April 1988

MEETING NOTICE

The next meeting will be Apr. 15th, at *CRAGIN FEDERAL SAVINGS & LOAN* 333 W. Wesley St. Wheaton, Ill. - Time - 7:30 P.M. sharp. Guests are welcome and need not be members to attend the meeting.

THE PRES SAYS

With the coming of 85-degree days, some persons get spring fever, some get the gardening urge, while FVEAA members want to get their cars out of the winter cocoon and back on the road. We will be assisted in this by activities at our winter meetings.

The Maryjanes (Power Transistors) have been tested and classified by Member Meyers and his helpers. They have been grouped according to turn-on characteristics and are ready to replace the former units in cars that are being upgraded to 48 volts. It occurs to me the removed power transistors may find some other use in battery chargers or other devices. I'll ask for a discussion of this possibility during our April meeting.

Member Stockberger moved quickly on the group battery purchase. I am informed the batteries may be picked up.

Battery charger kits should be available at the April meeting.

At the April meeting, we will discuss our appearance at the Kane County Fairgrounds on May 1st and the Rally at Argonne Lab in June. Our technical discussion, in addition to the items noted above, will also include a how-to discussion of fitting the new Maryjanes into an existing controller.

Bill

F. V. E. A. A.

FOX VALLEY ELECTRIC
AUTO ASSOCIATION
624 Pershing St. Wheaton, Il 60187

FIRST CLASS

ADDRESS CORRECTION
REQUESTED

MINUTES FVEAA Meeting March 18, 1988 at Cragin Federal Savings & Loan office, Wheaton

President W. H. Shafer called the meeting to order at 7:34 P.M. There were 18 members present.

Treasurer V. Vana reported that there is $1893.38 in the NOW account and $805.01 in the ~~checking~~ savings account for a total of $$2898.39, however a bill for the Mary Janes of $749.16 still has to be paid.

FLEA MARKET: Paul Harris to coordinate publicity. Pres. Shafer to write up a press release for the bulletin so members can give it to thier local papers. John Stockberger to get his batteries going for his car to exhibit. Ditto for George Krajnovich. John Emde to publish a map in next bulletin. Starting time is 6:00 A.M., public gets in around 8:00 A.M. Paul Harris to negotiate a choice location WITH A PLUG to enable our members to charge up. Paul will also try to get our members an exhibitors pass.

BUMPER STICKERS: Decision deferred to April meeting. Some members are going to try to come up with a different slogan or idea. Pres. Shafer suggestion, "Let 'em turn off the oil---we're ready"...another suggestion..."Beyond oil...Go Electric". Paul Harris made a motion and then ammended it for the club to buy 500 bumper stickers for up to $125.00...hoping to get some battery company to go for the other half of the cost of $125.00.

CLUB CAR: Still needs to be repaired. John Stockberger has a 1975 Fiat to sell to make room for working on the club car.John is going to tow the club car to Ken Myers to look over and do the needed welding.

VIDEO TAPE: Pres Shafer met with an instructor for video production, Jude Crouch. He would like to produce, mayber have some scenes included to intersprese with our panel. Cost to be minimal...only for materials...labor to be free. A date is not yet available or picked out yet for our program. Crouch would own the tape and rights.. but we would possibly negotiate for rights to put it on different cable stations.

John Stockberger says Illinois Battery Co. can provide the club with Alco 2200 battery at $48.95 and took a head count of those that were interested.

Rick Lewandowski says Tower conference has boothes at Home and Energy shows 2 to 3 times a year for 3 to 4 days and would probably give us a free booth for car display and a spokesman.

Battrey Charger: Ken Myers has made 10 boards so far at $15.00 each. At the next meeting ken will have a parts list and all boards with instructions and a cost chart.

Mary Janes were given to V. Vana to distribute to buyers and he also issued a check for payments to Bell Industries.

Ken Woods reported on Superconductor. Dr. Z of Ill Inst. of Tech. says we are many years away for usage on electric cars.

The meeting was adjourned at 9;50 P.M.by a misc. motion.

