Soft Technology

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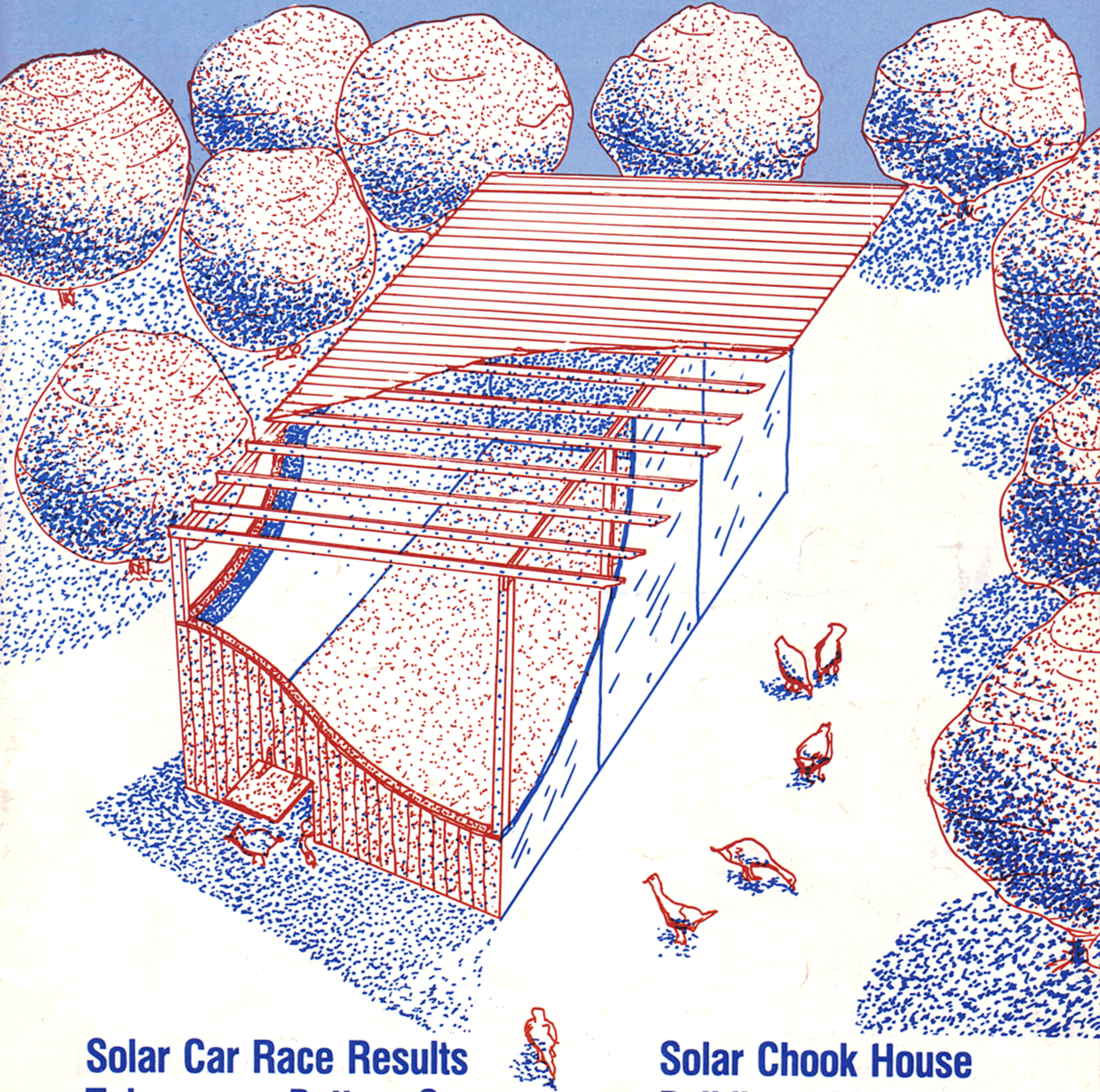

Solar Car Race Results
Telecom on Battery Care
Solar Electricity

Solar Chook House
Building with Mudbrick
Energy Futures

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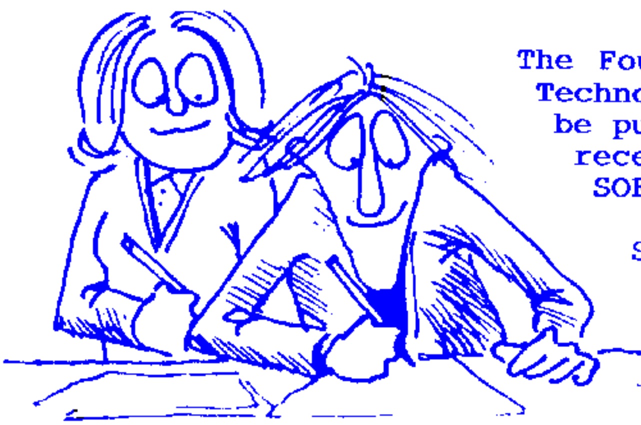

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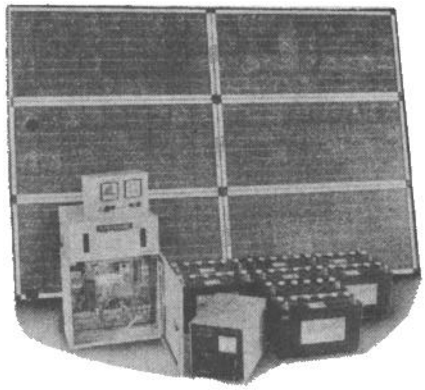

SOLAR ELECTRIC SYSTEMS P 13.

This issue of Soft Technology was edited by Mick Harris with the help of Alan Hutchinson, Noel Jeffrey, Jeff Hilder and others.

If you are interested in being involved in the production of this magazine, please leave a message on 419-8700.

Comments, contributions and criticisms are welcome and should be sent to the

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Energy Flashes

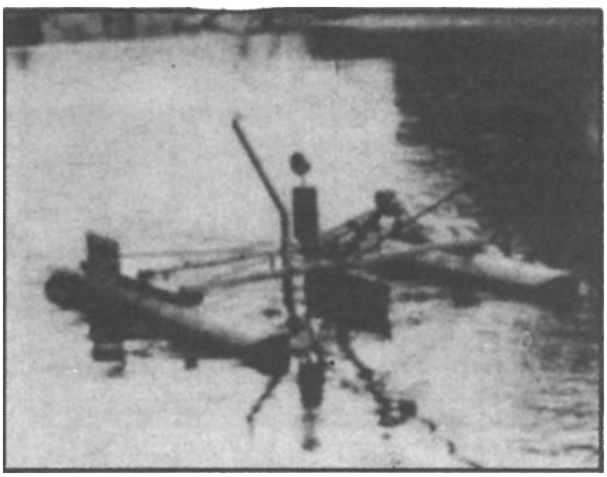
Water Powered Water Pump

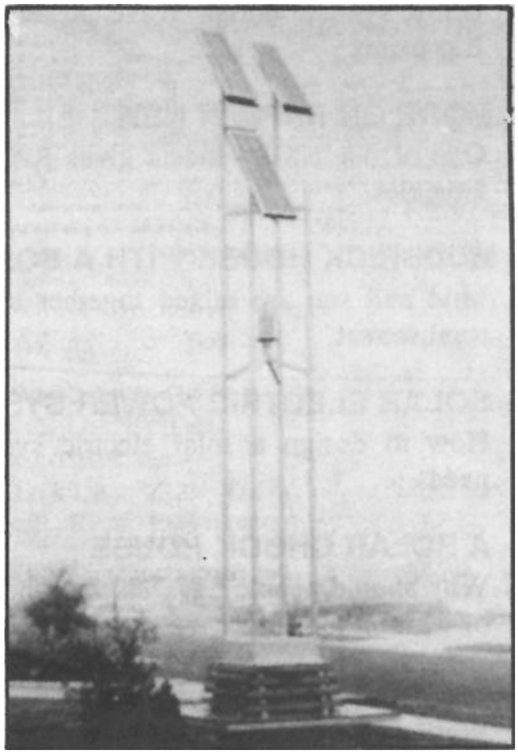
A N.S.W. farmer, Warren Tyson, has designed and developed a water pump which is powered from a turbine driven from a water flow. The turbine was designed as a spinning top with curved blades to operate outside a pipe in a river or stream.

The unit uses no external power source, it is suspended in the water from a pontoon and tethered well above the floodline, automatically adjusting to the water level.

The turbine can be used to generate electricity or drive a compressor. The turbines blades are self-cleaning, with the ability to remove river debris. The stream must have a depth of 1 metre and a minimum water flow of approximately 1 km/h.

It can be built in various sizes from 250 mm. to more than 30 m. and produces up to 670 kW if the depth and velocity of the water is adequate. A 1 m. diameter model, installed in a small stream in Victoria, has been pumping water to a head of 45 m. at the rate of 7 litres per minute and simultaneously supplying power to two houses and a dairy.





Solar Street Lighting

A Melbourne Company, Rankin Engineering, has commenced marketing a stand-alone solar lighting system.

The company became interested in solar lighting about two years ago but found that there was a lack of necessary equipment available to develop the type of lighting they wanted to produce. The company then applied for and was awarded a grant from the Solar Council to develop their product.

They have developed two types of lighting, one for remote areas with different facilities to operate in different climatic conditions, and the second system has been developed for use in parks and malls where conventional lighting systems prove to expensive.

Solar Power for Torres Strait Island

The Queensland Government is to build a solar power system to generate electricity for the commnunity on Coconut Island in the Torres Strait.

This is the first large scale application in Australia of photovoltaic solar power technology.

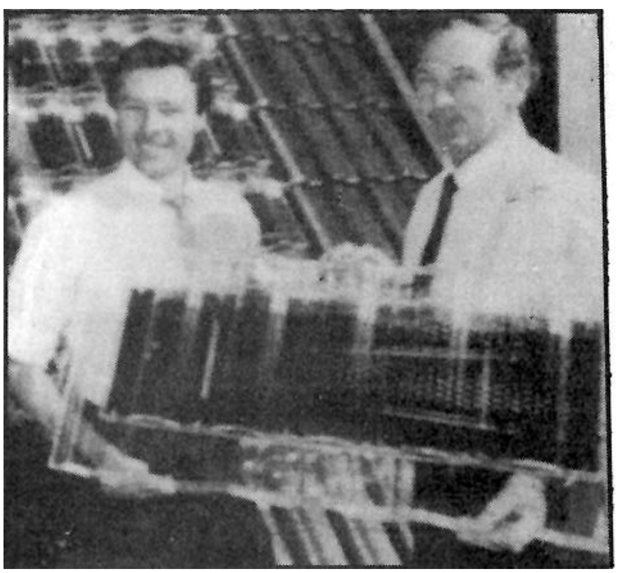
This project may lead the way to the introduction of many more "solar powered" communities in remote areas of Australia which are not connected to the State Electricity System.

Solar Tiles

A Sydney company, Solarite (Aust.) Ltd. is selling a solar roofing system, invented by Ken Lock,

The system, which is claimed to be more energy efficient than conventional solar collection units, can replace sections of convectional ceramic or cement tiles.

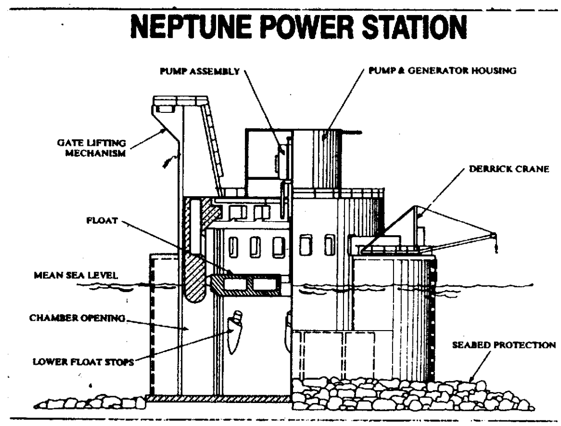
The tiles are constructed with a toughened clear acrylic with a black chrome solar collection panel mounted beneath it.



One of the solar tiles replaces three conventional tiles with twelve of the tiles being sufficient to service a 300 litre storage tank.

(Engineers Australia)

Wave Power for Western Australia



A Western Australian town may become the site of the worlds largest wave power generator.

A Sydney company, Wave Power International, plans to build the generator off the coast at Esperance.

The company is currently seeking approval from several government bodies and if authorised the plant will produce electricity for the State Energy Commission.

The plant has the potential to provide 20% of the areas power demand. The system was developed in the U.S. and consists of a concrete caisson containing a float and a pump. Waves force the float into an up and down motion which drives the pump. The pump then raises water which drives a generator. The plant will comprise an onshore substation with the generator sited approximately 300 metres offshore,

The project is designed as a commercial demonstration plant which will promote the technology around the world if the venture is successful.

Back in the U.S.S.R.

The Soviet Union is developing commercial methods for using biomass as fuel.

Since 1969, the U.S.S.R. have been operating two power generating plants using methane gas.

Presently there are biogas producing plants operating from organic sewerage wastes in Moscow, Leningrad, Kharkov and Odessa with twelve more cities soon to have similar plants.

By 1990 it is estimated that as much as 270,000 tons of equivalent fuel will be saved by reprocessing waste water. Waste water purification is becoming an important of methane generation and fertiliser production with the potential to produce two billion cubic metres.

The U.S.S.R. has two experimental plants for obtaining biogas from urban garbage in Kharkov and the Ukraine. By the year 2000 the entire mass of organic waste is expected to be used for the production of biogas.

Improved Solar Battery

A French company has produced a battery which they claim offers 35% more useable capacity and 55% longer service life than traditional solar batteries.

The new Stnco 3000 solar battery uses a high performance MFX alloy for the grids positive and negative plates are contained in individual microporous separator pockets with glass wool separators to improve cycling performance and battery working life.

The MFX alloy is said to reduce gassing during overcharging and reduce self-discharge to a very low value.

Porous filters trap conducting acid mist which results in the battery being able to retain 75% of its charge after six months of dead storage.

