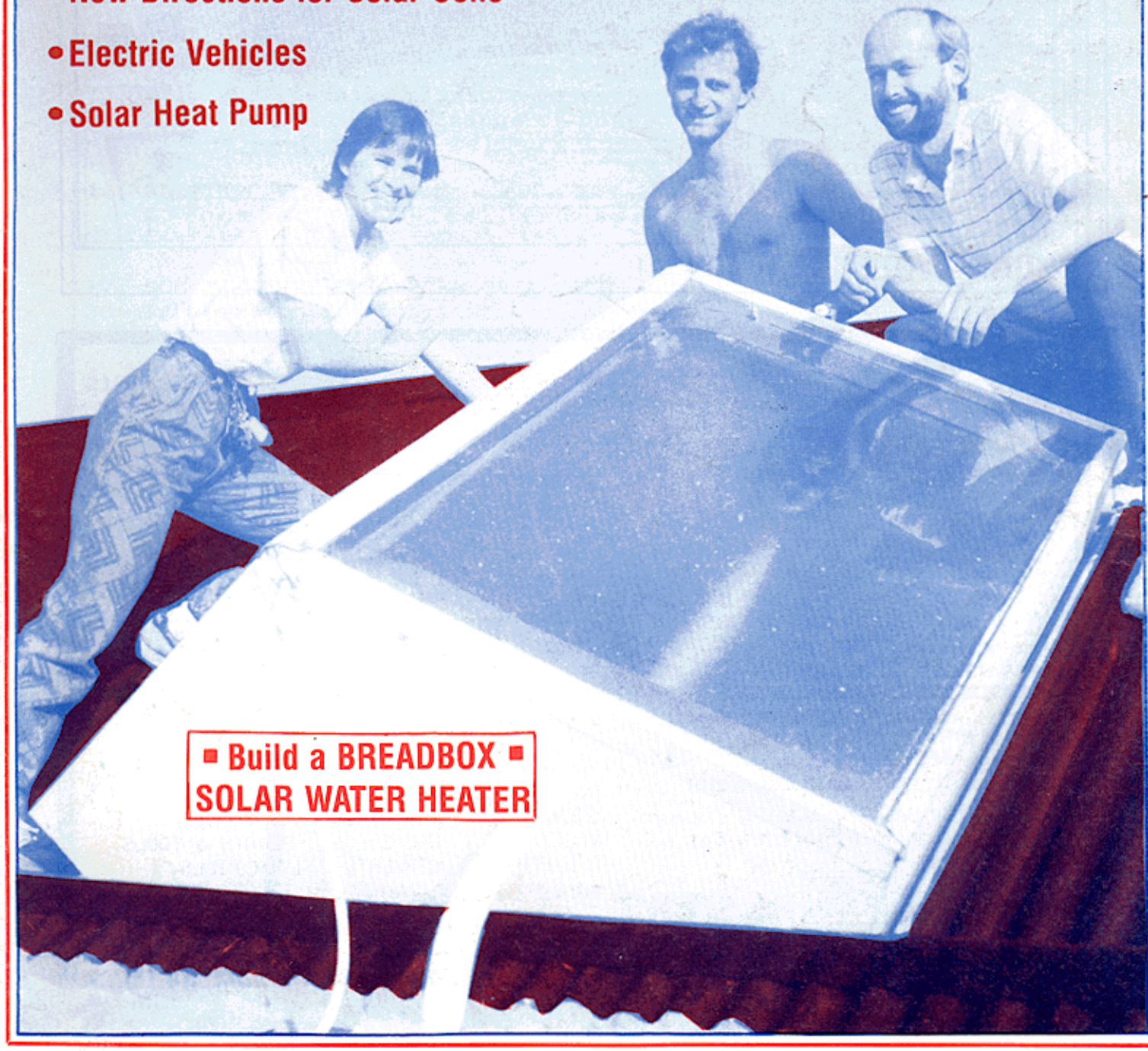
Soft Technology

Alternative Technology in Australia No. 25 Apr 87 $2.00

- The Amazing Bicycle Wheelbarrow
- New Directions for Solar Cells
- Electric Vehicles
- Solar Heat Pump