Respectfully submitted,

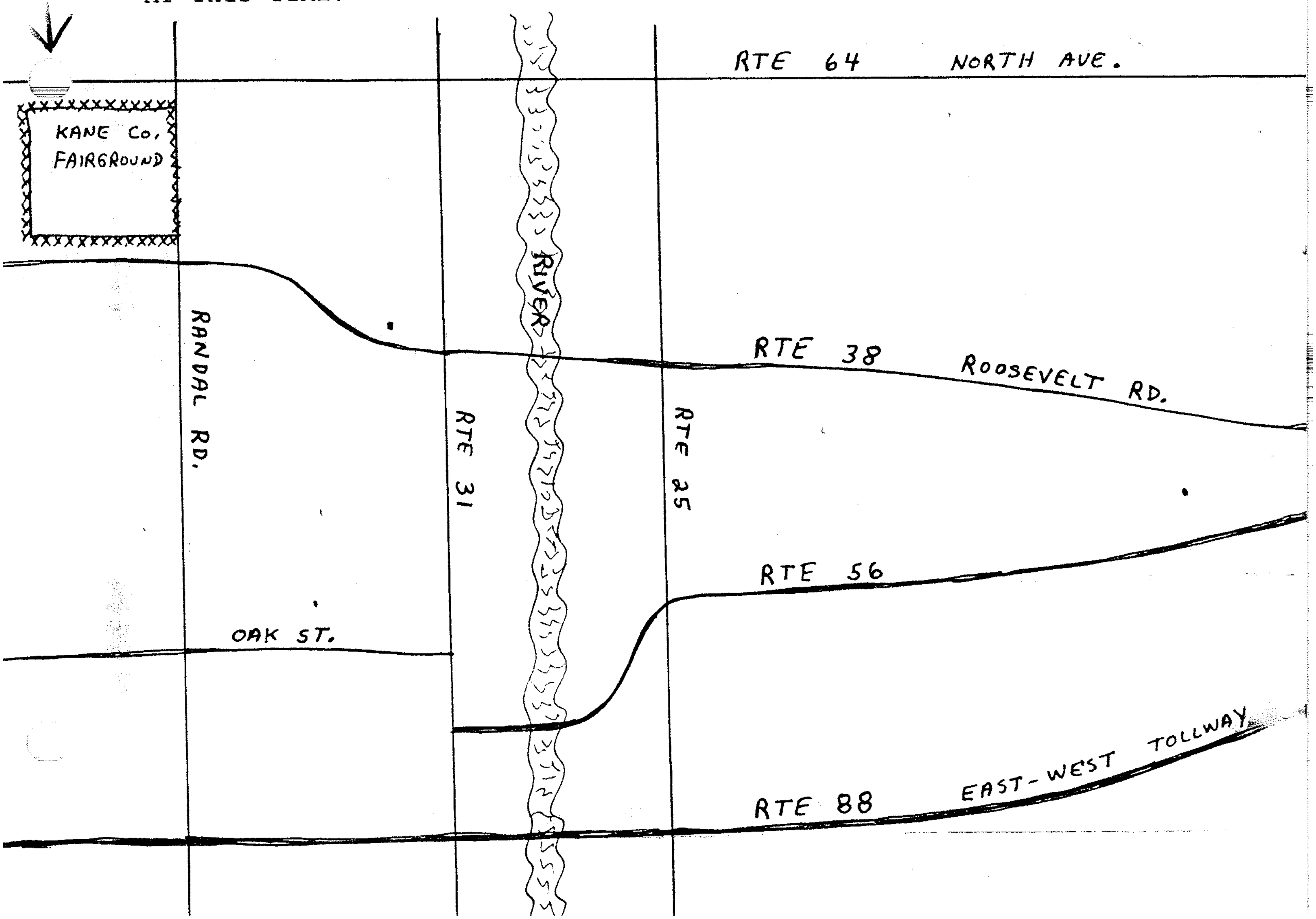
Paul P. Harris, Secretary

News Release

FOR IMMEDIATE RELEASE

THE FOX VALLEY ELECTRIC AUTO ASSOCIATION WILL HAVE A SHOW AND TELL SESSION AT THE KANE COUNTY FAIR GROUNDS, NORTH RANDALL ROAD, ST. CHARLES ILLINOIS ON SUNDAY, MAY 1, 1988 FROM 7 A.M. TILL 4:30 P.M. GENERAL ADMISSION IS $3.00 AND ALL ARE WELCOME.