New Range from Suntron

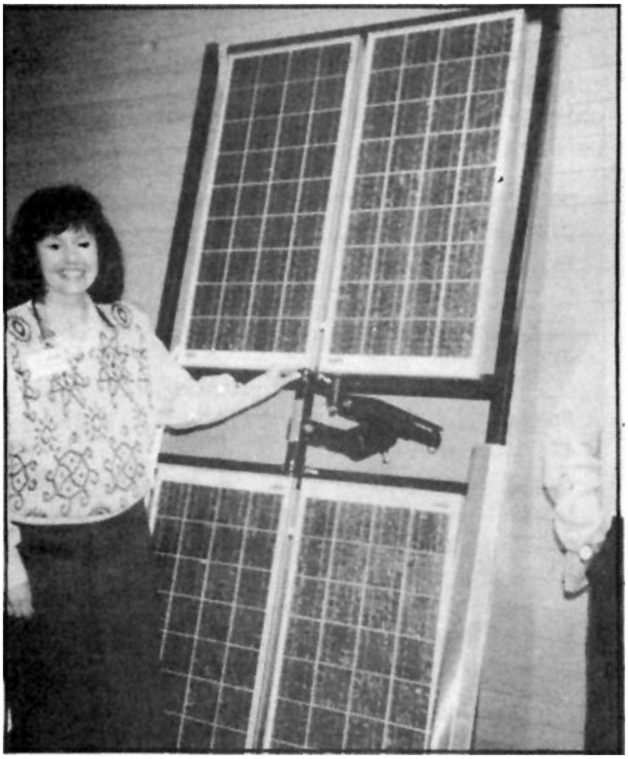
The Suntron Energy Company has produced a new and comprehensive range of products.

The centrepiece of the range is a 42 watt solar electric panel produced to Suntron's specification. The panels is actually manufactured by Phillips, the one Australian producer of solar panels who until now seemed to be ignoring the domestic market.

Suntron's range also includes high efficiency lighting equipment, inverters, control gear, deep cycle batteries, solar pumping systems, trackers, generator sets and a range of appliances suitable for use in solar electric systems.

If you want more information on what Suntron has to offer their address is:

Suntron Energy Company Pty. Ltd.
861 Doncaster Road, Doncaster.
Victoria, 3109. Ph (03) 848 4873.



Natural Bio Paints

Did you know that most paints contain environmentally damaging chemicals such as pesticides, benzene and coal tar. Well one company in South Australia is producing natural paints and finishes free from environmentally damaging chemicals.

The company, Bio Products Australia has two criteria for its "Natural Products". The "raw materials must be acquired without over exploitation of Nature and must be of a reproducable standard" and "manufacture and handling of the products should not contribute to the depreciation of Nature, nor should their quality be degraded".

The paints, varnishes, stains and polishes are made from raw materials of plants and trees, natural bonding-agents, resins and waxes. Herbal extracts from plants with active substances against fungus and insects, and natural pigments are used.

For more information contact Bio Products. 25 Aldgate Tce, Bridgewater, SA. If you are in Victoria, Friends of the Earth has some excess paint from the painting of their new building and are selling it of cheap. Their number is 419 8700.

150 kW Wind Generator in NSW

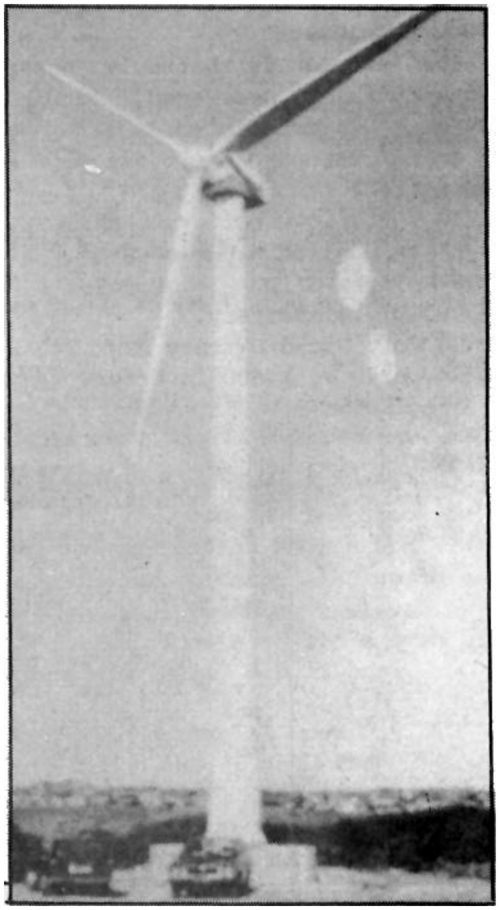
The Energy Authority of N.S.W. has installed a 150 kW Windmaster turbine at Malabar, a coastal Sydney suburb.

The power generated is fed into the State Electricity Grid at the Metropolitan Water Sewerage and Drainage Board's Malabar Sewerage Works.

The tower of the generator is 22 metres high with 11 metre long blades.

The generator and gearbox are located in a central nacelle with control equipment at the base of the tower.

The installation will later be isolated from the state grid to assess its performance in supplying power to remote communities.



More on RAPS in NSW

In the last issue of Soft Technology we had a look at the New South Wales Governments new RAPAS scheme. The Remote Area Power Assistance Scheme gives permanent residents of remote areas subsidies of up to $10,000 to assist to the cost of connection to the grid or for the setting up of an independent energy system.

However one of our readers got in touch to let us know RAPAS is not all it is cracked up to be. Here is what he had to say:

"I went to the Electricity Commission here in Tamworth and spoke to the Electrical Engineer in charge re RAPAS. The whole scheme seems to be a propaganda exercise and no good to me at all.

To qualify for the RAPAS scheme one has to comply with the Guidelines set down by the NSW government. Arco Solar (Solar Cells Australia) are not on the list of approved suppliers. For that matter only two suppliers on the list are from outside New South Wales.

The excuse is that only Australian made products are preferred, but it seems it is more NSW orientated.

Going through the list of equipment I own you can see why I have been disappointed.

(1). 12 Volt nicad battery bank 90AH.	(Not approved, purchased before scheme started)
(2). 5 kVA Dunlite Windgenerator.	(" " " " " ")
(3). 3 Solarex Gt100 P.V. Panels.	(" " " " " ")
(4). 1,000 V.A. Battery.	(Homemade, Not approved)
(5). 24 Volt Nicad Battery Bank 240AH	(Cost $16,000 - Not Approved, not Aust. made)
(6). 24V -240 V, 1,800 Invertor,	(Specially made in Melb. for Nicads, Not Approved)
(7). Arco Solar P.V. Panels	(Not on list of approved items)

Our reader went on to describe RAPAS as "selfish bureaucratic bungling" which doesn't "care for the people up the bush".

We had a look at the list of "approved products" and it certainly appears that a number of quite reputable, mainstream manufacturers have not been included. However the list we have was produced in July, 1987 and it may be that a number additional manufacturers have since been included.

Our reader did also make another interesting comment, and we will be seeking comment from Solarex on this point.

"Did you know Solarex panels must be kept cool. About 6 amp goes down to 2 amps at lunch when hot. Put garden hose on to cool of and they go back up 6 amp. I will put a sprinkler system on".

More feedback from readers is welcome; let us know how you have found the scheme. If you want more information on RAPAS, contact the Energy Authority of New South Wales.

A Mudbrick House with a Solar Angle

By Cris Spencer

In 1980 I moved into my own mudbrick house after three years of building: a task which I found very stimulating and rewarding as well as tedious and time consuming.

I liked the challenge of problem solving; the hunt for the best bargain, the search for usable materials for the cheapest price, even though I suppose I could have afforded to pay more.

At the time I was single and unattached which meant I relied a lot on friends to help, for that third hand, for company, and to help the time pass quicker on boring activities.

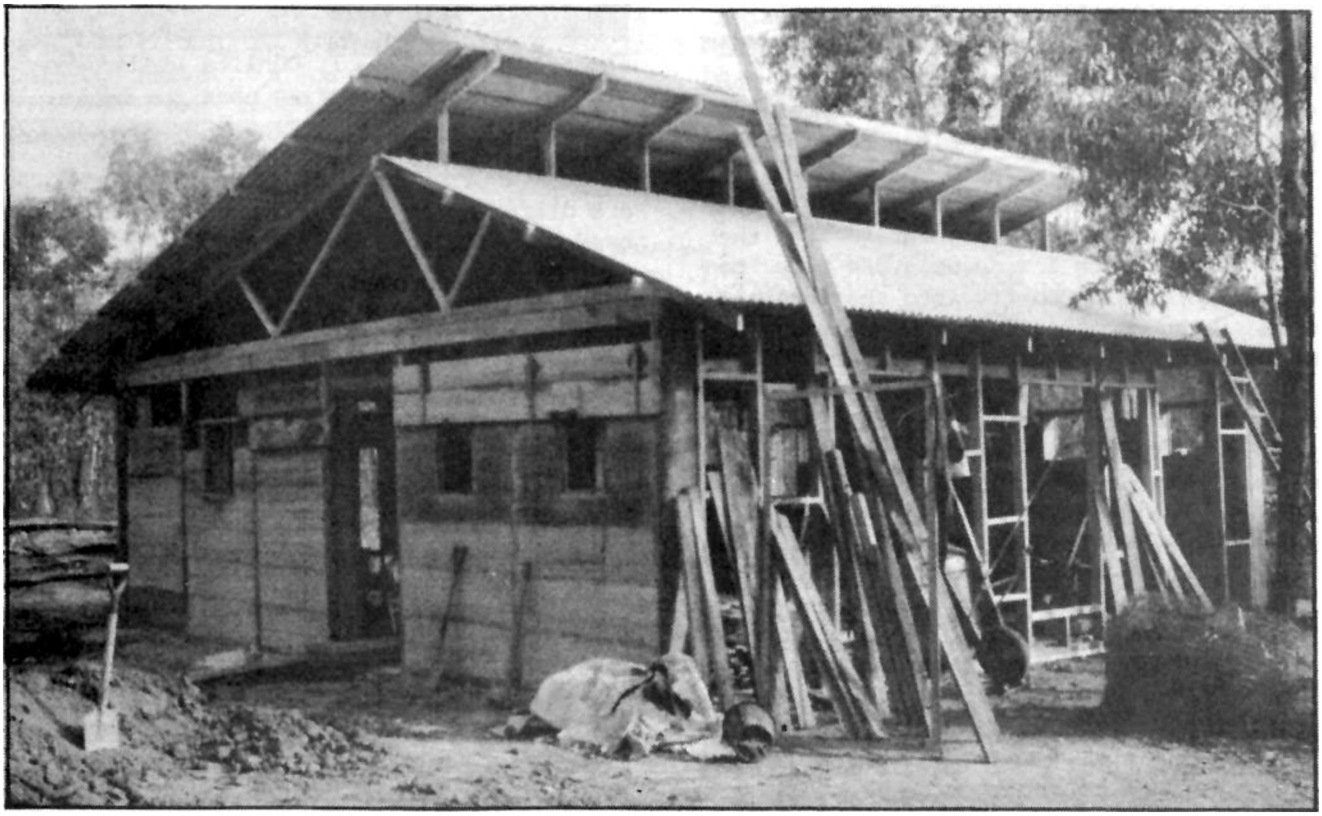
But it also meant that only one person needed to be consulted and only one brain had to nut out any particular, puzzle.

Some basic descriptions:

I had done some homework beforehand so I decided on the passive solar principles and had these features incorporated into the design:

a) Windows to the North;
b) West wall of solid mud-brick;
c) East two small windows;
d) Eaves designed to let in sun in Winter and keep out sun in Summer;
e) Rectangular shape in appropriate proportions; and
f) Verandah on the cool South side.

My architect friend came up with a simple, clean design for a smallish 9 square cottage with two bedrooms and open living and dining areas.



The internal walls were of timber, the advantage being that all the services, power, water, telephone and, in my case, leads and wires for a stereo unit, could be installed with greater ease.

The design also incorporated clerestory windows facing south because I liked them and because they admit more light into traditionally dark mud-brick houses.

Originally I planned to run hot water through the floor, pumped and heated by an open fire. The heating system consisted of a coil which passed through the chimney to a holding tank from where it would be pumped through the floor.

Eventually I used half inch poly pipe running it round where I wanted it and tying it to the mesh in the slab. When it came to pouring the slab, the building inspector advised that it would have to be an extra inch thicker because he thought hot water passing through the pipe could cause expansion and contraction which could weaken the slab if it was any thinner.

While finishing the slab the workmen sloshed the concrete around with total disregard for the pipes underneath. I was concerned in case their vigorous levelling and smoothing caused the pipes to move.

In order to reduce heat loss and friction, I decided on three coils emanating from a central point. With the help of a plumber I made up a 3/4 pipe to three 1/2" exits to fit into the internal wall with accessable gate valves to manipulate coils and flow.

The final problem I was never able to solve was how to go about joining the poly pipe to the three copper exits. I used a couple of fittings, but I was never able to stop them from leaking because of the difficulty I experienced working in the confined space around the coil ends in the slab. Now I wonder what effect the poly pipe has on the overall heating of the place.

I've been told since by a builder carpenter that mud-brick houses often end up costing more if they are built by tradesmen. This is because mud-brick houses

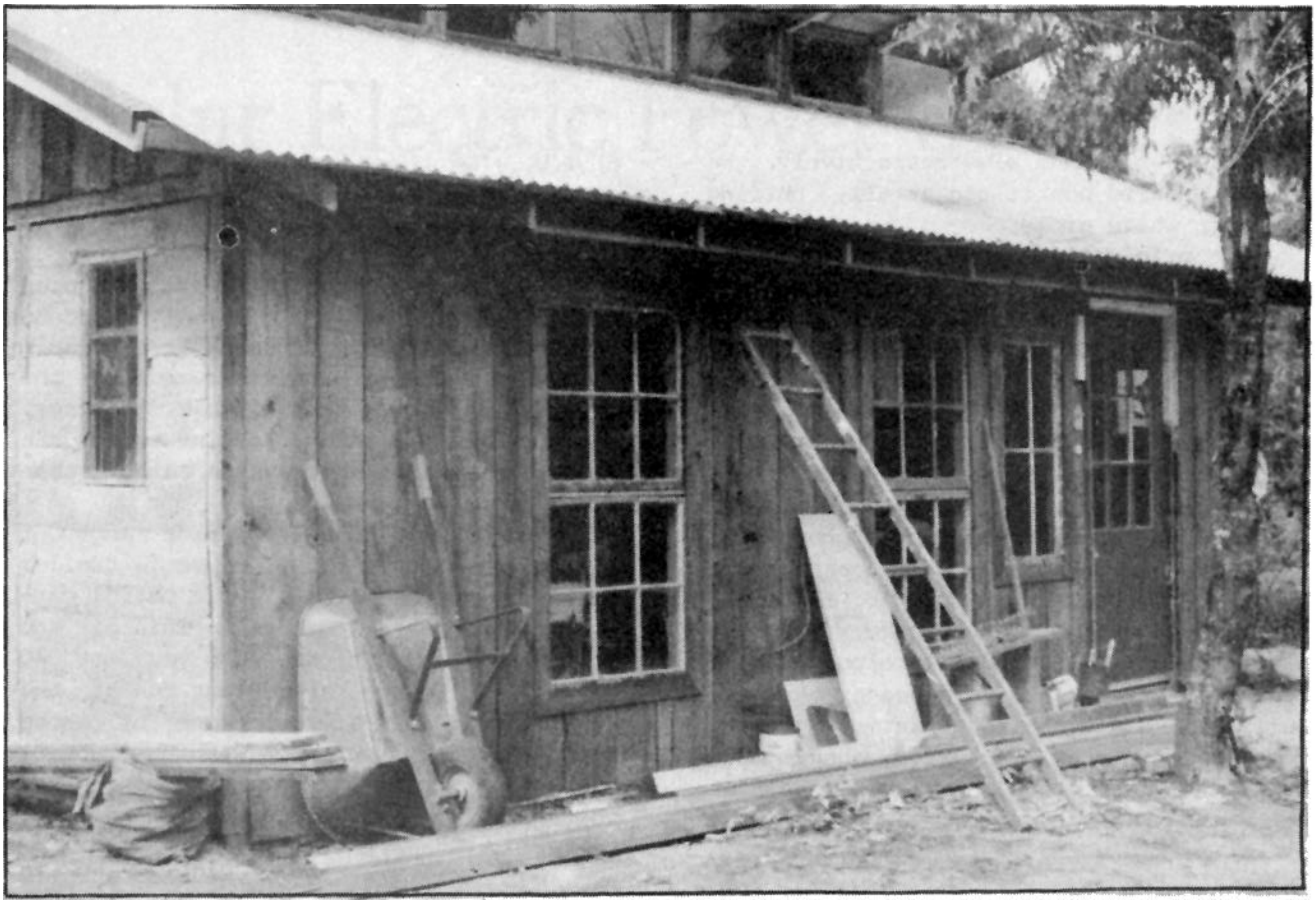
The secondhand 32 volt Dunlite windgenerator and windpump standing near the house.

are different to the houses tradesmen are used to building.