■ Build a BREADBOX ■
SOLAR WATER HEATER

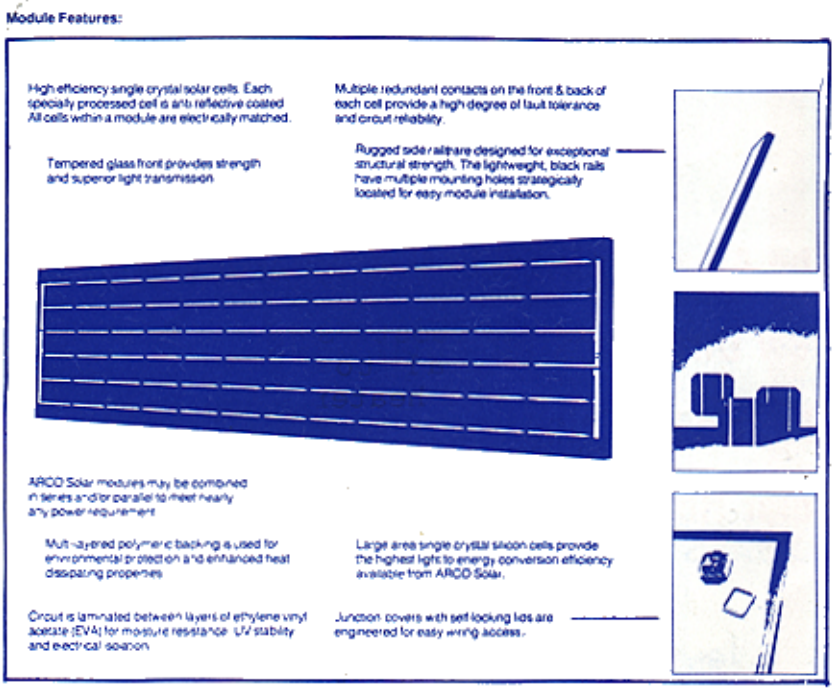
Solar Electricity by ELANTE

Elante have moved to new larger premises in Canterbury Road, Surrey Hills, and are continueing to stock a full range of Arco Solar Electric Panels and other products.

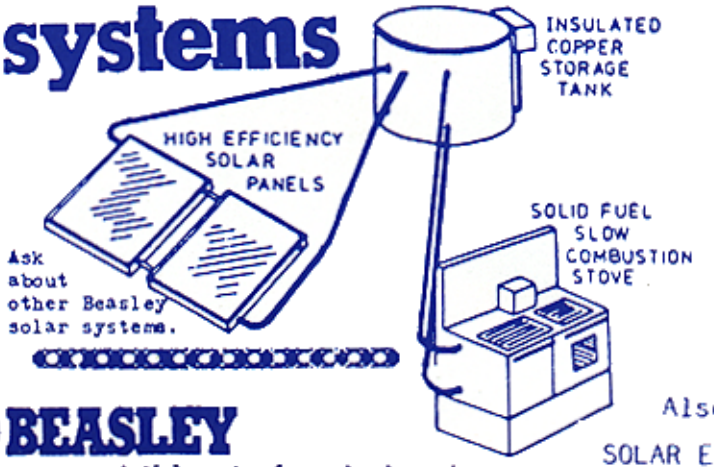
In addition **Elante** are also stocking a number of new lines which make a visit to their new premises a must.

The new address is:

Elante Pty. Ltd.
382 Canterbury Road,
SURREY HILLS,
VICTORIA 3127
Ph: (03) 836 9966.



solar hot water systems



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Contents

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SOFT ENERGY OPTIONS

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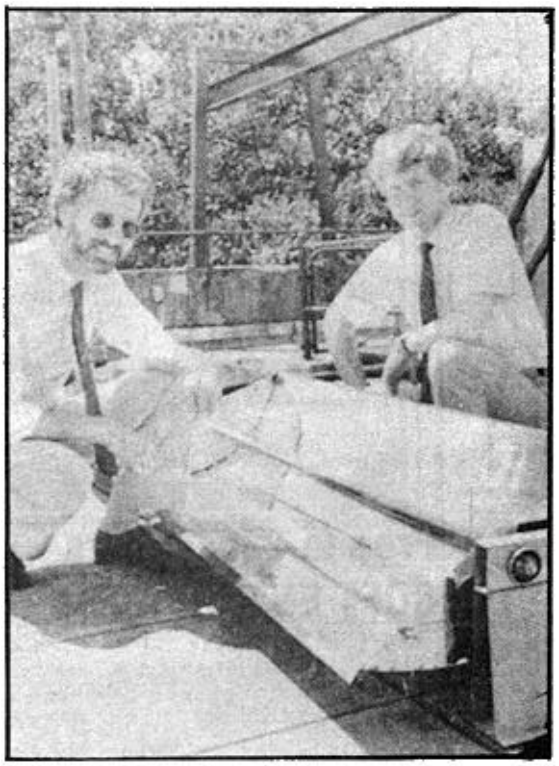
Energy Flashes.....



