F. V. E. A. A. NEWSLETTER

NOVEMBER 1990

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

MEETING NOTICE

The next FVEAA meeting will be **NOVEMBER 16th** 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: Enter at EAST entrance. We meet in room # K-157

THE PREZSEZ

The new FVEAA year begins in November with collection of 1990-91 dues ($ 15) and election of officers for the coming year. Because the FVEAA is solvent, the members at the last meeting agreed to extend memberships until November of 1991 for those who joined after June of this year.

The current officers, except for Treasurer Vana, have agreed to continue to serve for the coming year, but incumbency seems to be a disadvantage. Make your wishes known at the meeting.

I propose to initiate a series of monthly discussions on conversion techniques for the benefit of our new members. "Getting Started - Budgeting And Selecting A Car." will be the November 16th meeting topic.

Bill

FOX VALLEY ELECTRIC
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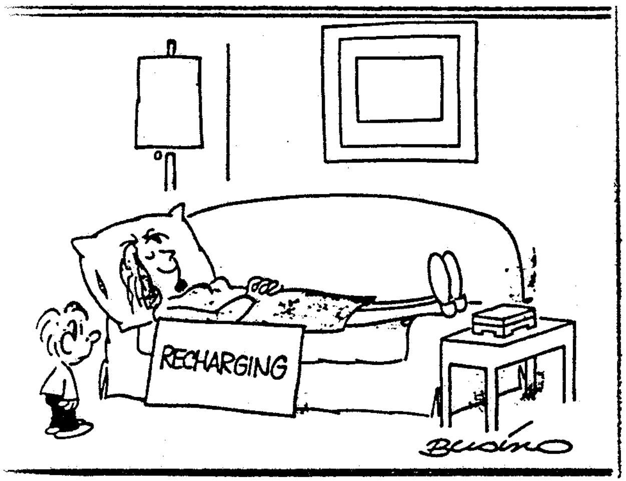
FIRST CLASS

ADDRESS CORRECTION
REQUESTED

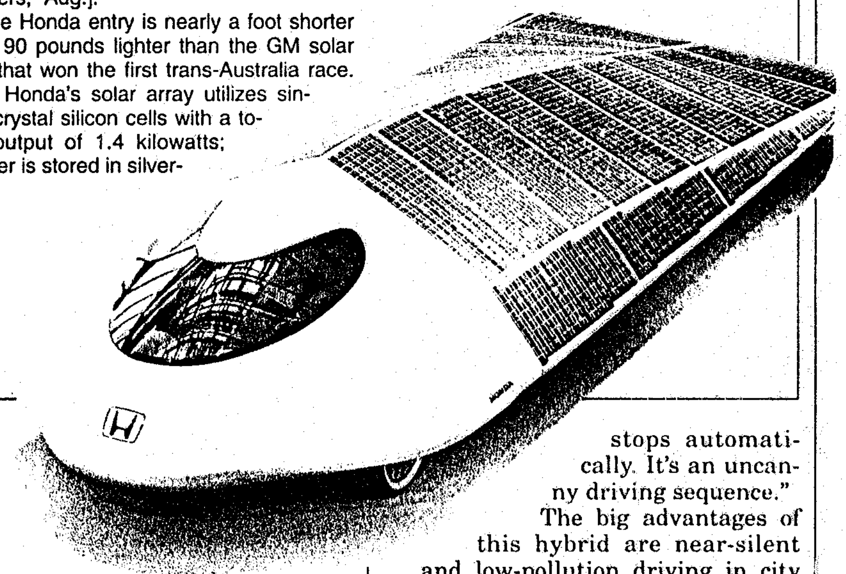


HONDA: RISING POWER IN SOLAR RACING

Already a world champion in two-wheel and four-wheel motor sports, Honda switches to a three-wheel layout (two front, one rear) for its newest racing effort. A team from Honda R&D Co., Ltd., is taking up November's 1990 World Solar Challenge from Darwin to Adelaide, Australia, with a car similar in shape to the General Motors Sunraycer, though somewhat leaner. GM will not contest this event itself, instead it is sponsoring the top three finishers of last July's Sunrayce USA ["Sun Racers," Aug.].