Most brick veneer houses have uniform specifications for wall heights and wall thicknesses so fittings to suit these dimensions come 'off the shelf' and therefore cost less because they are manufactured in bulk.

If you are building to your own specifications this can cause costs to escalate because you'll end up paying a tradesman $18 an hour to think through and solve any problems which arise on the job.

Some tradesmen can't handle these difficult conundrums and therefore charge or quote more for the job to cover any unforeseen 'timewasting'. This was another reason for my choice of wooden framed internal walls.



I chose trusses rather than beams. I used post and beam for the walls to ceiling height, since it entailed easier erection and made the ceiling look interesting.

I got used to the Gang nails especia-lly after I priced a metal plate and bolts for each truss junction. One 'blacksmith' didn't even bother to give a quote because it was a job which was too much out of the ordinary. The the metal alone was to cost more than the Oregon used for the trusses !

One holiday I made puddled mud-bricks while I paid off the mortgage. The next holiday twelve months later I set and laid the slab. Being 50 km from a provincial city meant higher transport costs for the concrete company.

The following holiday I erected the posts and the roof and during the third year I filled in the gaps between the posts with mud and timber. By this time the mud-bricks were 2 l/2 years old and a little weathered. It added character, as they say!

I used a mixture of new and recycled materials. The windows were all second hand. I had them sandblasted to remove the paint. A bit rough but a big time saver; most of them had to be reglazed anyway.

I used new timber for the frame and posts, and Oregon offcuts / scantlings for all internal wall coverings. This looks nice but they shrink and you can get the odd splinter. I found that this could be prevented by putting building paper behind the wood beforehand.

While I was building the house, I began examining the power and energy opt-ions available to me. I was a few poles away from the S.E.C. so I knew that having the power connected was going to be expensive.

While building I used an old power kerosene generator (32 volt) occasionally to run a drill. It was started on petrol and once it warmed up it it ran on kerosene.

It was some time before I discovered that kerosene came in two grades, power and ordinary, white and blue respectively. We often wondered how it ran at all, puffing out this white smoke.

I originally liked wind power as the as the real source of power with the kerosene generators as as a back up - yes I found two and another I refused because I was too mean to pay the extra $50 the farmer wanted.

While traversing the country I found two identical dunlite 750 watt four blade wind generators. I had them overhauled by Tony Stevenson and erected by a professional. Yes there is someone who can erect towers safely with the proper machinery and more importantly experience.

I erected a windmill to pump water from my storage tanks to a header tank as well. I had two windgenerators pumping into three truck batteries about once every two weeks and the result was flat batteries.

I forked out $600 for the proper ones but still there was not enough wind to to keep them charged despite a low current draw. The trees were too close and the and the towers too short!

What really irked me and the windgenerators many admirers, beside the squeaking of the bushes in the generator, was that the things would not charge until they reached a certain speed, so there were rarely days when they didn't go around at some stage quite quickly without having any effect on the needle of the ammeter.

About two years later we (yes there were two of us by then) sold one of them to help pay for a new diesel generator and three solar cells. We always used 32 volt lighting and I had some fluorescent tubes made up for the house, but ran a 12 volt line to run stereos.

Our other energy needs were met by:

a) fridge - gas with portable gas camping stove as back up.
b) cooking and water heating - wood combustion stove with portable gas camping stove as back up.
c) heating - open fire place.
d) T.V. - we lived without this by choice.
e) water heating - stove and solar panel were effective from October to March at best.

In the end I think I would have been better off with a 12 volt system all round because the range of appliances available is much greater. Most items made for the caravan market - rechargeable torches, clocks, drills, radios, and invertors are based on the 12 volt system rather than the 32 volt system I used.

There is also quite a wide range of 24 volt equipment made for semi trailer outfits. Furthermore, 12 volt petrol generators are easier to obtain, maintain and start than any options. Can you get 240 volt/l2 volt generators that run at the same time yet? If so get one of those because we found out when washing nappies every day that while you are running a 240 volt appliance you could also charge your batteries.

Before baby arrived, we used a Bamix washer, the laundromat, or friends or relations machines. A low amperage fridge still seems a long way off, if the power ever came through I think I would put in one or two power points to run a fridge but keep all the other lights and power points.

Later we realised that the house was too small and we built another structure using mud pour, consisting of two more bedrooms and a similar sized utility room. This time I oriented the clerestory windows facing Worth with a suitable overhang and this made for a bright room and cheerful room.

With the Benefit of Hindsight:

a) In rural areas flies love to congregate in cool spots on hot days. South facing verandahs especially favoured swarming spots.
b) The house kept cool in summer until the fourth day of a heatwave and it then took two days to cool down. Otherwise the mudbrick kept the temperature very stable and it feels good too.

CONTINUED PAGE 35..............

Solar Electric Power Systems

BY MICK HARRIS

With increasing numbers of people using solar cells for power in remote locations, we have had increasing numbers of enquiries about how you plan your system. How many panels do I need? What batteries should I use? etc. Well here are the basic simple steps that you need to use in planning your system.

In the next issue we will be having a look at a range of of Solar Electric houses. How the systems are put together, what they power, the costs and how well they service peoples needs.

STEP 1. HOW MUCH POWER DO YOU NEED.

This is simply a matter of working what you are going to use, how many watts each item is and how many hours you will be using it.

If the appliance doesn't have the wattage on it look for the tag with the volts and amps, and then multiply them together to get the wattage, (if its already got the wattage then use that).

If there isn't any indication of the wattage or amperage contact the technical services section of the manufacturer.

Here is an example of how you would go about this stage:

Lights:
Fluorescent,20 watt*3 hrs= 60 watts
Fluorescent,20 watt*2 hrs= 40 watts
Fluorescent,40 watt*2 hrs= 80 watts
Incandescent,25 watt*1 hr= 25 watts
Incandescent,75 watt*1 hr= 75 watts
Entertainment:
Stereo 50 watt*1 hr= 50 watts
T.V. (B.&.W) 40 watt*2 hrs=80 watts
Kitchen:
Blender 150 watts*5 min= 12 watts
*Fridge (Small) daily 300 watts
Others:
Pump 80 watts*1 hr= 80 watts

TOTAL 802 watts

When you go through this stage make certain you really do accurately assess how much you would individually use in your home. The example above is just designed to show you how to work this out. They are not figures you should take as being the level of consumption you would yourself use.

* Also don't automatically assume it's a good idea to use an electric fridge, gas may be better. The fridge listed above would be a super dooper high efficiency model. (Refer Soft Tech No 26 for more on this.)

Once you have done this part of the job the rest is reasonably easy.

STAGE 2. HOW MANY SOLAR PANELS.

When you are making an estimate of the the number of solar panels you are going to need most people estimate the panels will give an average of six hours maximum output per day. This means a 45 watt panel would give an average of (45*6) 270 watts per day.

So if you need 802 watts a day, and you are using 45 watt panels then three panels (270*3) will give you 810 watts just enough to run your system.

Keep in mind that the 6 hours maximum output is an average, you will get less in winter and more in summer. Also make sure you have a bit of extra capacity in your solar panels as there are losses in wiring charger and batteries.

STEP 3. WHAT BATTERIES DO I NEED?

Here you have to make sure you have enough juice (storage capacity) in your batteries to keep you going for a few days without flattening you batteries so badly that you damage them.

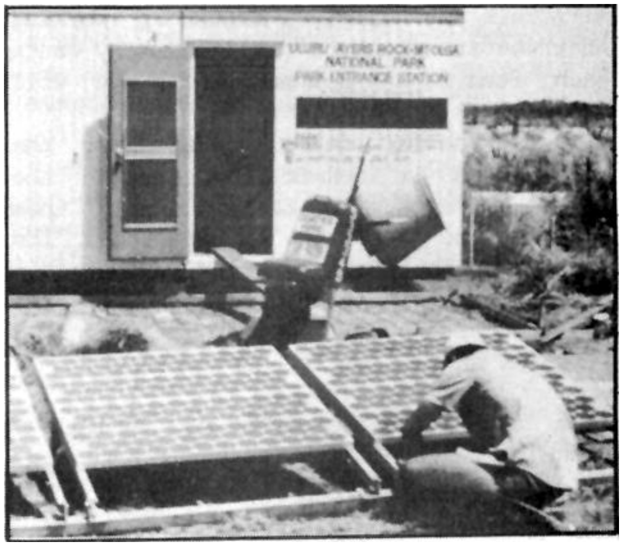
Batteries are rated in amp hours. To find out how many watts your batteries can store you multiply your amp hours by the battery bank's voltage:

For example if you have a 12 volt battery bank rated at 200 amp hours then your capacity is (12*200) 2,400 watts. Sounds like lots, eh! Especially when you are only using an average of 800 watts a day.

But if you assume you want to have two days power in reserve...well that's (800*2) 1,600 watts. And if you are going to be kind to your batteries you might not want to go below 70% of their capacity.

If you use 1,600 (over 2 days), you have taken your batteries down to 30% of maximum capacity....no good. You will have to get bigger batteries. or maybe be ready to start up your backup generator on cloudy days or during winter.

Lets work through the idea of bigger batteries, lets assume you went to a 500 Amp Hour battery bank. Amps (500) times Volts (12) gives 6,000 watts. Now even if you take out 2 days of power (1,600 watts) you still are down to only 62.5 % of capacity. You can get away with that although you might have to start up your backup generator every few days in winter.



OTHER THINGS TO REMEMBER

Work through these steps until you get the feel of them. Once you have them worked out they are easy.

The other thing to keep in mind is inverters. Those magic gadgets that turn your 24 or 12 volt power supply to conventional 240 volt AC. These things are generally only about 80% efficient.

This means if you take 100 watts out of you batteries you may only get about 80 watts to you appliances, loosing 20 watts in the guts of your inverter on the way.

So if you are running most of your equipment from an inverter, design your system so you have an extra 20% coming in from you panels and an extra 20% capacity in your batteries.

WHAT VOLTAGE?

A final word. 12 volts versus 24, (or even 32 or 48 or 110). Twelve volts is good for small to medium systems (say 1 to 4 panels). 24 volts for Medium to large systems (4 to 8 panels). 32 and 48 for large systems (6 panels or more). 32 and 110 volts are often used for larger wind generator systems.

These are not hard and fast rules however, just a rough guide for people starting out.

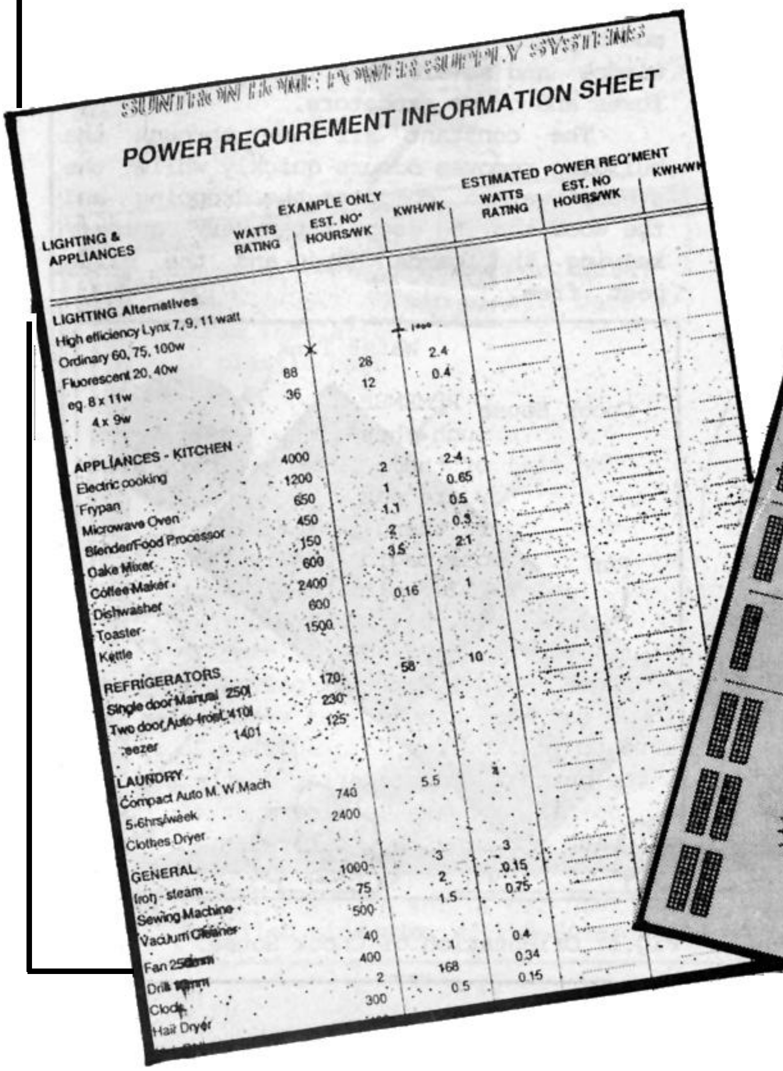
The reason for this is the lower the voltage the higher the current you need for the same number of watts. In simple terms this means lower voltages make bigger sparks is switches and other things burning them out quicker, and perhaps more importantly you loose more juice with lower voltages as the electricity goes through the wires.