SOLAR STEAM LAUNDRY

A promising new solar technology will soon be doing the laundry, sterilising surgical instruments and warming patients at Canterbury Hospital in Sydney, NSW.

The hospital has been chosen to test a prototype industrial steam-generation system devised by researchers at the University of Sydney, using a Federal Government energy development grant.

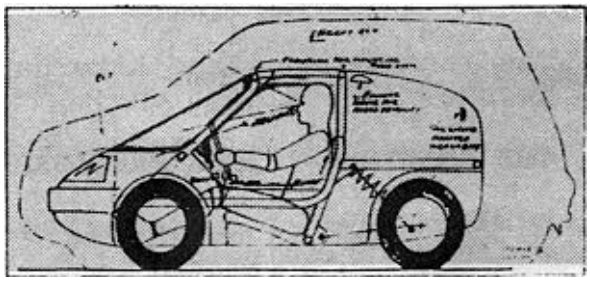
The unmanned. system should be in place on the hospital's roof by the end of this year. It will connect with an existing steam system powered by attended coal and gas boilers. A second trial is planned for Parkes Hospital in 1988 to establish the long-term economic value of the system.

According to a study by the physicist in charge of the project, Dr, David Mills, and Dr. Viv Hall of the university's Economics Dept. the system could generate steam for as little as half the cost of LPG in inland NSW.

Dr. Mills said many solar technologies were not at an advanced stage, but their further development and widespread use were being impeded by social attitudes rather than technical barriers.

"One of our biggest problems is that middle-class people tend to think they're going to lose something with solar," he said.

"They identify it with long hair, hippies and living in domes, and think their lifestyle will be negatively affected. That's simply not true, Passive solar design for houses, for example, carries with it intangible benefits like better lighting, warmth distributed evenly through a house, and so on."



VEGIE POWERED CAR FOR CHINA

A car which can be fuelled by vegetable oil, runs for 100,000 kilometres without maintenance and costs $3500 could become an important new Australian export to China.

The car has been put together by a group of inventors and is being developed for the Chinese market by a newly formed company, Protech Capital Investments.

Dr. Coogan said the car, which would cost about $3500, was being developed for China's communes, whose residents were

benefiting from the new direction of the country's economy. It would be a replacement for bicycle transport now used by commune families.

He said there were no plans to market the car in Australia because of the Federal Government's proposals for the country's motor vehicle industry, but the design could eventually be developed into a low-cost sports car.

The diesel engine was "not very choosy about fuel", said Dr. Coogan, and it could run on soya or peanut oil (perhaps having to be supplemented by kerosene).

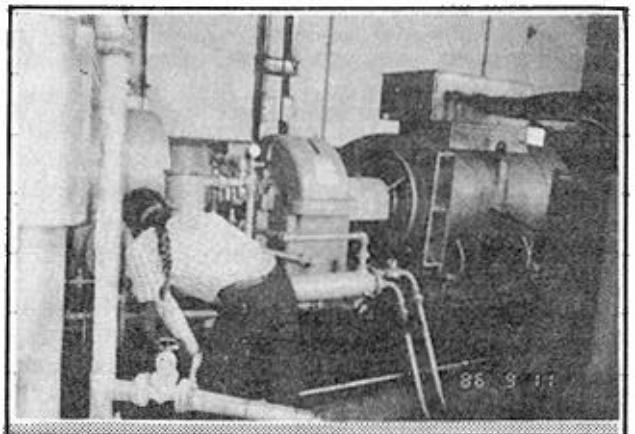
SOLAR POWERED COAL PLANT

A pilot plant which uses solar energy to produce dried brown-coal products from liquid coal slurry has begun production in the La Trobe Valley, Victoria.