The Honda entry is nearly a foot shorter and 90 pounds lighter than the GM solar car that won the first trans-Australia race. The Honda's solar array utilizes single-crystal silicon cells with a total output of 1.4 kilowatts; power is stored in silver-zinc batteries. The DC motor peaks at 4.5 kilowatts of power delivery, good for a top speed of 75 mph. In contrast, the GM Sunraycer carried gallium arsenide solar cells, had a 7.5-kilowatt motor, and a top speed of 82 mph.

With 40 entries expected (10 from the United States) and three years of development time since the last Solar Challenge, the Australian race promises to be the world's premier event for sun-powered cars.—*Norman S. Mayersohn*



Diesel-electric VW

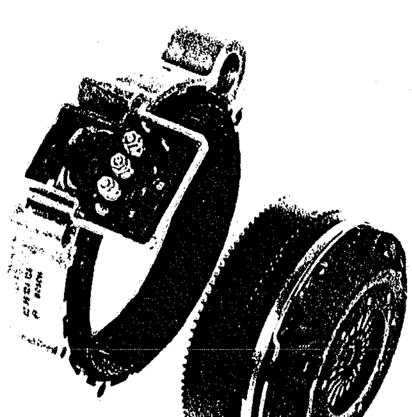
The Volkswagen Golf looked normal enough to our correspondent in London, but under the hood were two power sources—a diesel and an electric motor. David Scott filed this summary of his drive in this unusual hybrid at a British demonstration:

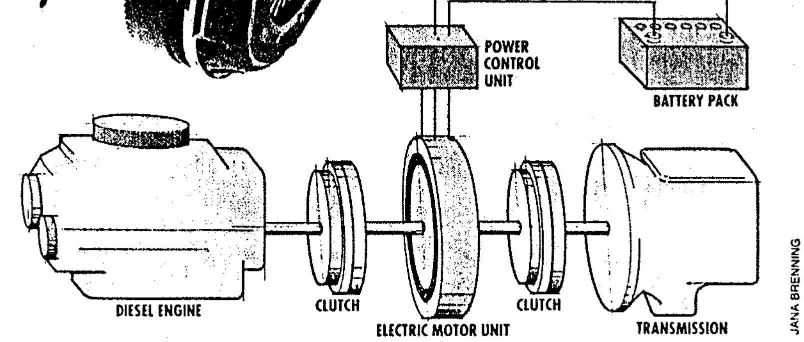
"What a strange experience. Opening the door I hear a muffled whine for a few moments. I twist the starter key, but nothing seems to happen. There's no clutch pedal, and I hesitantly stick-shift the semi-automatic gearbox into first. A cranking starter motor breaks the silence, followed by the hushed clatter of an idling diesel.

"I squeeze the throttle, and we move off smoothly and accelerate briskly up through the gears to twenty-five miles per hour, when I lift my foot. Instantly the engine stops, but we roll quietly up to thirty miles per hour as I gently squeeze the pedal again. We have gone electric. Wanting more surge, I jab the accelerator, and immediately the diesel restarts and takes over. Now I brake to a halt, and as I shift to neutral the engine stops automatically. It's an uncanny driving sequence."

The big advantages of this hybrid are near-silent and low-pollution driving in city traffic, where fuel consumption can stretch to 95 mpg due to little need for the engine. But unlike electric cars, on the open road there's no range limit with diesel power, and top speed is 94 mph. The Volkswagen design, which has been much refined since the project started three years ago ["ANF," Oct. '87], is now in limited production for environmental research in Switzerland and ready for immediate volume manufacture.