To solve this you can use bigger wires (costs more), more solar panels and batteries (costs more), or higher voltage, (generally costs the same).

When you come to planning a solar electric system you local AT retailer generally has it down to a fine art. Talk to them. They often have leaflets which go through the basics. We show some bits of some of them here.

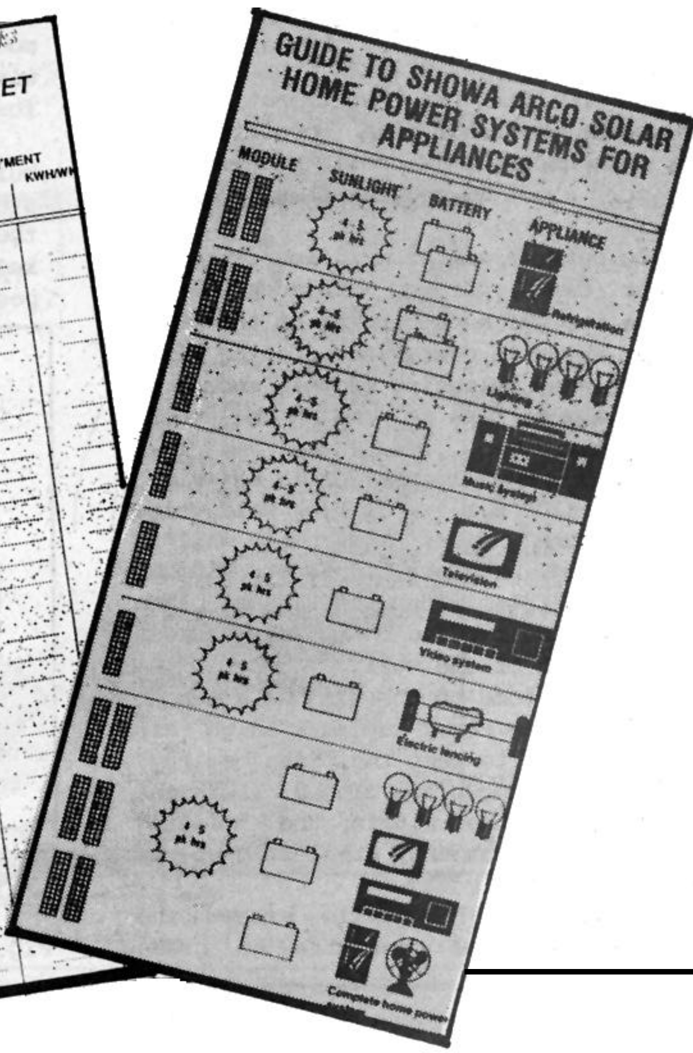
Also don't make the mistake of buying now and thinking later, a little bit of work now can make life much easier later.

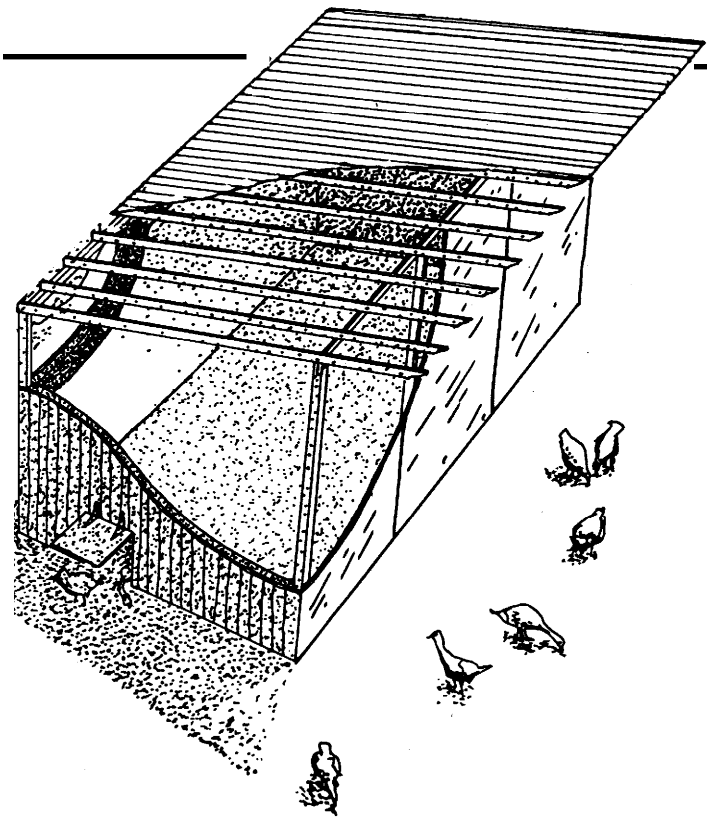
Stay tuned for the next issue of Soft Technology when we will have a look at some real live Solar Electric houses.



POWER REQUIREMENT INFORMATION SHEET

LIGHTING & APPLIANCES	EXAMPLE ONLY WATTS RATING	EST. NO* HOURS/WK	KWH/WK	ESTIMATED POWER REQ'MENT WATTS RATING	EST. NO HOURS/WK	KWH/WK
LIGHTING Alternatives						
High efficiency Lynx 7, 9, 11 watt						
Ordinary 60, 75, 100w	✕	28	2.4			
Fluorescent 20, 40w	88	12	0.4			
eg. 8 x 11w	36					
4 x 9w						
APPLIANCES - KITCHEN	4000	2	2.4			
Electric cooking	1200	1	0.65			
Frypan	650	1.1	0.5			
Microwave Oven	450	2	0.3			
Blender/Food Processor	150	3.5	2.1			
Cake Mixer	600					
Coffee Maker	2400	0.16	1			
Dishwasher	600					
Toaster	1500					
Kettle		58	10			
REFRIGERATORS	170					
Single door Manual 250l	230					
Two door Auto-frost 410l	125					
1401 …eezer						
LAUNDRY		5.5				
Compact Auto M. W. Mach	740					
5-6hrs/week	2400					
Clothes Dryer		3	3			
GENERAL	1000	2	0.15			
Iron - steam	75	1.5	0.75			
Sewing Machine	500					
Vacuum Cleaner	40	1	0.4			
Fan 250mm	400	168	0.34			
Drill 10mm	2	0.5	0.15			
Clock	300					
Hair Dryer						





SOLAR CHOOK HOUSE

By Ian Grey

The building has been operating for over seven years in the mountain area north of Buchan in Victoria and is the home for about 15 - 20 hens and 5 - 10 ducks.

The outside of the building is timber (ex car cases) painted with sump oil to preserve it, while the inside on the East and West walls is corrugated roofing iron to permit easy delousing if this should be needed, and to make it hard on the teeth of any rats.

The South wall interior is an eight inch thick (200 mm) mud-brick wall white washed on the inside. The North wall is timber-framed with acrylic sheet windows across the full width and four blade louvre windows top and bottom also across the full width of the wall.

At least some of the windows are open during the day every day as a high air flow is needed to keep the birds healthy, but all the windows are closed at night to retain the heat within the building during winter but they are left open in summer.

Between all the walls except the North wall we packed loose straw in green garbage bags to provide insulation, this was also used under the roof. The space between the walls was 100 mm and under the roof the gap was 150 mm.

The heat created by the sun, the brooding birds and the decomposing deep litter maintains an even temperature all year. At night the birds cluster near the mud-brick wall and well away from the window and so are less likely to attract foxes and other predators.

The constant air flow through the building removes odours quickly while the steady warmth composts the dropping and the wood shaving deep litter very quickly keeping the garden happy and the birds pest free.

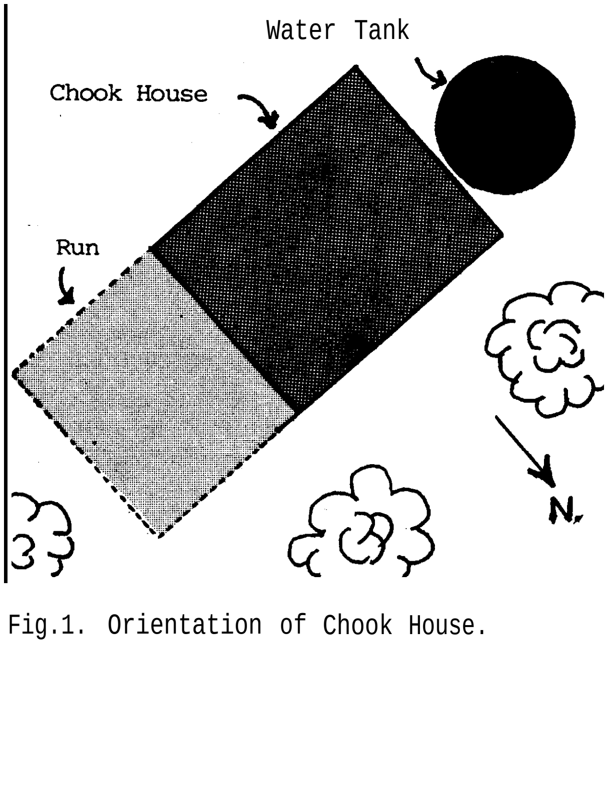


Fig.1. Orientation of Chook House.

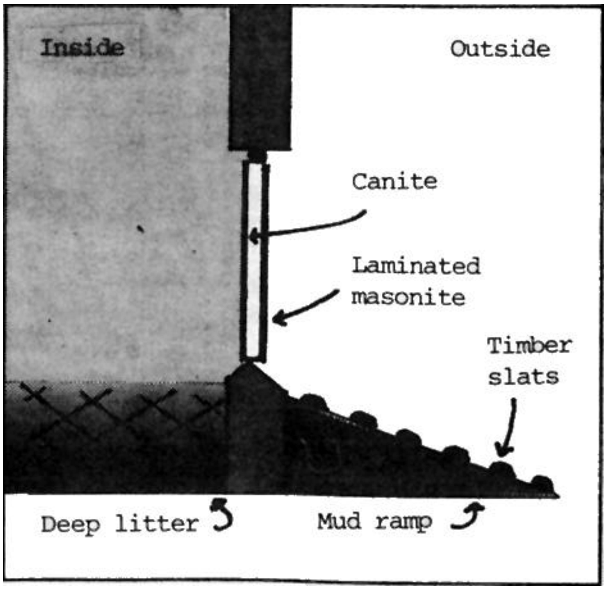


Fig 2. Insulated hen door detail.

The birds have an insulated doorway to the run (as shown on diagram) so as to reduce cold draughts particularly around the ducks.

The open run with trees around it protects the building to the East while a large 40,000 gallon water tank stops the hot west sun.

The chook house has had many satisfied and tasty inhabitants who earn their lodging by a steady flow of eggs. There has never been a pest or an infection problem in the main building although we have lost some birds to feral cats and young chickens to hawks and eagles so I would rate this effort as tried, tested and successful.

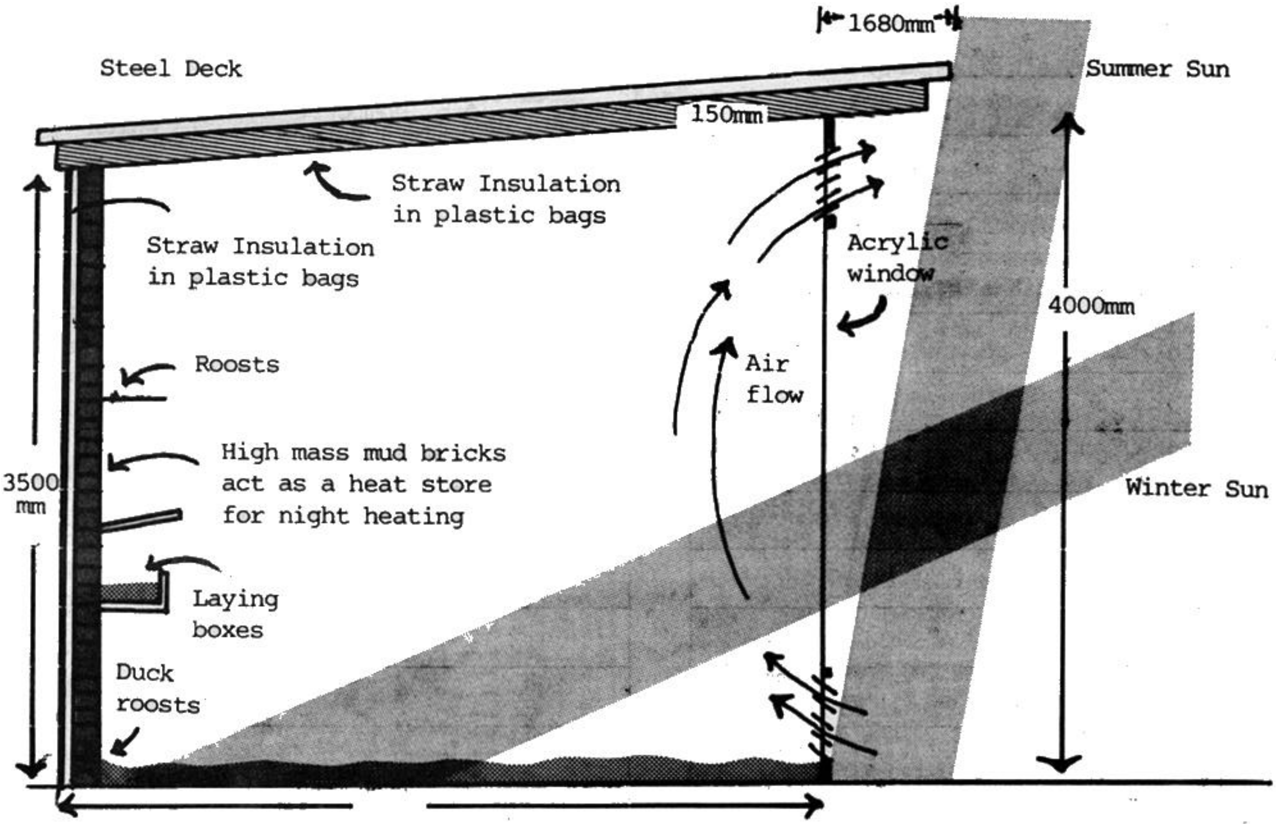
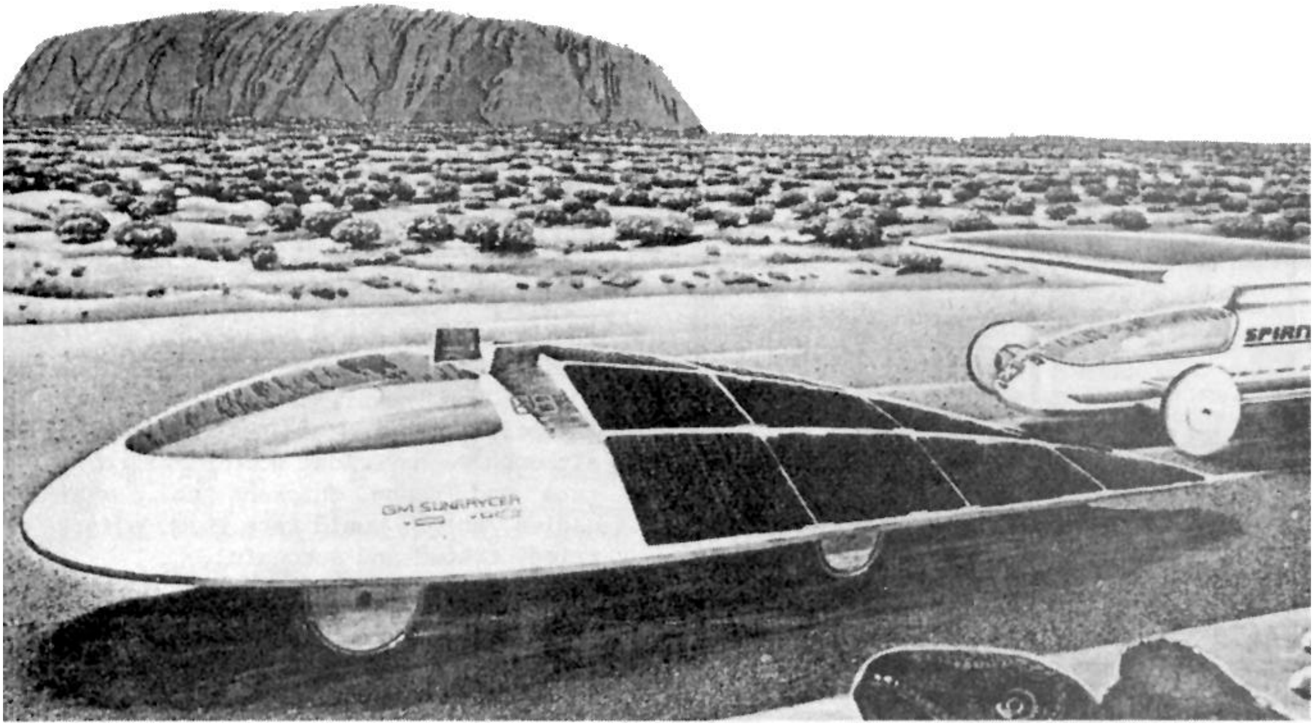