The solar coal-drying process involves pumping thick coal slurry into ponds which are exposed to the sun and wind. The drying process takes up to four months and the hardened coal products are then 'harvested" with a front-end loader. Coal produced by this process is extremely dense and less likely to suffer from weathering in open stockpiles than briquettes.

A commercial plant producing 100,000 tonnes of dried coal a year would cover about 1sq. km., and would have about 50 drying ponds and stockpile up to 50,000 tonnes of dried brown coal.

AIS Science Newsletter



PALM OIL POWER

Why dump waste organic matter when you can use it to generate power. The photo, taken at a palm oil plantation near Medan, Sumartra shows a setup for generating electric power from the waste from oil pressings. It shows a Dutch 1 MW steam turbine & generator set running from Japanese boilers fired from the waste. The rounded lump in the middle is a 1 MW gearbox!

Karl McLaughlin

THE FLYING WINDMILL

Transfield Pty/Ltd, a NSW based construction firm, is sponsoring research by the mechanical engineering department of Sydney University into development of a flying windmill which could one day be used to provide power to remote areas such as Antarctica.

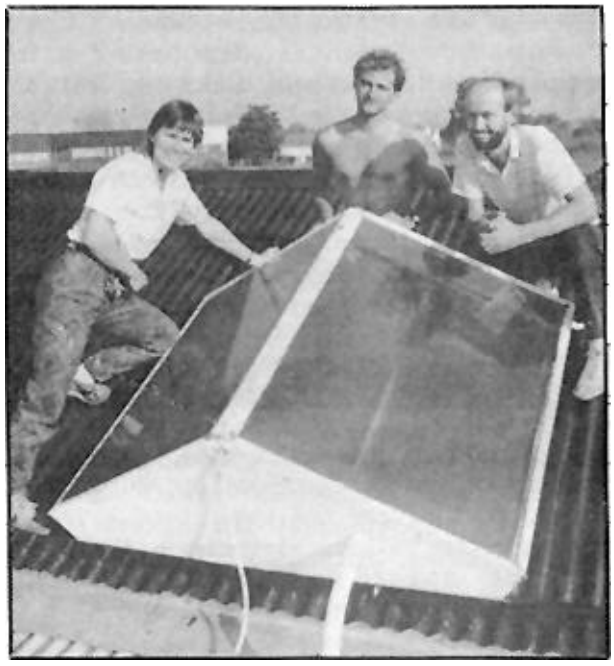
The project involves a device called a gyromill, which uses helicopter technology to fly in winds that rush along high above the ground,

The wind turns a propeller-like blade that generates power. The electricity is then transmitted to the ground by cables. Being able to fly, the gyromill can ascend to where the winds are stronger and can avoid the turbulence normally near the ground.

A gyromill with four-metre blades could generate 3 kw of power. However, future models with 16-metre blades might be able to produce megawatts.

Build a Breadbox Solar Water Heater

By Mick Harris



What's bigger than a breadbox, has windows and a big black thing that goes slosh slosh? One of the simplest and cheapest solar water heaters that you could ever want to make.

This water heater was put together by the Brunswick City Council Electricity Supply, a local electricity utility with the imagination and guts to investigate a range of energy saving and renewable energy options which could be utilised by the community.

The ideas on which the water heater is based come from the U.S. where this kind of design has long been dabbled with by do-it-yourselfers.

When you boil it down to basics all it is is a standard Hot Water Tank sitting inside an insulated box with windows on top. The sun shines into the box heating up the blackened water tank and water in the process.

How good is it?

While the efficiency of a system like this will not match the standard flat plate solar water heaters, the systems simplicity and low cost easily offsets this drop in efficiency.

The lower efficiency is a result of the lower amount of exposed blackened metal which collects the heat and heats the water, In a normal flat plate solar water heater you generally have 3 or 4 meters of collector area (that's in South Eastern Australia), while with this design you may only have about 1.

However you do get some additional benefit to this because you have the tank in a "hot box" where the tank is heated by hot air trapped in the box as well as direct sunlight. When you take the total area of glass of the collector it may be closer to 2 sq. m. (about l/2 the area of a flat plate unit).