The heart of the system is an ultra-slim 2.3-inch-wide electric motor unit flanked by two clutches bolted to the rotor and sandwiched between the transverse engine and its end-on gearbox. The ingenious eight-horsepower device is not only for propulsion, but replaces both the engine flywheel and starter and doubles as an alternator for regenerative braking. Developed by Robert Bosch GmbH in Germany, its different functions are electronically controlled, while the two clutches operate by a micro-switch in the gearshift knob. Power is from a suitcase-sized 72-volt battery pack carried in the trunk. This provides an electric range of 28 unaided city miles before needing an overnight recharge. PS





This hybrid drive design packs a slim 2.3-inch-wide electric motor (top) into the area normally occupied by the clutch and flywheel of the Volkswagen Golf's diesel engine.

WHAT DETERMINES BATTERY LIFE

Purchase of a battery for an EV is an important part of a project's cost. The number of 6-volt modules used vary from 6 for a single-string, 36-volt system to 16 for a double-string, 48-volt arrangement. Battery cost can vary from $300 to over $800.

Amortization of the battery during use is the most-costly operating cost, exceeding the 5-6 cents per mile for electricity. Under test conditions to an 80% depth-of-discharge, the usual commercially-available EV battery (Golf cart style) achieves about 200-300 charge-discharge cycles. A 10-unit battery system would have an amortization of 7-10 cents per mile depending on energy consumption per mile of travel.

The EV owner has an economic incentive to extend battery life. To do this, listed are the following factors which contribute to battery deterioration .

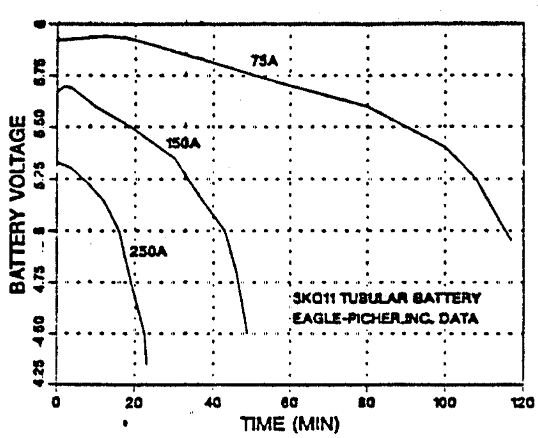
Peak Current

The EV battery is designed to maximize stored energy, unlike the more-familar automobile starting-lighting-ignition (SLI) type used in conventional cars. The EV battery is not designed to deliver high currents. The most-frequent application is the golf cart where the vehicle must cover 36 holes in a single day and starts are relatively infrequent (depending on the handicap).

The standard test for golf-cart batteries determines the number of minutes the battery will deliver a constant 75-amps until voltage cut-off of 5.2 volts (Per 6-volt battery). The accompanying chart illustrates how increasing peak currents reduce battery energy delivery.

In an EV, the battery is required to deliver high peaks during acceleration. These can be 3-6 times higher than the rated steady-state value of 75-amps. Repeated high peak currents will cause more-rapid battery deterioration by raising local temperatures in each cell, causing material shedding, and accelerating grid corrosion.

DISCHARGE CURVE



The EV driver can avoid many high peak currents by utilizing the transmission gears to start. An electrical system that incorporates parallel battery strings will reduce cell peak currents.

Deep Discharges

The EV battery will last much longer if the car is not repeatedly driven to its extreme range, especially in the winter. Tests indicate when depth-of-discharge exceeds the 80% design level, battery life is reduced to less than 100 cycles. At extreme discharge levels, differences develop between cells that can only be corrected by extensive overcharging. Also, at these levels there is a risk of cell reversal.

Immediate Recharging & Idle Time

Battery life can be extended by commencing a recharge immediately following discharge. Immediate recharge prevents the growth of sulfate crystals which are formed during discharge. If a discharged battery is allowed to stand, large, hard-sulfate crystals form which are impossible to transform back to lead and lead oxide during recharge. It should be noted that regenerative braking is a type of immediate partial recharge.

Battery life will be increased if it is charged whenever the car is parked. A 1-amp trickle charge is recommend to maintain a fully-charged battery. If you can negotiate "plug-in" approval at work for your EV, your battery life will be extended. Not much you can do about recharging while your EV is parked at the train station parking lot.