Fig.3. Detailed side view of the Solar Chook House.

Solar Race Results



Well Australia's first North to South Solar Car Race is over and as the dust settles we have a look at how the contestants faired.

As most of us already, know the 3 million dollar General Motors car came through an easy winner. Even though the GM vehicle was exceptionally lucky with the weather it does give us an impressive indication of the potential of Solar Electric Vehicles.

The GM "Sunraycer" covered 3,200 kilometres from Darwin to Adelaide in just under 45 hours, with an average speed of 67 kilometres an hour and an unofficial top speed of a record 113 km/h. The car was even filmed by the camera crews overtaking conventional vehicles.

The Sunraycer used a combination of highly efficient Gallium Arsenide solar cells (the same as those used in the Aussat satellite), brushless neodymium magnet motor, direct drive (no gearbox losses), silver zinc batteries and aerodynamic design to ensure success. They also made full use of lightweight design by use of a kevlar frame.

GM spectacular win was assisted by great luck with the weather which was often cloudy and windy for the rest of the contestants, while the Sunraycer managed to keep ahead of clouds, speeding along in bright sunshine.

The Australian Ford team took second place in their "Model S" and were closely followed by the Swiss team which probably would have taken second place except for an accident which held them up by four hours,

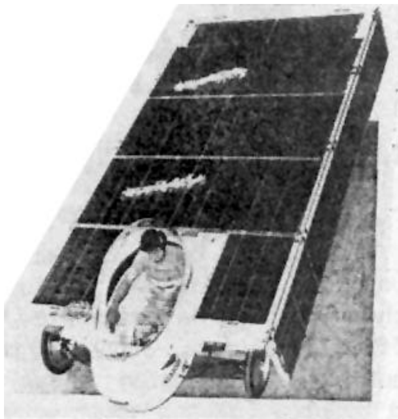
Next was Australian Geographies "Team Marsupial" (Dick Smith and Co).

The cars tended to have a number of things in common. They used lightweight construction, many using Kevlar, carbon fibre or lightweight metal such as aluminium.

Some were gearless while others used high efficiency gearboxes. A range of motors were used with the permanent magnet motors being quite common. The solar cells were of a variety of types including the old standard, the Monocrystaline, the Polycrystalline and of course the Gallium Arsenide used by GM.

The good thing about the "World Solar challenge" is that for the first time a Solar Car is starting to look like it really could be a viable option.

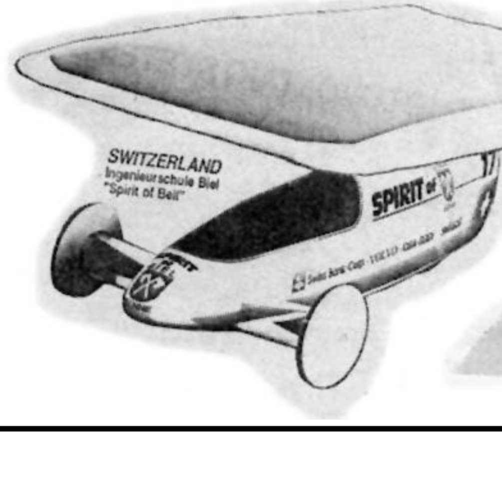
A solar car which can travel at 113 kilometres an hour is a great achievement. And with the big car companies like General Motors and Ford bothering to enter and actually winning an event like this the experience they are gaining today may well be incorporated in tomorrow's cars.

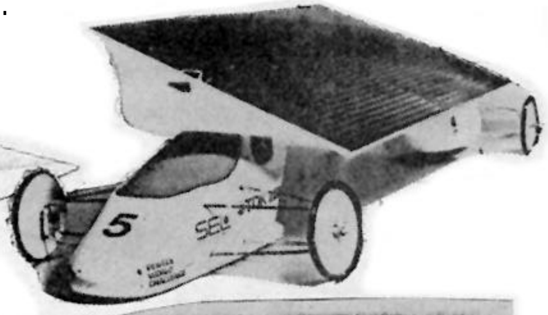


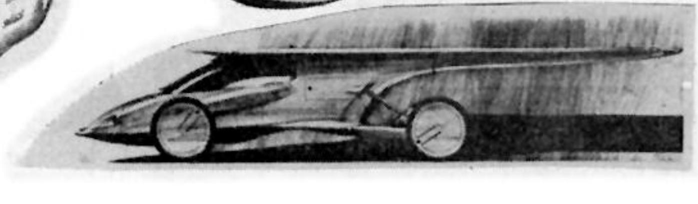
THE RESULTS OF THE WORLD SOLAR CHALLENGE.

PLACE	COUNTRY	ENTRANT	TIME(Hrs)	AV. SPEED
1.	USA	GM. "Sunraycer"	45	67 km/h
2.	Australia	Ford. "Model S"	68	45"
3.	Switzerland	Ingenieurschule Biel. "Spirit of Biel"	70	43 "
4.	Australia	Australian Geographic, "Team Marsupial"	81	37 "
5.	Australia	Darwin Inst. of Tech. "Desert Rose"	95	31 "
6.	Australia	Caulfield Inst. of Tech. "Desert Cat"	98	30 "
7.	Australia	Solar Resource Syndicate	117	26 "
8.	USA	MIT/Solectron. "Solectria IV-B"	(2,399 km)	
9.	Denmark	Sonderborg Teknikum. "Chariot of the Sun"	150	20 "
10.	USA	Crowder College. "Star"	(2,067 Km)	
11.	Australia	F. Castino & D.E. Lajovic. "Alarus"	146	21 "
12.	Japan	Hoxan Corporation. "Phoebus II"	153	20 "
13.	Australia	Morphett Vale High. "Photon Flyer"	(1,298 km)	
14.	Japan	Semiconductor Energy Lab. "SEL Southern Cross"	Still trying to finish when we got this information.	

NOTE: Twenty five car started the race. The ones not listed above retired before the 5 day deadline, mostly so they could attend the finish celebrations and presentation of the World Solar Cup.







The ATA Report

News, Events and Activities from the Alternative Technology Association

Well, 1987 has been a year of consolidation for the group. Finishing touches to the Workshop, a new office, and a part time office supervisor have all been necessary but time consuming areas of work.

1988 should bring the fruits of this work with the first change you will notice being the magazine itself. The developments in Desktop Publishing have made it possible for us to afford to typeset our magazine for the first time.

So the next issue will have the twin benefits of looking better and having more in it, because of typeset instead of typewritten copy.

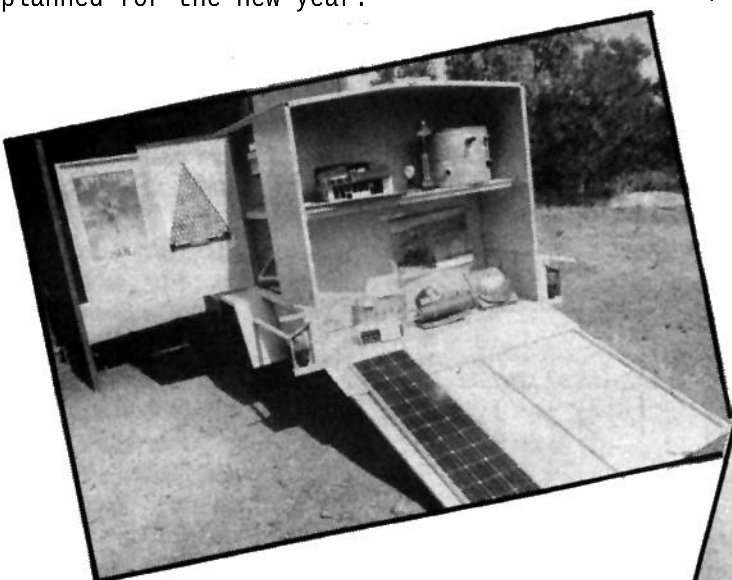
We recently ran our first formal (and paying) course at the Solar Workshop. It was a one day session on Arc and Oxy Welding. The course, which also included a section on silver soldering, went very successfully and was enjoyed by all. Lots more of these kinds of activities are planned for the new year.

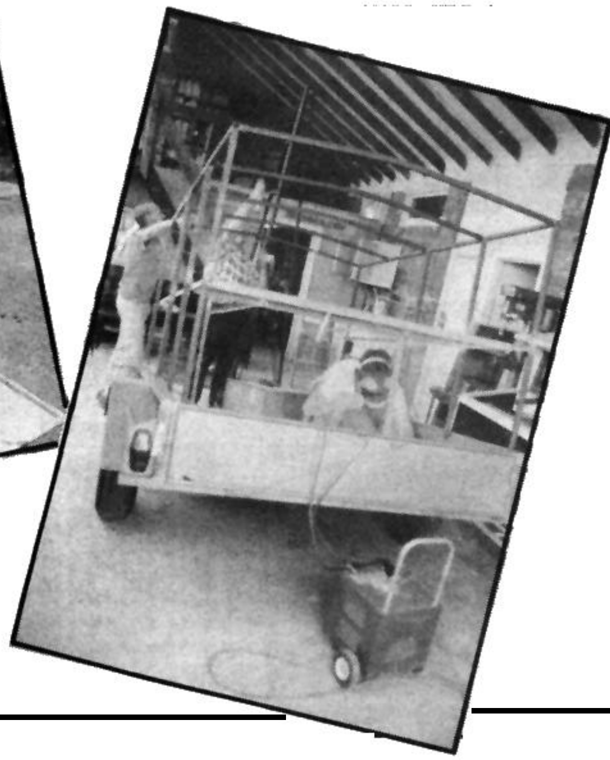
The group has also developed a new dimension by doing some hard research on future energy supply options for Victoria. To date this has involved presentation of two submissions to the Victorian Parliament's "Natural Resources and Environment Committee"

A new project which is underway involves the construction of a display trailer. This will include working models and full sized displays including Photovoltaics, Solar water heating, Wind power, Micro Hydro, Passive solar House design, Methane Digestion, Low voltage appliances, Composting toilets, Recycling, and other forms of appropriate technology.

The trailer will be used for displays at Community Fairs, Rural Field days, in schools and in other appropriate events.

We are now commencing planning for Soft Technology as well as for our general activities and special projects for the year to come. If you have any ideas please drop us a note. All comments are welcome.





A New Windgenerator

A couple of Melbourne inventors have recently come up with a new windgenerator which deserves more than a passing mention.

The wind turbine is basically a modified Savonius design linked to a specially developed low speed generator.

Using this design makes it possible for the windgenerator to avoid a number of the problems associated with the more conventional horizontal axis designs.

These problems included the need for the windgenerator to continuously have to turn to "track" into the wind, the need to have to climb to the top of the tower to do maintenance and the fact that these generators tend not to produce electricity at low wind speeds.

This new wind generator has overcome these problems with its low speed ground mounted generator and vertical axis design.

The turbine has been developed by "Fiscar Pty. Ltd." a small privately owned company which was formed about 3 years ago to conduct research and development based on ideas about the potential performance of generators. The concept itself has been put together over the last 10 years by John Vanderwolf and his sons Ron and Andrew.

The company is wholly Australian owned, and intends to keeps the technology in Australian hands rather than let the benefits be lost overseas.

The key to Fiscars design is the low speed generator. When linked to the Savonius turbine the generator will produce 1kVA at l2 volts at 140 RPM.

The generator starts producing power at 30 RPM (in winds of around 6 km/h) and is about 95% efficient. The windmill itself self regulates its speed to 120 RPM, even in storm conditions. It is virtually maintenance free with the exception of the bearings which need greasing every 3 months.

Using this system the manufacturers estimate power can be produced for around 3 cents per kW over a 25 year expected lifetime.