The Advantages

This kind of Water Heater has some big pluses even though it is less efficient.

First it's dirt cheap. Maybe $300.00 if you bought all the materials at top retail prices, maybe less than $50 if you scrounge most of the materials. If you compare that to a standard flat plate water heater at about $1,500 off the shelf and similar price if you do-it-yourself, this design starts to look pretty good.

Second, its so simple. Simple to build, simple to install and the plumbing is simple too.

Third, its easy to add-on. Often people get inspired about solar water heating only to find its very expensive to

install and they generally can't add it on to their existing water heater which is "working fine", With this system all you do is take the cold pipe which runs to your existing water heater and direct it to your new solar water heater.

Connect the outlet from the solar water heater straight back to your existing water heater and the plumbing's complete. Whenever there isn't enough sun to heat up the water in the solar water heater your good old original heater does the job just like before. But when the sun shines, free hot water.

The last big advantage is **the system is foolproof, The** water tank has so much water in it and the box is so well insulated that it won't freeze up and bust its pipes as some flat plate collectors have.

On the other end of the scale it can't overheat, boil the water and blow-up because it has a standard safety valve, (pressure-temperature relief valve), which is used on mains pressure water heaters. Also because the tank is mains pressure you can use it on your standard city plumbing and not have to resort to gravity feed, (although you could if you wanted to).

How to Make One

I came to be involved in this water heater through my job as an energy advisor with the Brunswick Council. In supervising the project it was important for the prototype to look good and "professional". Hence we decided to contract the construction out to a sheet metal workshop.