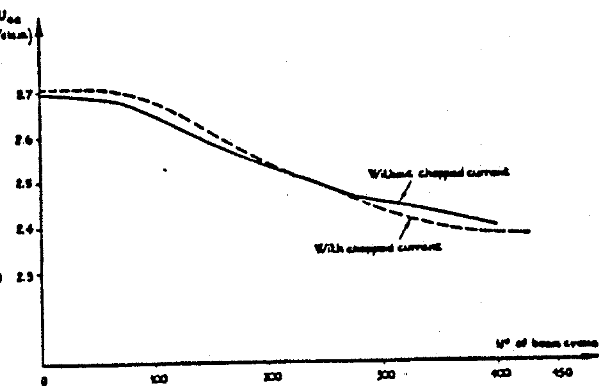
Weekends are made for equalizing and watering. This will bring those weak cells back into line.

Charger Design & Management

Careful attention to the design of the charger and its use will pay big dividends in extended battery life. A charger should contain more than a transformer and rectifier bridge.

End-of-charge voltage declines as a battery ages, therefore the charger should be equipped to adjust voltage. The accompanying curve shows voltage decline with age.

The charger voltage should also be adjusted for temperature. Refer to the two curves included with the previous low temperature discussion.



End of charge voltage versus the number of basic cycles (from Laboratory tests on flat-plate batteries).

Some end-of-charge gassing is necessary as previously discussed. Gassing causes electrolyte stirring within each cell and is necessary also to bring all series-connected cells to a full charge level. Too much gassing will cause sludging, electrode passivation, and transformation of lead to lead sulfate as the higher-density electrolyte is moved upward. This was discussed in last months's stratification article.

Recharge should be complete. Any lead sulfate crystals formed during discharge and not transformed by recharge will act as a starting point for additional crystallization during the next discharge. Residual lead sulfate also favors the growth of large crystals which cannot be eliminated by recharging.

One way to manage an unsophisticated charger is to keep track of the AC energy input (Kwh) and trip mileage driven. The charger can then be timed to return about 115% of the energy consumed between charges and then revert to a 1-amp trickle charge for maintenance. This technique requires observation of gassing onset and a log of data. The amount of charge must be temperature-compensated.

Thermal Management

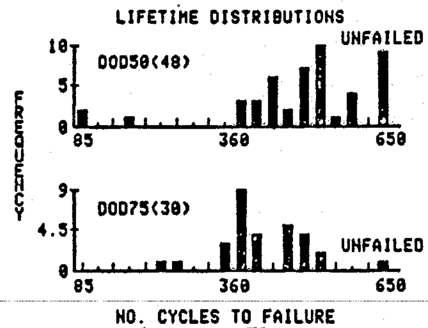
A battery delivers its best performance and has the longest life when cells are around +40C. Design measures that maintain this operating temperature will pay off.

Uneven distribution of cell temperatures is a major cause for different performance from each cell. Keeping each cell at the same temperature is a major design challenge. If all battery units are packed together in one area, the center cells will be warmer than those on the outside during operation and charging. If cells are distributed in the car, front and rear for weight balancing, they will also experience temperature differences.

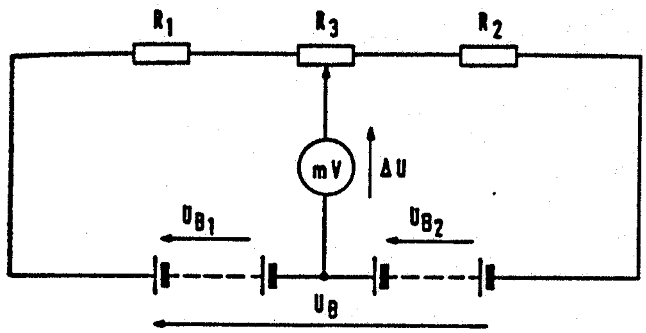
Some suggestions for cell temperature management are forced cooling for the interior batteries, keeping all units in the same location, and enclosing the assembly in a styroform package with controlled ventilation.