The generator costs $5,800 ex factory and the Savonius windmill $3,750. Fiscar can put a full system which includes the generator, windmill, 5kVA battery bank, cables, concrete and inverter together for about $15,000.

Fiscar also plan to produce a water turbine using the same generator. They estimate that when coupled to an appropriate water turbine their generator could produce 24 kVAH per day or enough to provide the basic power needs of up to 5 houses.

If you want more information you can contact Fiscar Pty Ltd, 2 Oaklands Ave,

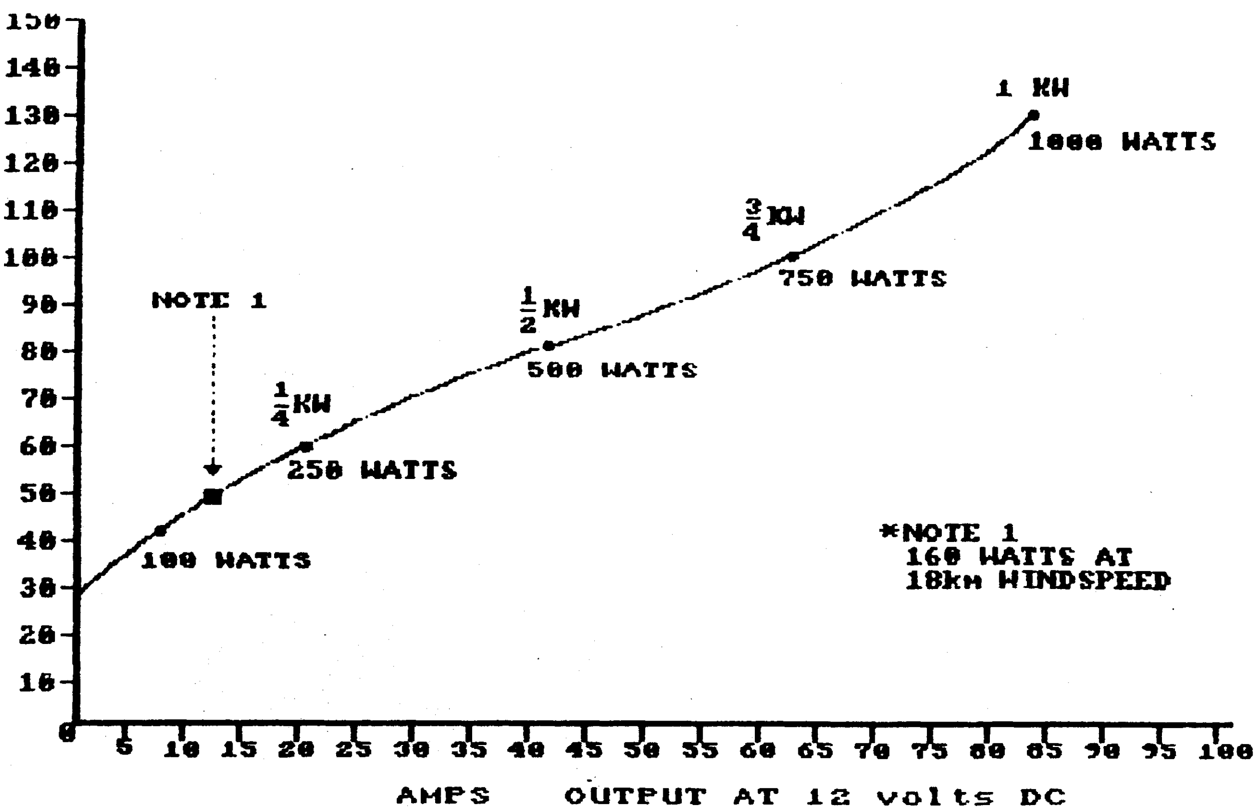
Ferntree Gully, Melbourne, Australia, 3156. Phone (03) 758 2324.

Eds Comment.

One of the biggest problems with small scale wind generators has been that the siting of the wind generators has often involved compromise.

Very few people wish to live on a bare hilltop, and the odd tree or nearby hill are often a reality of life. This leads to problems of turbulance which can result in losing blades or the generator continually "hunting" to keep facing into the wind and giving less power in the process. Alternatively a bad site can simply lead to low wind speeds and hence low power output.

A wind generator based on the Savonius type design with a low speed generator should solve all these problems. It's long overdue and we wish Fiscar the best of luck.



Future Energy Possibilities

Every once in a while the State Governments sit down and make multi million dollar decisions about how the electricity needs of the particular State will be provided.

The politicians and bureaucrats decide how many coal power plants and where, or in some cases if gas will be used to produce electricity and how. And that is usually where the decision making stops.

However, in these enlightened days other issues are creeping in, issues of renewable energy and energy conservation.

When these enquiries are taking place the possibility exists to convince the decision makers to spend some of the multi millions on renewables and conservation.

If it were possible to talk these Inquiries into allocating just a few per-cent of their capital budget to investing in conservation and renewables the results would be dramatic.

In Victoria the "Inquiry into Electricity Supply and Demand Beyond the Mid 1990s" is now taking place, and the Alternative Technology Association had a go at steering the Inquiry in the right direction. Here is the list of recommendations which summarise our 30 page submission.

a. Broad Objectives

1. The SEC investment in conservation, cogeneration and renewables should be at least 10% of investment in conventional generation plant on an annual basis.

2. The SEC should encourage equivalent levels of investment by the private sector.

3. The SEC should make a commitment to increasing the proportion of electricity supplied by renewables over the planning period to the year 2000 from the present 7% to 10%

b. Pollution

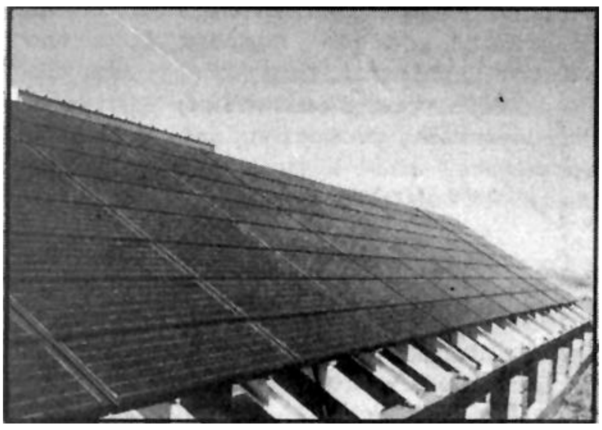
4. In consideration of the general environment and the people of the Latrobe valley, the SEC should adopt the highest possible standards of pollution control for its power stations east of Melbourne.

c. Renewables

Renewable energy sources are effectively infinitely available, have a low environmental impact, are less capital intensive and more labour intensive. The SECV should enthusiastically promote, research and develop these energy sources. It should then integrate these energy sources into its energy mix for maximum overall benefit.

5. The undeveloped hydro potential of Victoria should be developed, by a combination of SEC and private (incentive motivated) development. This should include schemes down to a size of 50 kilowatts.

6. The SECV should recognise the potential for solar hot water to provide hot water during peak periods and both promote and



market solar water heating systems throughout Victoria.

7. The SECV should be involved in the development of "smart" solar water heaters which minimise electrical load, especially during peak periods.

8. The significant capital savings which are possible by not having to extend electricity grid in country areas should be recognised and subsidies made available to persons who choose to supply their energy needs through alternative sources.

9. A scheme should be developed which allows country residents who are not connected to the grid to lease a RAPS system from the SBCV.

10. The installation of a test medium sized windgenerator at Breamlea should be accelerated.

11. The SEC should commit itself to the establishment of a trial wind farm with a peak electricity production of at least 2,400 kilowatts.

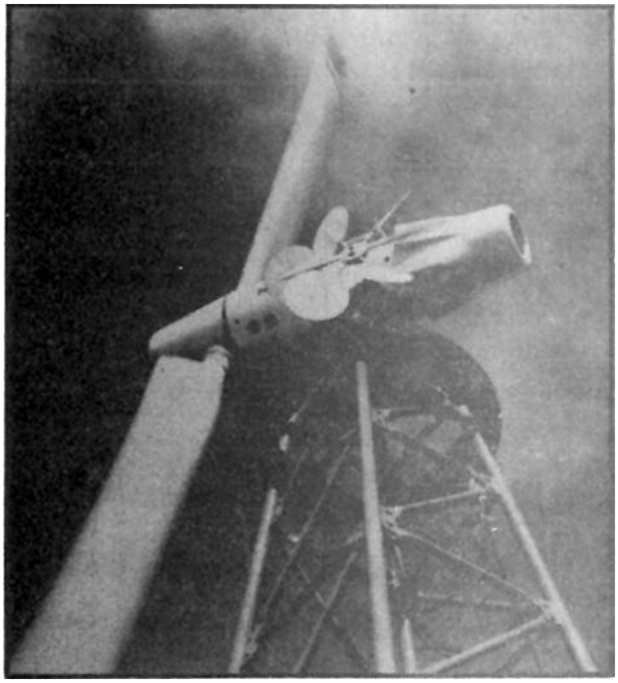
12. A pilot photovoltaic array should be established on a commercial building which has energy consumption patterns which match solar radiation.

13. Stand alone photovoltaic systems which can be used for remote lighting, advertising, etc within the metropolitan area should receive support from the SECV. In particular this should take the form of development assistance, independent assessment, promotion and retailing of products and actual purchase of systems for the SECV's own use.

C. Conservation

As conservation is the most cost effective mechanism of reducing load, significant resource, including financial resource should be allocated to this en&

Because many conservation measures such as those associated with buildings are outside the jurisdiction of the SECV it is essential that the SECV work with the Department of Industry, Technology and Resources to ensure that broad government policy recognises the economic, employment and environmental benefits of energy conservation.



14. The SECV should actively invest in the most cost effective energy conservation measures with regards the retrofitting of existing housing stock.

15. Aggressive and thorough public education should be used as a method for ensuring improved energy usage patterns within the community.

16. The SECV should work in conjunction with the appropriate bodies to reform the uniform building regulations to improve the energy efficiency of future buildings both domestic and commercial. The first step in these reforms should be the formation of a working party made up of representatives of the SECV, DITR, Solar Energy

Council, Department of Housing and Construction, and the Ministry for Planning and Environment,

17. Specifically the SECV should push for the introduction of:

i. Higher compulsory standards of insulation for all new buildings;

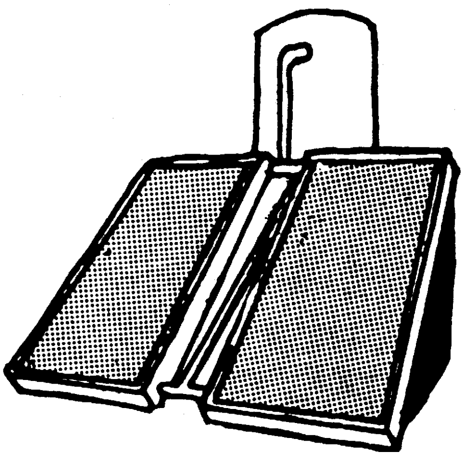
ii. Modification to town planning regulations to guarantee solar access;

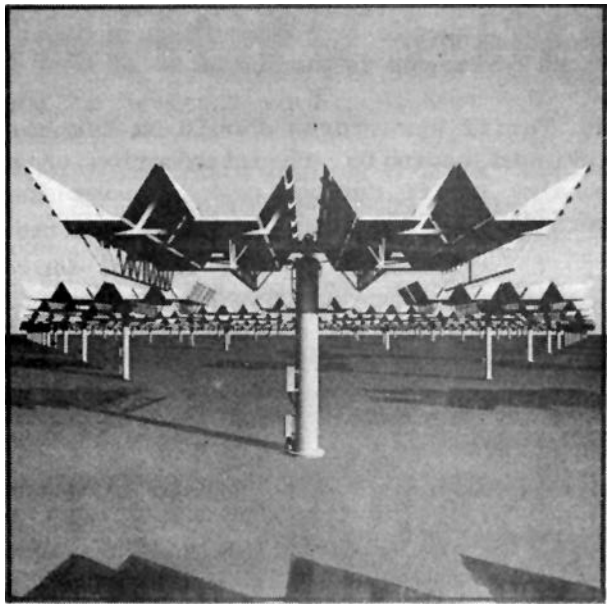
iii. Examine incentives which will encourage developers to set out new subdivisions in a way that is conducive to the construction of passive solar buildings;

18. Energy labelling should be extended as quickly as possible to other appropriate appliances. The option of rebates and other incentives should be used to increase the rate of acceptance of energy efficient appliances. Eventually compulsory standards should be introduced.

19. The potential for increased efficiency in the aluminium production process should be realistically assessed and this potential incorporated into the SECs energy planning.

20. The SEC should assist local fluorescent lamp ballast manufacturers to retool for electronic ballasts and then regulating to ban sales of conventional ballasts.





d. Load Shifting.

Load shifting should be approached with a much higher degree of enthusiasm than has been the case previously. Where potential exist for load shifting, these possibilities should be examined much more quickly and where prospects look good, adopted and promoted as quickly as possible.

21. The SECV should examine the option of "smart" houses and appliances to a much greater extent than has been done previously.

22. The strategy to use off peak hot water as a method of improving load profiles should include solar water heating.

23. Efforts should be made to make Storage water heaters compulsory in flats and units.

24. The SECV should be actively involved in investigating, developing, testing and promoting improved heat banks and heat pumps-

25. Electric cooking should be discouraged in all domestic and commercial applications where gas is available.

26. Tariff structures should be further reviewed leading to the introduction of a penalty tariff during peak consumption periods.

27. Ice Storage systems for commercial and industrial applications should be promoted and encouraged.

STOP PRESS

The inquiry has presented its draft recommendations and has only given lip service to issues of conservation and renewables. Their comments as regards this area have been that they believe these things are a good idea and should be encouraged, however without concrete objectives you can bet that little or nothing will happen.

Now is a key time when pressure on members of the committee making the decisions may have a real effect.

Write to the Chairman of the committee urging the inclusion of concrete objectives on conservation and renewables in the report of the inquiry.

The Chairman is Hon N.B. Reid MLC, Bendigo Province.

Send your letter care of:

Natural Resources and Environment Ctte.
19th Level, Nauru House,
80 Collins Street,
Melbourne, Vic. 3000.

If you want a copy of our submission or more information on how to get these people to take renewables and conservation seriously, contact us at the office on 419 8700. Someone is in on Tuesday and Thursday and on other days you can leave a message.

Also help in preparing our comments on the draft findings will be very welcome.