FEATURED WILL BE 3 ELECTRIC VEHICLES AND THEIR BUILDER/ OPERATORS. ALSO ON HAND WILL BE OTHERS FOR DEMONSTRATIONS AND TO ANSWER ANY AND ALL QUESTIONS. THE FOX VALLEY ELECTRIC AUTO ASSOCIATION IS OPENING UP MEMBERSHIPS AT THIS TIME.



Battery-powered cities?

By Keay Davidson
Scripps Howard News Service

Two years after the "superconducting revolution" electrified scientists, engineers and entrepreneurs, they're hustling to turn their new knowledge into products.

But don't hold your breath waiting for superconducting toasters. The technology's grandest spinoff may be a huge underground gizmo that is "super" in every sense of the word: an electrical "storage coil," hundreds of feet in diameter, that might light entire cities — or shoot missiles from the sky.

In theory, it would be the ultimate battery. Through its frigid interior, electricity would spin endlessly with almost no resistance. The coil might provide the sudden surges of electricity needed for the "Star Wars" program's batteries of lasers and particle-beam weapons.

Alternately, a storage coil could enhance a commercial electric grid. By storing power when demand is low and releasing it when demand is high, it could soothe the utilities' supply-and-demand woes.

Anyway, that's what the experts at Bechtel National Inc. in San Francisco say. Bechtel and Ebasco Services Inc. of New York City are dividing a grant of almost $30 million from the Defense Nuclear Agency to develop rival designs for a superconducting storage coil.

WHETHER THE STORAGE coil proves to be a boon or a boondoggle, one thing is clear: It's one of the most imaginative proposals to make practical use of superconductivity, a phenomenon in which electricity flows without resistance.

The storage coil would operate by what could be called, perhaps unfairly, "old-fashioned" superconductivity — that is, superconductivity that requires temperatures close to absolute zero (minus 459 degrees). By contrast, since early 1986 scientists have made breakthroughs in "high-temperature" superconductivity.

Experts say it's too early to tell whether the post-1986 breakthroughs could be applied to the proposed storage coil. Some say Bechtel officials will consider that possibility in their design study.

Two years from now, DNA officials expect to choose either Bechtel or Ebasco's proposal as the winning design. The winner will be turned into an actual working model, a storage coil perhaps 300 feet in diameter and costing $50 million-$60 million. The coil would be sunk in a trench several feet deep, and bathed in extremely cold liquid helium.

In theory, "the stored energy can be retrieved slowly or almost instantaneously," a Bechtel spokesman said.

Also, the working model is expected to be able to feed 10 to 25 megawatts into a utility grid for two hours.

Bechtel is receiving $13.8 million under the two-year grant to develop a design for the Superconducting Magnetic Energy Storage (SMES) Engineering Test Model (ETM).

BECHTEL HAS conducted SMES research f[or] more than six years with funding from the U.S. Department of Energy and the Electric Power Research Institute, a utility think-tank in Palo Alto, Calif.

One proposal is that SMES-type systems could serve electrical grids until a missile attack, at which point energy would be diverted to the SDI system.

A small prototype storage coil has already been tested successfully by GA Technologies in San Diego, said Terry Walsh, project manager for SMES/ETM.

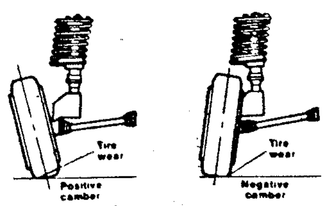
Maybe the storage coil will work, maybe it won't. A prominent skeptic is Nobel laureate Phillip W. Anderson of Princeton, a top authority on superconductivity and outspoken foe of SDI. Years ago, he recalled, the Defense Department was interested in studying a similar idea and at that time one of Anderson's colleagues blasted it as unfeasible in "a devastating memo. (But) they went ahead and funded it anyway."