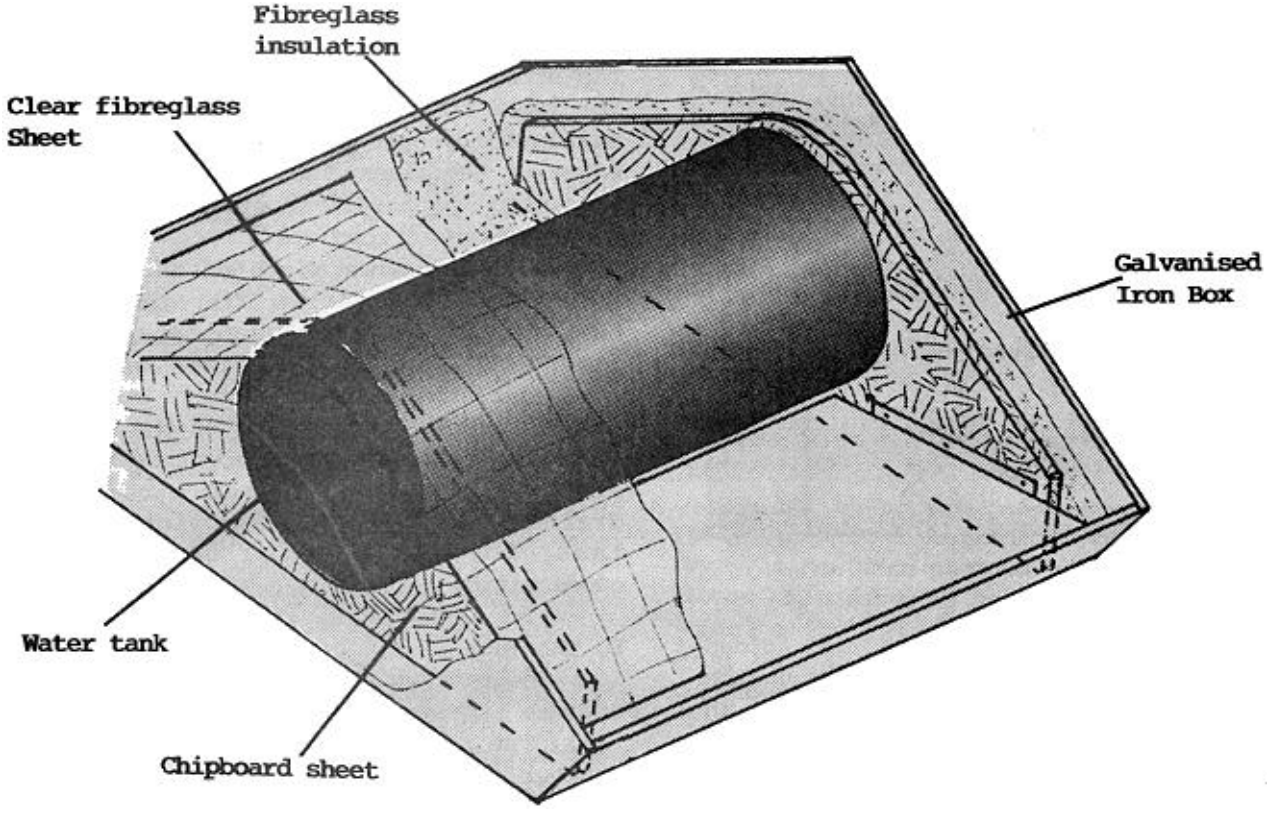


Figure 1. Cut away view of the Breadbox Solar Water Heater.

The result, while it looks good, and works quite well, may be a little difficult for people who lack the equipment or skills in folding sheet metal. For those it may be better to read the following, pick out the relevant points, and construct in the way which is easiest for the person involved. An all wood version of the heater (except the tank of course), is quite practical and possible.

The version we built consisted of folded galvanised iron back and sides with chipboard inserts at the ends to hold the tank in place. The top was glazed with clear fibreglass sheet and glass as a second and outer layer. The box itself was insulated with a high density fibreglass batt which had silver foil on one side.

A. The Box

The box is made of 3 pieces of folded galvanised iron sheet. The largest sheet forms the base and the two low sides. The sheet is 1200mm x 1770mm and folded according to Figure 2.

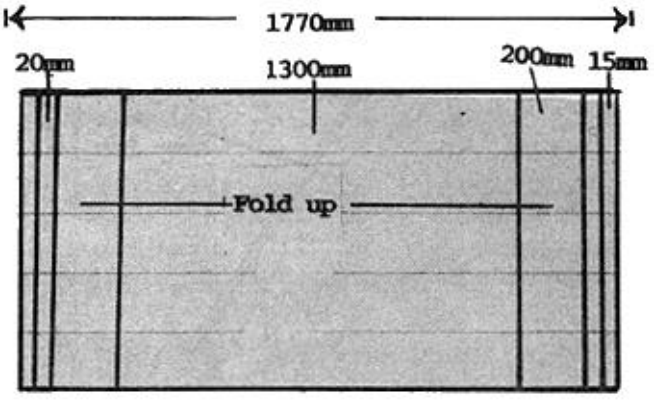


Figure 2. Folding of main back and low sides.

The 2 side panels are cut and folded according to Figure 3. When making up the panels make sure you include an overlapping strip so you can pop rivet the sections together.

Also make sure you fold the top, long ends of first sheet so that you have a flat section for the glass sheet to rest on. (refer Figure 4).

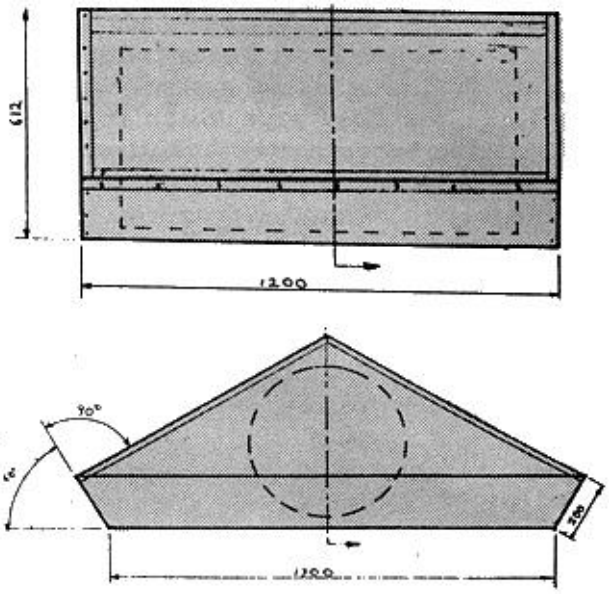


Figure 3. The Sides

You also have to make up a central, top strengthening piece, (refer Figure 5). You have to make up strips of glazing metal which cover the top ridge and other edges of the glass. These strips are fixed into place with self tapping screws after construction is complete.