Telecom's Techniques For Long Battery Life

One of the most expensive components of a solar or wind powered electrical system is the battery bank. The battery bank can cost thousands of dollars and correct care and maintenance of these batteries can increase their lives by three or four times. Telecom's long experience with lead acid batteries has made them the ultimate authority in battery care.

In this article we reveal Telecom's battery care secrets and detail the proceedures which have given such long battery life. The material which follows are direct extracts from Telecom's internal maintenance manual. Bear this in mind while reading what follows, as these are basically the instructions for the technicians who maintain the battery banks.

1a. Cell Density

As a battery is charged the concentration of Sulphuric Acid in the electrolyte increases.

For a cell in good condition the measurement of the density is a good indication of the state of charge of the cell.

density = 1.180 - cell discharged
density = 1.220 - cell half charged
density = 1.240 - cell charged,

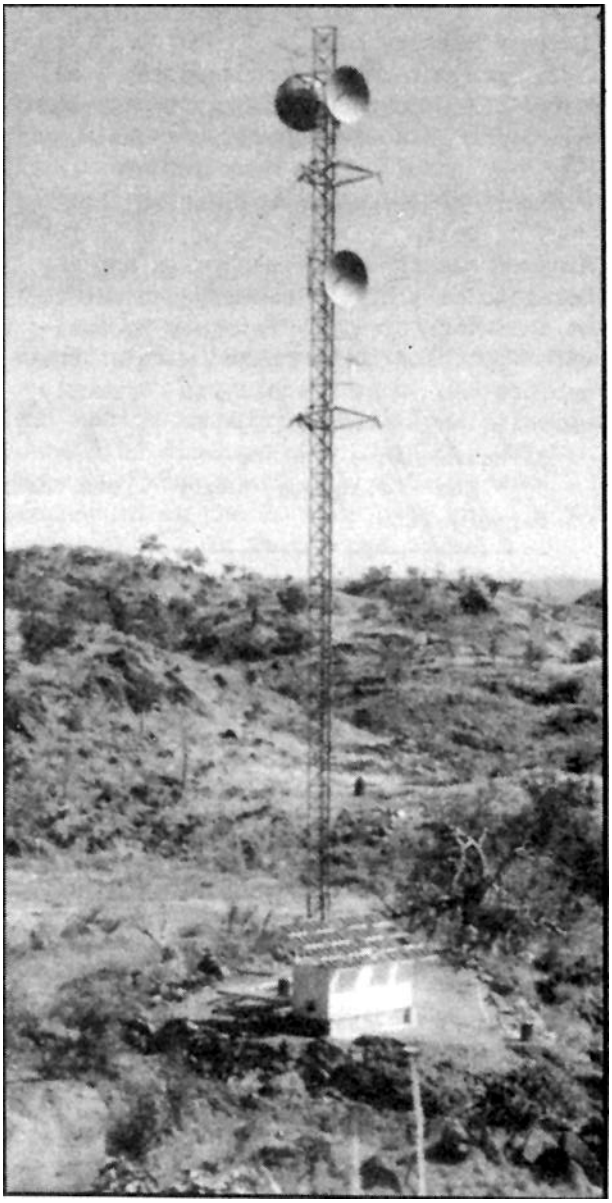
These readings are at 25°C. These must be modified for different temperatures using the correction table.

When checking density the following precautions should be observed:

- never check after adding distilled water;
- stratification of the electrolyte may lead to inaccurate density readings;
- a true reading can only be taken after a full boost charge when the electrolyte is properly mixed.

During the charging process, lead sulphate is converted at the negative plate to pure lead and at the positive plate to lead dioxide with sulphuric acid being liberated into the electrolyte.

If this simplified process is kept in mind a great many problems encountered in battery installations may be recognised and understood.



A solar powered Telecom repeater station hidden away in the Australian outback.

b. Safety

Prior to and during the course of any work on Battery installations, all relevant safety guidelines must be observed. A face shield and protective clothing should be worn when working with acid.

2. Spacing of Cells

Battery cells have been damaged due to arcing and surface current tracking as a result of inadequate spacing between cells in a battery bank.

To prevent such occurrences, all battery cells must be adequately spaced apart to the following specifications:-

a. Minimum cell spacing between adjacent rows of cells - 12mm.
b. Minimum clearance between cells and any metallic part of the battery cabinet to be a minimum of 12mm. This may necessitate positioning of cells within the cabinet so that no cell is directly opposite angle iron supports.
c. Minimum cells spacing (measured at top of container) between in-line connected cells should ideally be 3mm but may be influenced by terminal positions.)

Surface tracking should be further minimised by wiping all cells, first with a clean cloth moistened with weak soda solution then with a clean cloth moistened with water.

d. Ventilation

Battery cabinets or rooms must be adequately ventilated to prevent an accumulation of an explosive hydrogen gas mixture.

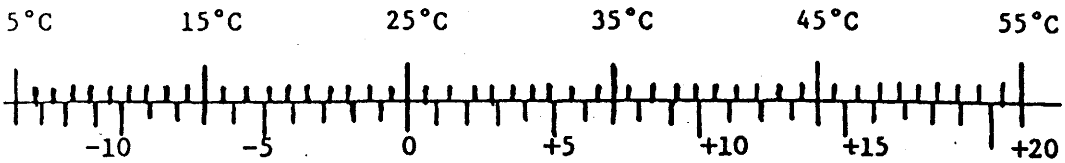
Ventilators must be placed as high as possible near the top of the cabinet. The external entry point to the ventilators must be adequately screened by a suitable fly wire/mesh to prevent the entry of birds, rodents and insects into the battery cabinet. On several occasions, entry by such intruders has lead to significant cell damage.

3. Maintenance Routine

The following table lists minimum routines required to maintain long battery life.

Frequency of routine	Type of routine	Details of routine
Monthly	Float voltage - pilot cell	During light load should be 2.2+- 0.03v
	Float voltage - battery bank	should be 2.2+- 0.03v x cell numbers
	Density - pilot cell	as per scale below
6 monthly	Float voltage - all Cells	During light load 2.2+- 0.03v
	Density - all cells	Before adding water
	Electrolyte level	Record low levels
	Visual inspection	Case cracks, tight terminals Colour difference between +ve & -ve plates
	Container cleaning	wiped with cloth and weak soda solution
Yearly	10 minute discharge test	Detect weak cells
5 yearly	Full discharge test	Determine battery capacity

Density / Temperature Correction



2. Selecting Pilot Cells

A pilot cell is used to perform regular readings on the condition of a battery during its useful life. The cell with the lowest density and/or cell voltage is usually selected as a pilot cell as it is the weakest link in the battery bank. A selection of a pilot cell should be made each time the battery is most charged and equalised.

4a. Sulphation

Batteries should be examined for signs of sulphation before any discharge testing is performed. Sulphation refers to the crystals or crusts or hard, impervious layers of insoluble lead sulphate that has formed on the battery plates.

It is usually due to one of the following reasons:

- having the battery stand in a discharged or partially discharged state for a long period of time;
- persistant undercharging or floating the battery at too low a voltage;
- emergency discharging beyond the normal capacity;
- operating the battery at excessive temperature; and
- internal short circuits.

It is usually indicated by white or tan patches on the plate assemblies and commoning bars, particularly on the negative assembly. The sulphate film on the positive plate usually appears lighter in colour.

Other causes include: low density, rapid increase in voltage when small charging current is applied (less than 50h rate), excessive voltage drop when a load is connected and a tendency for the battery to gas immediately when put on charge.

b. Fixing Sulphation

Sulphation can be corrected by charging the battery at the 20h rate until a cell voltage of 2.3v is reached. If sulphation is still present, the battery should be discharged at the 10h rate for 2 hours. The battery should then be recharged at the 20 hour rate until a cell voltage of 2.3v is reached.

This charging/discharging procedure should be repeated until no sulphation is present. The battery should then be charged at the 20h rate and the battery should be checked for equalisation.

5. Other problems

a. Copper Contamination

In some cells copper reinforcements are used inside the lead terminals. This exposes the risk of copper contamination should it become exposed to the electrolyte. It is usually indicated by brown discolouration of the negative plate together with corrosion of the terminal posts. Cell life is reduced in a matter of days.

b. Plate Corrosion/Growth

Corrosion can occur at the negative grid and its connection bar causing the two to separate. It usually occurs when the connection is exposed to the gas above the electrolyte levels. If the electrolyte does not cover the connection this problem can occur. An arc can occur when the plate separates from the connecting bar which may cause an explosion in the battery. Care should be made to ensure electrolyte covers the connecting bar and that the level markings on the battery do include the connecting bar. Positive plate growth can occur, usually in older batteries when the positive plates lengthen and widen as a result of a chemical action which can lift the positive terminal post. This can cause cracking of the case or high resistance joints. Batteries or cells will need to be replaced if this problem occurs.

c. Gassing

If a cell has plates which gas unevenly or not at all, it should be examined for internal short circuits which may be caused from scale bridging across the plates.

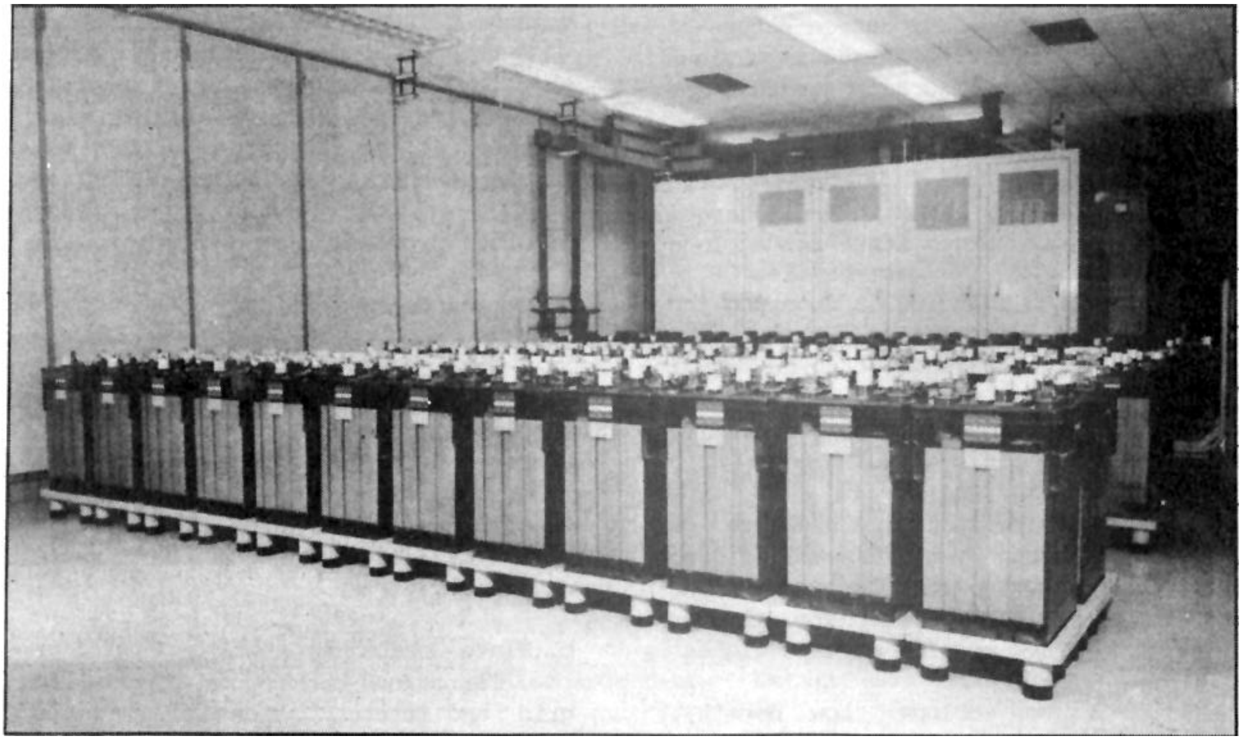
d. Plate Discolouration

The normal colour for healthy plates are:
Positive plates - matt black (lead peroxide)
Negative plates - steel grey (pure lead)
Any variation to this is usually caused by one of the listed problems.

e. High Resistance Joints

These can occur as a result of corrosion, fracturing or vibration at the connection terminals and connecting cables. Connections should be checked as follows:
1. Intercell - from the centre of one battery to the centre of the next.
2. Links between battery rows - from the centre of the end cell post of one row to the link side of the other joint.
3. Battery cables - from the centre of the final terminal post to the end of the cable.

The voltage drops from the above tests should not exceed 9 millivolts for



batteries above 500 Ah capacity and 3 millivolts for batteries 500 Ah and below, The voltage drop across adjacent batteries should be 0.5mV or less.

These tests should be performed at the 10h rate for charging or discharging.

6. 10 Minute Discharge

This test is performed every 12 months (see table). It generally highlights the presence of any weak cells; which are indicated when a voltage difference greater than 0.5v is recorded between the highest and lowest cells in the battery, or when the lowest cell is less than 1.97v.

When performing the "10 minute" test, all cell voltages and densities should be recorded. If the density and voltage differentials are greater than 15 points or 0.03v respectively the battery must be boost charged and equalised. It is recommended to boost charge batteries off load.

Charge the battery initially at the 10h rate (see table) until any cell reaches 2.35v then the charging rate is reduced to the 20h rate. When the cell voltages have reached 2.6 to 2.8v and all cells are gassing freely, the charge is maintained until three consecutive half hourly readings of battery voltage are constant.

The battery should then be isolated and allowed to return to its float voltage. It should then be restored to float operation for one day when its equalisation should be checked. To equalise the battery, it is connected to a charger with the voltage set at 2.2v per cell and left on for one hour. All cell voltages should now be 2.2v and the difference not exceeding 0.03v and the density around 1230 to 1250 with the difference not exceeding 15 points.

If the battery is still out of specification the procedure should be repeated and finally the battery should be discharged at the 10h rate for 2-3 hours followed by a boost at the 20h rate. This should overcome the problem.

Batteries should he tested independently and as close as possible to the 3h rate using an appropriate sized resistor or load. Record minimum voltage reached (usually occurs in first minute) and voltage after 10 minutes. For a 12 cell battery it should drop to 23.2 - 23.4 volts then recover approximately O.O2v/cell and stabilise. Record discharge current every 2 minutes.

If the voltage does not fall below that stated above and individual cell readings have been taken after 10 minutes, check all cell potentials are even. Any variation greater than 0.5v maximum to minimum indicates low capacity cells. If all cell potentials are within the limits the battery can be boost charged,

Table 1 : Charge/Discharge Currents

Battery Capacity (Ah)	3h Rate (A)	10h Rate (A)	20h Rate (A)
25 *	9	3.5	1.75
45 *	12	5	2.5
90 *	24	10	5
200 *	48	21	11.5
500 *	125	55	25.5
1440	346	144	72
2000 *	500	210	105
2170	520	217	108
3200	766	320	160

equalised and returned to service. If the potentials are above the limits the battery should be boost charged, equalised and the tests repeated and cells replaced if possible.