"WHAT THE (superconductivity) field needs more than anything else is money in basic research, (not) a bunch of entrepreneurs, the typical Defense Department type, siphoning off money that should go into basic research," Anderson said. Such research "should be funded by the DOE and National Science Foundation, because the minute the Department of Defense goes in you start wasting 90 percent of the money."

Superconductivity research should be oriented toward peacetime applications, not toward weaponry, Anderson said. "If a presidential candidate (ev[er]) says that, I'm his man forever."

Tires, Suspension, and Alignment. . .

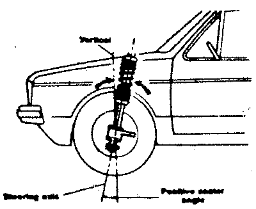
There are three basic elements to proper suspension alignment; camber, caster, and toe. Understanding how these elements effect your electric vehicle's "alignment" will help you to spot problem areas and correct them before unnecessary tire wear occurs.



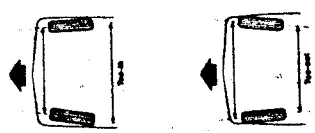
CAMBER

Camber is the inward or outward tilting of the wheels from vertical as viewed from the front or rear of the vehicle. Incorrectly adjusted camber angle can contribute to tire wear, and cause the vehicle to pull to one side or the other.

CASTER



Caster is the forward or rearward tilt of the steering axis (an imaginary line drawn through the strut pivot point and lower ball joint) as viewed from the side of the vehicle. Positive caster is utilized on most cars to stabilize the steering in a straight direction.



TOE

Toe is the difference in the distance between the front edge of the two tires as opposed to the rear edge. To avoid scuffing, the front wheels should be parallel with each other while the vehicle is being driven.

Learn to spot the signs of alignment problems and correct them quickly. Also, always maintain the proper air pressure in your tires as recommended in your Owner's Manual.

MINUTES FVEAA Meeting February 19, 1988 at Cragin Federal Savings & Loan office, Wheaton, Illinois.

President W. H. Shafer called the meeting to order at 7:33 P.M.

There were a8 members present and one guest.

Treasurer V. Vana reported that there is $944.84 in the nOw checking account and $776.45 in the savings account for a total of $1721.29.

FLEA MARKET: Dick Ness talked to Mrs. Robinson and her son regarding a choice location for the club at the Kane County Fair Grounds, possibly for free and we may get May, June, July and August for 2 or 3 cars to display and passing out of some literature on the club and electric autos in general.. They advertize weekly and the market is heavily attended. It is held on the 1st Sunday of each month. We are scheduling our first go at it for May 1, 1988. Paul Harris to coordinate some publicity and to have Pres. Bill Shafer to send a confirmation letter to Mrs. Robinson.

BUMPER STICKERS: John Stockberger has talked to a printer for a standard size, yellow stock with black lettering and temporary mastic and has gotten the following figures. $1.28 ea. for 125 order, 78¢ ea. for 250 order and 48¢ ea. for 500 order. delivery 2 weeks. Paul Harris also ahd talked to a printer, but had not gotten the figures or a sample to show. Harris is going to try to have a sample for the March meeting and also the prices.

CLUB CAR: Pres, Bill Shafer reports the batteries are charged up, the car is sitting in a snow bank awaiting the Spring Thaw to continue working on the car.

Frank Delmonico to check out prices on a GOLF CART type battery for club.

VIDEO TAPE: Pres Bill Shafer is going to try to arrange for a taping session at the Oak Park Cable Studio. Try for the 3rd Friday Nite in April. We will have a panel of 'experts' for speaking and possibly showing of their autos etc.. Also we will be able to pitch our upcoming exhibit at the Kane County Fair Grounds the following 2 weeks later...good timing.

BATTERY CHARGER: Ken Myers reports that there are no boards available as yet. The first prototype is being reworked..the board is goinf to be enlarged to make it easier to build and eliminate electrical-mechanical problems, (which could be created by all thumbs like me).

SHOW and TELL: John Stockberger showed some video tape of Solar Power race in Switzerland, 1986 and also the Australian race in 1987...very interesting.

KEN WOODS invited everyone to try to attend an exhibit at the Museum of Science and Industry on February 27, 1987..10 A.M. subject.Superconductivity.