The only other piece of sheet metal is used to fix the clear fibreglass sheet to the timber end tank supports, (refer Figure 4). One side of this sheet is screwed to the fibreglass sheet while the other is screwed to the top of the timber.

When you put the box together silicon all the joins, however drill a couple of drain holes at the lowest points of the tank. This allows any build up of condensation to drain out of the tank.

B. The Tank

The tank we used was a standard steel enamel lined, mains pressure hot water tank. The size we used was an 80 litre, however there is no reason why a larger (or smaller) tank could not be used provided the box is redesigned to suit and your roof is strong enough. (Many commercial solar water heaters have 300

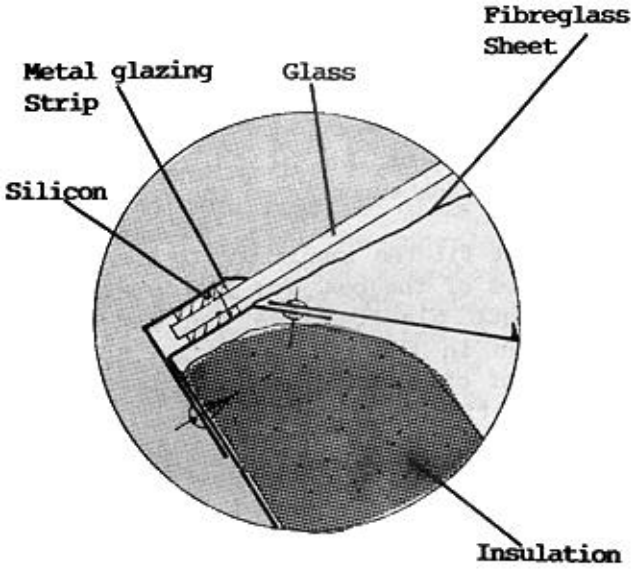


Figure 4. The Edges

litres or so on the roof, although they do spread the weight over a number of square metres).

We bought the tank new from a local hot water tank manufacturer, R. Edmonds & Son in Clayton, Melbourne. They trade under the name Edson, and charged us $220. You should be able to get a new tank cheaper than this.

One important feature of the tank was a PTR valve - pressure temperature relief valve. This valve is standard on all mains pressure hot water units. It is designed as a safety valve-to relieve pressure if a

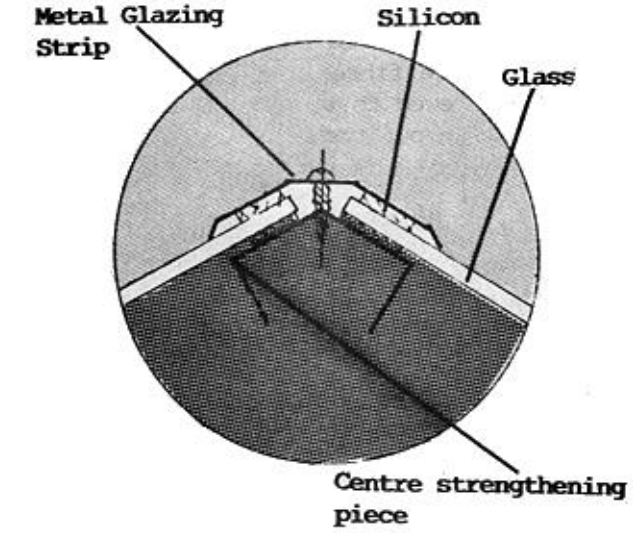


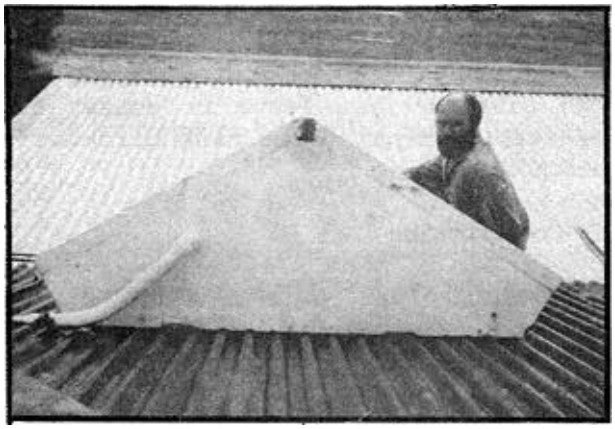
Figure 5. Top centre piece

tank overheats and hence avoid the tank blowing up.