7. Boost Charging and Equalising

Batteries which have become heavily sulphated or which have been discharged beyond their nominal capacity under emergency conditions require careful recharging and cycling to regain full capacity. Charging currents must be kept low - initially the 50h rate should be used until 20% of capacity is restored. The current may then be progressively increased to the 20h rate while ensuring that the cell voltage remains lower than 2.3v until all sulphation is eliminated. It may be necessary to cycle the battery under limited current and voltage conditions two or three times before boost charging and equalising to achieve full capacity.

Boost charging and equalisation must be performed:

a. Prior to installation of a new battery;
b. After a test discharge has been performed;
c. Prior to a test discharge if cell voltage variations of 0.03v or density variations of 10 points are exceeded;
d. After an A.C. power failure has occured;
e. If the difference between the minimum and maximum density is greater than 25 points when the battery is on float;
f. If the difference between the minimum and maximum cell voltage is .05 volts or more when the battery is on float;
g. If the density of any cell has fallen by 15 points or more from the reading after the last boost charge;
h. If any cell voltage is less than 2.17v on float.

The purpose of equalising the battery is to ensure that each cell is holding the same charge thus enabling the full capacity of the battery to be realised.

If you are not in attendance, the charging voltage must not exceed 2.3 volts/cell (55v for a 24 cell battery) and the charging current must be less than the 2h rate current).

Charging off Load

A battery in good condition should be charged off load at the 10 hour rate until a cell voltage of 2.35 volts is reached. The current MUST then be reduced to the 20 hour rate and the charge continued until the battery voltage is constant for 3 consecutive half hourly reading.

In URGENT circumstances only, the recharge may be STARTED at the 3 hour rate but immediately the voltage reaches 2.35 volts per cell the charging current must be reduced to the 20 hour rate. This procedure should not normally be used as it may reduce the battery life.

Proceedure -BOOST CHARGING OFF LOAD-
Constant Current (Preferred Procedure)

a. Ensure that the voltage of the battery to be tested is held at 2.2v/cell. Read and record all cell voltages, densities and temperature in the Battery Record Book under "Quarterly and/or Equalising charge".
b. After recording density readings, add distilled water as required to top up the electrolyte to the High level mark in each cell.
c. Examine the battery for signs of sulphation. If present follow the sulphation correction procedures set out previously in this article.

d. Connect the battery to the charger which should be switched off.

e. Turn on the charger and commence charging at the 10h rate.

f. Measure and record the voltage drops across all battery cabling and cell linkage connections.

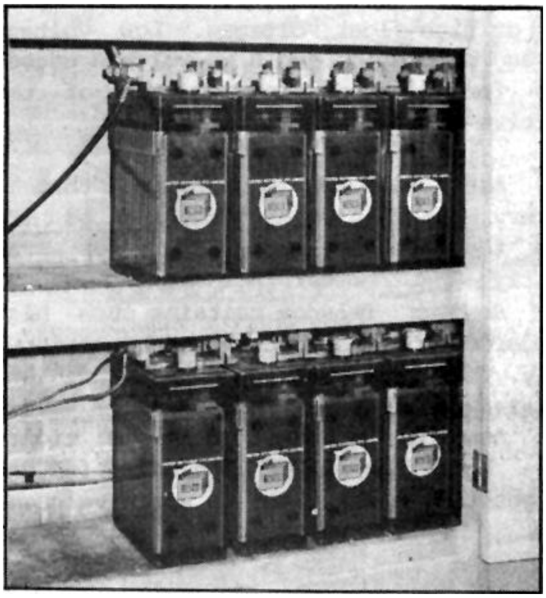
g. During the charge the following readings should be taken at half hourly intervals.

- overall battery voltage
- battery charging current
- pilot cell temperature
- individual cell voltage.

h. When any cell voltage reaches 2.35 volts reduce the charging current to the 20h rate,

i. Keep a close check on cell temperature and if any cell reaches 45°C suspend the charge. Leave the battery open circuit until the temperature falls below 35°C.

j. When the cell voltages have reached approximately 2.6 to 2.8 volts and all cells are gassing freely, maintain charging until three consecutive half hourly readings of battery voltage are constant. The charger should then be switched off and the battery should then be restored to float operation until the following day when its equalisation must be checked.



Procedure - EQUALISING

a. After floating overnight, reconnect the battery to the charger and set the voltage to 2.2 volts per cell (52.8v for a 24 cell battery).

b. After 1 hour read and record all cell voltages, densities and temperatures.

All cell voltages should be around 2.20 volts with the difference between the maximum and minimum not exceeding 0.03 volts.

Depending on the age of the battery all temperature corrected density readings. should be around 1.230 to 1.250 with the difference between the minimum and maximum not exceeding 15 points.

All cell temperatures should be around room temperature.

c. If the above criteria are not met and more than two cells are out of specification, the battery should be charged again and the equalisation procedure repeated. If two or less cells are out of specification they should be individually charged at the 20h rate until the cell voltage remains constant for three half hourly readings. The equalisation procedure is then repeated after the battery has been allowed to stand for 12 hours connected to the float voltage of 52.8v.

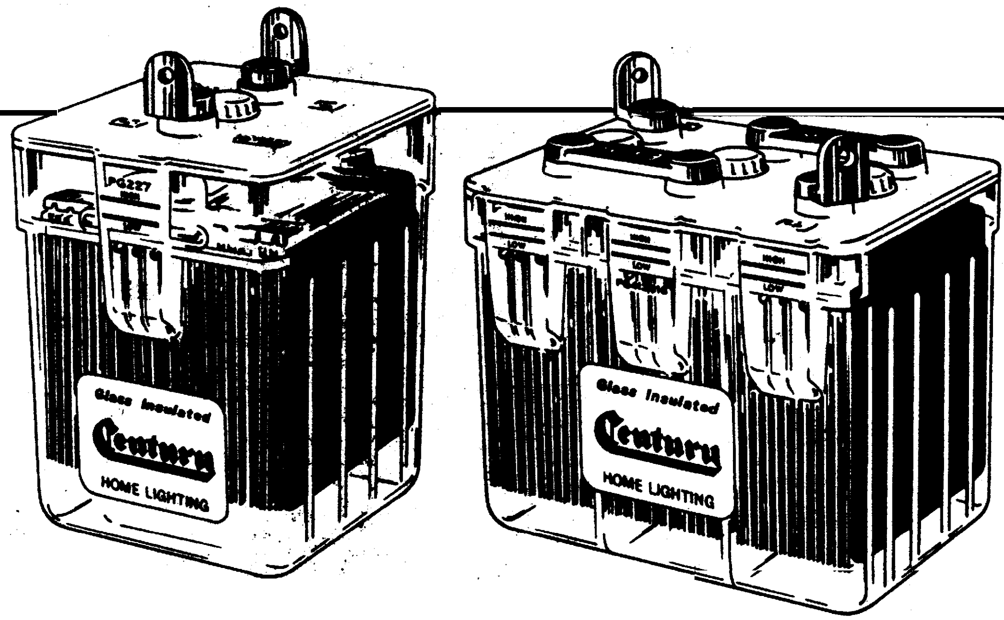
d. If the equalisation limits are still exceeded, a shallow discharge at the 10 hour rate for 2-3 hours, followed by a boost charge at the 20 hour rate, to the fully charged condition will generally overcome the problem.

e. When satisfactory equalisation has been achieved, reconnect the battery to float operation.

Charging Individual Cells

Individual cells charging is useful for conditioning one or two cells in a battery if, despite boost charging, their voltage and density are too low for the eqalisation limits to be met.

The charging procedures just listed are applicable to single cell' charging except that:



a. the charging current should not exceed the 20h rate
b. the charger concerned is a single cell charger
c. reference to any but the cell being charged is deleted.

When connecting the charging leads to he cell, care must be taken to maintain he correct polarity of positive lead to positive terminal and negative lead to negative terminal.

Records

A 'Battery Record Book' should be - kept for the battery bank. In it is to be recorded all initial installation details of cell make, type and capacity, dates of manufacture and installation, purchase contract information, cell voltages and temperature corrected densities.

The results of all routines should be recorded in this book, including pre and post boost charging details of all voltages and densities and results of capacity testing for continued monitoring of battery condition.

Comparison of routine readings with hose achieved at the previous boost charge enables the need for conditioning charges to be evaluated.

Battery record books should be analysed periodically to ensure that recurrent problems are dealt with satisfactorily.

8. End of Life Indicators

i. Positive plates have lengthened and widened, and as a result, the positive post lug is higher than the negative.
ii. Defective attachment of plates to the commoning bars may be apparent.
iii. On the second test discharge i.e. after test, cycling and re-test the capacity is less than 90% of that specified for the test discharge rating.
iv. The charge efficiency is below 80%.
v. The voltage at end of the charge is less than 2.6v per cell.
vi. The density of the electrolyte is low and does not improve with cycling.

Premature failure may be due to:
a. Internal short circuit of the cell.
b. Corrosion of positive plates due to impurities in the electrolyte.
c. Bad manufacturing processes.
d. Incorrect operating practices such as low or high float voltages. Low voltage causes sulphation and high voltage causes over formation and disintegration of the positive plates.

After Telecom has determined that a battery bank has reached the end of its life the batteries are sold off for scrap, usually by tender.

However, Telecom maintains such high standards that the batteries are replaced while still in reasonable condition, certainly good enough to get you going in your new solar house if money is tight. These batteries can be good value if you can get them at or close to scrap value.

MUDBRICK HOUSE..................
CONTINUED FROM PAGE 12.........

c) Comparing the mud pour versus mud-brick method. Pouring is the quicker method, you handle the mud one time less: It seems easier to work with and is better suited to people who only build at weekends but has less character than unrendered mudbrick.

d) Try and keep your kitchen, and/or bathroom to the North; this is where your solar panel will be and thus the distance from the storage tank to the solar collector outlets is very close, a mistake in my design.

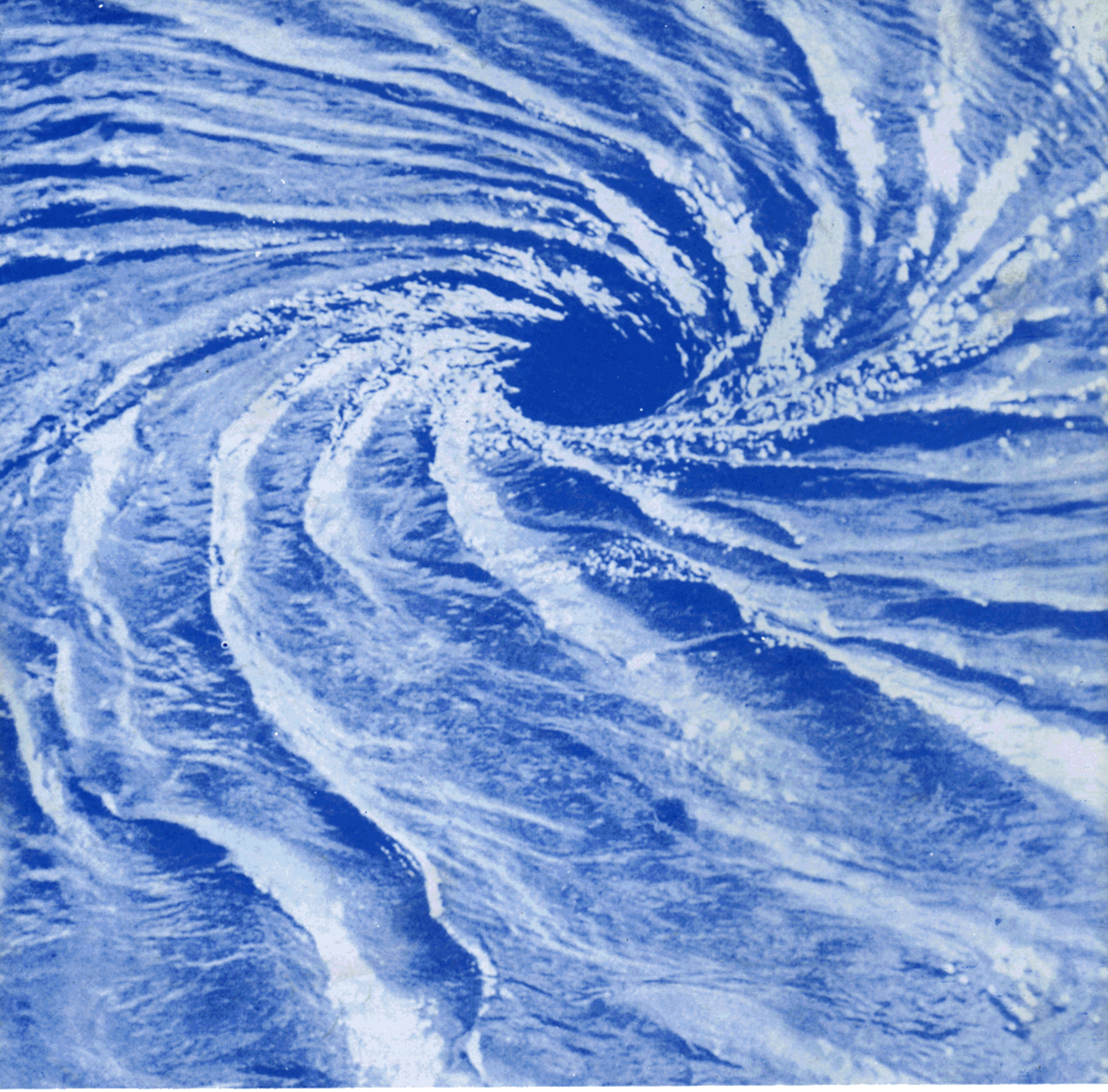
e) When I build again I won't make my own mudbricks, I'll use a machine or buy them.

If you are in a hurry to build, or want an excellent package, I would give thought to an "Acacia" kit home which is designed on 11 solar principles, insulated correctly, hassle-free because all the problems have been ironed out. They come with Photovoltaic solar panels and water heating kits and they go up in no time.

They might not be mudbrick but they are well designed and well priced. Let's face it once you get used to a house you stop noticing your surroundings.

Alternatively, a company like Fasham has solar designs in kit form. You can buy the kit of windows, internal fittings and roof, and where they suggest using brick you put in mudbrick.

They'll change their dimensions slightly to suit the requirements of you or your builder. This enables you to draw on their experience, buying power and you are being provided with new good quality materials (hopefully), with no preliminary work to prepare them for building.



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