The meeting was adjourned at 9:27 P.M. by a motion by V. Vana..who else..

Respectfully submitted,

Paul P. Harris

Paul P. Harris, Secretary.

Prospects for Electric Vehicles

by Prof. Olle Lindström, Royal Institute of Technology, Sweden.

Professor Olle Lindström is with the Department of Chemical Technology, Royal Institute of Technology, S–100 44 Stockholm Sweden

In the first part of a controversial assessment of batteries for electric vehicles, Professor Olle Lindström examines potential applications for electric cars, and then defines battery parameters.

Environmental concern should be a major argument for electric transportation although such issues are not considered to be very important today. However, this will change when the effects of traffic pollution on public health become better known.

Today the EV has to operate on the same terms as the ICE vehicle and this makes it uncompetitive. However, it is rational to use electric systems where they are more cost effective than their ICE counterparts. User's costs with an electric forklift truck are less than with an ICE truck and the performance of the electric truck is satisfactory for many job profiles. Opinions differ, however, about the cost effectiveness of public transportation systems with trolley buses, battery buses or diesel buses.

Electric delivery vans with lead acid and nickel/iron batteries are cost effective today in many applications. In particular the electric delivery van could be a key component in new local goods handling systems: "from shelf to shelf" because of its combined indoor and outdoor capabilities.

This paper however is concerned only with the electric passenger car, which is not cost effective compared to today's ICE automobile. The EV is at present an almost handmade commodity – what it needs is its own Henry Ford! EVs for the general marketplace would have to be mass produced at a rate of a least one hundred thousand units per year at a level of automation and production efficiency second to none. The EV has to be optimised and debugged in every detail to achieve the same perfection as the ICE car, which means a development cost of hundreds of millions of dollars and a project duration of about 5 years.

Applications for the 1990s

General Motors was working on an EV project on this scale several years ago but dropped it although they have apparently not given up the idea. Their two-seater EV commuter using GM Delco Remy nickel/zinc batteries is on show at the GM World of Motion building at the Epcot Center in Florida.

This seems to be typical of the situation everywhere Interest in the EV is declining – because of presently favourable opinions about the energy situation – but the EV idea is still very much alive. Growing environmental concern and a tougher environmental policy will keep EV programs going. Nevertheless the most important thing is to find several EV applications which may attract the user in the early 1990s – from a user's point of view, not from an environmentalist's point of view.

The busy commuter is one such potential EV-user, and the retired resident is another. The former user would need an EV designed in the "minicar" range, the latter one in the "microcar" range. The minicar is equivalent to a sub-compact weighing about 1000 kg fully loaded, the microcar is half this size. Payload is about 300 kg for the mini and 150–200 kg for the micro.

Consumer attitudes

If the EV is to take a market share from light-weight ICE vehicles it has to be a light-weight vehicle itself, and this requires not only a high performance EV battery but also a new view on EV performance.

What could be done to change consumer attitudes? A set of sales arguments for the mini and micro EVs could be: "Why hurry when you are not in a rush:" "Low cost:" "Safe performance".

The argument for slow speed parameters in the EV forms a countergambit against a major issue in the battle between the giants on the market scene: Power for the fascination of acceleration. This "move leisurely argument" is already used by manufacturers of very small cars with engines in the range 50 to 125 cm^3.

"Low cost" means that the EV should cost no more than the ICE vehicle in the same transportation job.

"Safe performance" has many implications and has positive meaning for the general public. The all electric vehicle is well suited to provide the driver with technical means to improve the safety of the car and the safety of driving. The electric system is inherently very reliable so an EV may be safer to drive with fewer breakdowns.

Safe performance also means sufficient power for driveability in the city which will fit into the traffic picture in the beginning of the 1990s. This may be a somewhat less difficult requirement in the 1990s than today; the development of more fuel efficient and less polluting cars could lead to reduced kW ratings at least for the commuter cars of tomorrow.

Car design

The retired resident would not use his micro EV during rush hours and should be satisfied with a driveability which will fit his capability and the quiet traffic environment he prefers.