Module Monitoring & Replacement

Due to manufacturing variations and other factors, cells do not have a uniform decline and failure characteristic. The accompanying histogram shows the failure characteristic for 48 EV batteries subjected to a 50% discharge depth and for 30 tested to a 75% level. Since cells do not havea "one-hoss-shay" characteristic, detection and replacement of early-failing units can extend the life of the battery as a whole.



The next diagram is a schematic of a simple monitoring system for a 2-string battery pack. Since cell deterioration is accompanied by a decline in voltage, a failing cell can be detected. A lower cell voltage will unbalance the bridge circuit indicating a need for investigation. The circuit also monitors the condition of all inter-connections so a poor connection will also be detected.



Adding Water

Almost nothing will cause more premature cell failure than neglecting to maintain the proper electrolyte level. A low level increases the cell specific gravity which accelerates sludging and grid corrosion. Water should be added before charging. It helps some to give the syringe a healthy squeeze when adding water to promote electrolyte mixing.

Cleaning

If the battery shows signs of collecting sulfate around a post, cleaning with a sodium bicarbonate solution is recommended. These deposits can cause a discharge during standing.

Extended Lay-Up

If the EV will not be used during the winter months, the battery should be fully-charged and equalized first. About once a month, the battery should be given a recharge to compensate for self-discharge. A battery will lose about 1% of its charge per day at +20C. This increases with higher temperature.

William H. Shafer
17 November, 1984

Dr. Ed Francis Organizing Trip to Switzerland Tour de Sol

Professor Francis is planning a ten day educational tour to Switzerland to coincide with the Tour de Sol race in Switzerland in June 1991. The Tour de Sol is the original solar electric car race in Europe.

The all expense tour for the ten days including transportation, hotel and two meals per day will be approximately $1800.00. You may remember that Dr. Francis, the principal investigator for the 6KW solar photoelectric installation in Aurora, presented information on the current status of photocell development at our August 18, 1989 meeting.

For further details contact: Ed Francis, Department of Industrial Technology, Illinois State University, Normal, IL 61761
Office phone (309) 438-7862- Home phone (309) 452-7252.

AP Laserphoto

Racing with the sun

One of eight U.S. entries in the World Solar Challenge car race runs through a stability test Saturday in Darwin, Australia. The University of Michigan's "Sun Runner" is among the 36 entries from nine countries that are to leave Sunday from Darwin for the 1,925-mile race.

Chicago Tribune Sunday, November 11, 1990

FOX VALLEY ELECTRIC AUTO ASSOCIATION

FVEAA

Rev. April 15, 1988

MEMBERSHIP

A membership in the FOX VALLEY ELECTRIC AUTO ASSOCIATION (FVEAA) is open to everyone. Currently there is only one grade of membership regardless of the members degree of participation in association activities. Membership in the FVEAA is contingent upon payment of the annual membership fee. The membership fee can only be waived by special vote of the board of directors. Each member in the FVEAA receives a copy of the FVEAA NEWSLETTER each month. They are also entitled to attend and vote at all association meetings.

All memberships in the FVEAA run from November 1st to October 31st of the following year. The dues are $15.00 per year payable at the November meeting or by mail.

The following form may be used to apply for membership or to renew your membership.

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APPLICATION FOR MEMBERSHIP OR RENEWAL

Date ______________

Name ____

Address ____

City ______________________ State ________ Zip ______________

Phone # __________________________ (please include your new area code # if it changes)

- ☐ Just interested in electric vehicles
- ☐ I have an electric vehicle (describe) ______________________________
- ☐ I wish to build an electric vehicle

Amount enclosed $____________

Make checks payable to: FOX VALLEY E.A.A.

Mail to: MR. VLADIMIR VANA, FVEAA TRES.
5558 FRANKLIN
LA GRANGE, ILL. 60525