., Hackensack, Nj 07601

NEW ENGLAND
■ *Maynard*
Bob Batson 508/897-8288
1 Fletcher St., Maynard, MA 01754

SOUTH FLORIDA
■ *Ft. Lauderdale*
Steve McCrea 305/463-0158
101 S.E. 15th Ave., #5, Ft. Lauderdale, FL 33301

VANCOUVER, B.C.
■ *Vancouver*
VEVA 604/987-6188
543 Powell St., Vancouver, BC V6A 1G8

■ *American Solar Car Ass'n.*
Robert Cotter
P.O. Box 158, Waldoboro, ME 04572

NON-AFFILIATED GROUPS
■ **EVCO** 604/987-6188
Box 4044 Sta "E"
Ottawa, Ontario CANADA K1S 5B1

■ **DEVC**
George Gless 303/442-6566
Denver, CO

■ **Fox Valley EVA**
John Stockberger 708/879-0207
2S 643 Nelson Lake Rd., Batavia, Il 60510

For info on the EAA, send SASE to the address below or call 415/591-6698 or 415/685-7580. Please call weekdays 10am – 5pm Pacific Time.

Advertisement Rates: 5 lines for $5.00. 1/4 page for $15.00. Submissions to be "camera ready."

EDITOR: Paul Brasch DESIGN/PRODUCTION: John Broenen CONTRIBUTIONS: John Newell

ELECTRIC AUTO ASSOCIATION
1249 Lane Street, Belmont, CA 94002

NON-PROFIT ORGANIZATION U.S. POSTAGE PAID SUNNYVALE, CA PERMIT NO. 420

Address Correction Requested