Let us derive formulas for mini and micro EVs along these lines. There are ICE models on the scene which may contribute a basic pattern for these designs: the Volvo LCP 2000 or the GM AERO 2000 for the mini EV and the French "voiturettes" such as the Ligier JS6 and the Microcar de Jeanneau for the micro EV.

The Volvo LCP 2000 and the GM AERO 2000 are prototypes for the demonstration of advanced technology which may be used in production cars at the turn of the century, and as can be seen from Table 1 they are somewhat similar.

Both cars use turbo-charged diesels for the front wheel drive and can accommodate four passengers. Top speed and acceleration are in line with present thinking that the greatest desire of every driver is to violate traffic regulations!

The major purpose of these cars is to demonstrate low fuel consumption figures. The user may not be able to achieve the targets set out in Table 1, but a practical figure around 5 litres/100 km would nevertheless be impressive.

It may appear at first that this kind of future ICE competition would make it even more difficult for the EV to compete than it is today. On the contrary, energy efficient car designs will improve prospects for a related EV version considerably, because of increased range, while the driver of the ICE vehicle may not bother too much about the reduction in fuel consumption, as fuel accounts for only 10 15% of his total costs.

Many EVs on the street today look like boxes on wheels – with corresponding drag coefficients, but the GM EV at the Epcot Center has the same sleek appearance as the GM AERO 2000. The mini EV will have to be designed like that to give the necessary range, although the electric drive system is just as important.

Today's car is in fact very much an electric vehicle. There are more electrical wires than fuel pipes and more electrical components than mechanical ones thanks to the qualities of electrical energy: easy control, immediate response and high conversion efficiency. The combustion engine is out of place in this electrical environment. The marriage between the heat engine and the electrical system is not a good one. The conversion efficiency from the fuel tank to usable electricity is only 5–10%, so the kWh of electricity produced aboard the automobile is very expensive. One overlooked advantage with the EV is that the all electric machinery circumvents this problem. So we may say that the EV is already here if we examine the ICE vehicle in this way.

Range vs battery energy density

The EV, however, lacks the most important components, i.e tank for electrical energy and electric engine(s) for propulsion. There are electric motors available which match the ICE, but there is no battery which will match the energy density of the fuel tank, and there never will be.

The present ambition to make EV performance as competitive as possible with ICE performance has led to the ridiculous, well publicised picture of the EV hauling a battery trailer as large as the EV itself! The battery weighs frequently up to 30% of the total weight, and an additonal 40% has to be added for structure weight associated with the battery. A battery weighing 500 kg thus means a weight contribution of 700 kg to vehicle weight. A very substantial part of the battery energy is then used to move around the battery itself. (Fig. 1)

Table 1 Advanced ICE concepts

	Volvo LCP 2000	GM AERO 2000
Wheel base, cm	254	260
Length, cm	398	434
Width, cm	165	165
Curb weight, kg	707	815
Drag coefficient	0.25–0.28	0.23
Engine, kw	39 (alt. 66)	51
Fuel consumption, litres/100 km	2.9	3.3

The range is shown plotted against the fraction of battery energy which is used for transportation of the battery itself. The baseline design is a mini EV weighing 1000 kg with 10% of the total weight allocated to the battery. Energy consumption is based on 0.14 kWh/tonne km from the battery (Elton J. Cairns has reported 0.14–0.17 kWh/tonne km for urban driving). Compare for example the 100 Wh/kg battery with the 25 Wh/kg battery at say a 50 km range: 40% of the energy in the low energy density battery is wasted on battery transportation compared to 10% for the high energy battery. In this particular example a 50% higher fuel cost (battery charges + electricity) for the high energy density battery would break even with the low energy density battery. High energy density has an economic value which may compensate for higher electricity costs.

The only way out of this dilemma seems to be to cut the battery weight to 10–15% of the total weight and to find out what this kind of EV could do on the market place. Such EV designs will at least be comparable with the advanced ICE options with respect to size, weight, appearance and appeal, but what about speed, acceleration and range?

A low speed EV is acceptable in a traffic environment where all cars are running at the same speed. A radical solution could be to put up EV lanes in the multi-lane freeways connecting the metropolis with its suburbs. Streets in sensitive city areas could be open for small non-polluting EVs but closed for the ICE counterparts. Such changes are in line with the efforts of society to cope with the ever-increasing environmental problems of the modern city.

What would be the desired maximum speed for the EV formulas to fit into this vision of the future urban transportation system? Probably above 50 km/h and below 110 km/h. I would suggest 60 km/h for the microcar formula and 90 km/h for the minicar formula. No premium is given for acceleration though a kick-down feature could be incorporated with some battery systems.

A low speed rating gives room for weight reduction compared to the ICE formulas in Table 1, which approach 200 km/h.

Table 2 summarises these EV characteristics.

Ranges are reported for three battery energy densities 50, 100 and 150 Wh/kg. 150 km is frequently quoted as a goal for the EV (by the automotive industries) which would need an energy density of the battery around 150 Wh/kg.

As discussed above the philosophy behind these normative formulas is to provide a light-weight practical car and to change the environment around it to fit the car. A secured range of approximately 100 km should be satisfactory for the users of the mini and micro EVs. A level of 100 Wh/kg is then necessary, 50 Wh/kg is too low.

Low speed ratings make a long range less important. These cars are not designed to cover a lot of mileage, but will provide transportation for people in and around cities with no pollution. In order to cope with the range question an infrastructure could be developed around the EV which could include recharging areas at parking lots, reserve batteries available at service stations etc. Electricity could be made available everywhere. There are unexpected business opportunities literally around the corner. The down-sizing of the battery, which is the characteristic feature of these EV designs, facilitates such arrangements. Even fast recharge would require little power, and mechanical handling of the batteries would become much easier.

Table 2 Selected EV formulas

	Total Weight kg	Battery Weight kg	Speed max. cont. km/h	Sustained power from battery kW	Battery energy density Wh/kg	Range† 50 km/h cruise	km Urban driving (32km/h)
Micro EV	500	50	60	3	50	63	40
					100	125	80
Mini EV	1000	100	90	10	150	188	120

† Ranges are the same for the micro EV and the mini. Average power from battery is 4 kW/tonne for the two modes of operation. (Elton J. Cairns has reported 4–5 kW/tonne.

Cost

The EV formulas drawn up in this scenario are key components in a total electric system, in the same way as at present ICE vehicles are part of a large and complicated transport infrastructure. There are several cost levels in these systems. The user, e.g. the commuter, is observing and controlling one set of cost parameters. Other direct and indirect costs associated with the network of streets and roads, car accidents, illness and diseases caused by pollution, etc, are not counted by the user, but he has to pay for them in one way or the other. The situation is the same when it comes to benefits like the efficiency and flexibility of individual transportation means, the job opportunities caused directly and indirectly by the auto industries, etc.

I shall not attempt to quantify the various terms in a complete cost/benefit analysis of an EV scenario *vs* the ICE real world. The user is, however, interested in items like first cost, tax and insurance, fuel, repairs and maintenance, physical life, salvage value etc. The EV formulas with down-sized batteries shown in Table 2 should be cost competitive with the corresponding ICE mini and micro formulas. The tax problem (in countries like Sweden) is overcome by the weight equalisation. Insurance policies for the EVs should be favourable because of the limited speed. The EV is also expected to last longer than its ICE counterpart, and the annual fixed and operating costs, excluding fuel costs, should be lower.

Gasoline prices seem at present to be fairly stable and have even come down slightly e.g. in the US. The cost of electricity varies a great deal around the globe in the range of 10–100 mills/kWh. The present pessimistic view on the prospects of the EV in the US is based on the argument that the cost of electricity alone, not counting the battery cost, is higher for the EV than the cost of the gasoline for its ICE counterpart.

An ICE minicar consuming 5 litres/100 km for a price of $1/US gallon has a fuel cost of $1.30/100 km. The mini EV user has to buy ~ 15 kWh from the utility for a 100 km ride. The break-even cost for electricity then amounts to 87 mills/kWh – not counting battery expenditure.

In Sweden, to take the home country of the VOLVO LCP 2000, gasoline is costing $0.50 litre and electricity 30 mills/kWh. The same kind of estimate gives a break-even battery cost of $100/kWh at 500 deep cycles If this battery cost is introduced in the estimate for US conditions there will be an added cost for the battery of $2.00/100 km on top of the electricity bill of $1.30/100 km at 87 mills/kWh. However, it seems likely that this cost could be paid for by the cost advantages with the EV mentioned above.

Conclusion

The environmental and resource conservation qualities of the EV justify continuous and intense development efforts even if the commercial prospects may look dim at the moment. In my opinion, the EV has to be a light-weight, well designed vehicle with a battery load accounting for only 10–15% of the total weight. Limited range and speed has to be accepted and should be compensated for by means of modifications in the transportation system as a whole. The EV formulas chosen need a battery with an energy density around 100 Wh/kg and a delivered cost at a level of $100/kWh at 500 deep cycles or the equivalent. This challenge to the battery developers will be discussed in a subsequent paper.

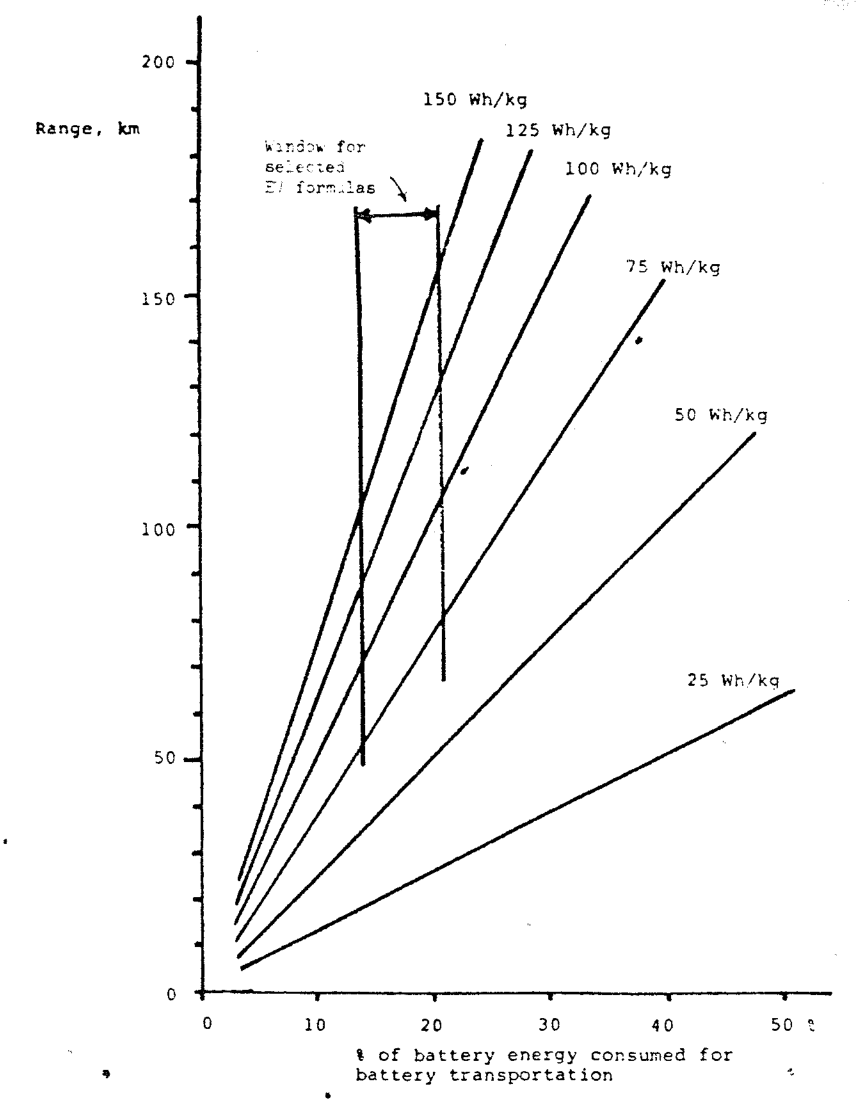


Fig.1 Plot showing relation between EV range, non-productive battery use and energy density of batteries.