In an electric water heater, overheating is prevented by a thermostat. In your solar heater there is no such mechanism, and while I never noted our prototype overheating, it did get very hot at times and the P.T.R. valve is an essential safety precaution in any mains pressure installation.

In a gravity feed situation you should be able to avoid using the P.T.R. valve provided it is easy for the expanding hot water to flow back up the inlet pipe.

You should connect a wire to the lever on the P.T.R. valve (which should be located at the top of the tank), and run



it out through the front of the box, (refer Figure 6).

Also run a pipe from the valves' outlet down to the bottom of the water heater and out onto the roof. This *is* to allow any water which squeezes out through the valve as the unit heats up, to run away. Also once every now and then (every 6 or 12 months) you should manually operate the valve (with that bit of wire you put in). If you can't be bothered clambering up onto the roof to operate the valve every 6 months, don't panic, you should still get many years of trouble-free operation, The valve may ultimately fail a little earlier, (maybe in 10 years) but it is easy to replace,

The tank is held in position by two

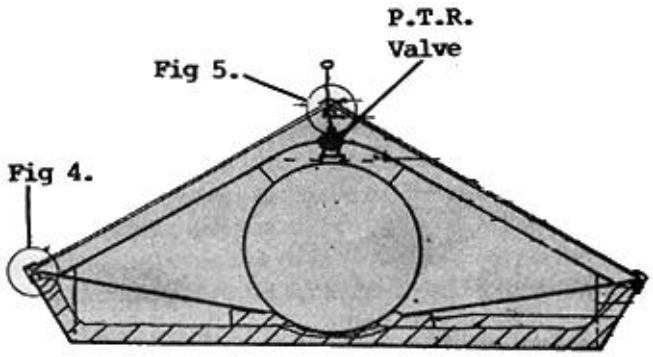


Figure 6. Top view showing PTR valve

sheets of one inch chipboard. These sheets are fixed in position by self tapping screws at either end of the box. They are cut to fit neatly in position and each have a large hole which hold the ends of the water tank. (refer Figure 5).

The only other things to do with the tank are to close off the hole the electrical element goes into, (if you have the element just leave it there, its easier), and paint the tank black with blackboard paint.

C. Construction

After folding all the sheet metal parts, pop rivet the 2 ends to the back section. Make certain you silicon all joins. Leave one end loose until after you have the tank in place. Screw the chipboard tank supports to the ends of the box.

Next fit the insulation to the bottom and sides of the box. You can now fit the tank into place. Slide the tank into position in the two holes in the end pieces of chipboard Rivet the loose side into position.

The plumbing in the form of the inlet, outlet and P.T.R. valve overflow pipes can now be connected. Cut holes for the inlet and outlet pipes. Seal the holes with silicon or rubber gaskets. Leave enough pipe from the P.T.R. valve to run along under the centre strengthening piece and down onto the roof.

Fit the centre strengthening piece. Drill a hole near the top for the wire which allows you to manually operate the P.T.R. valve.

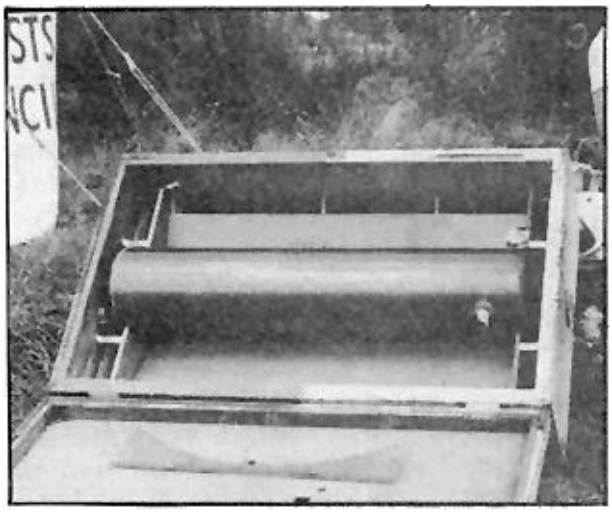
In our water heater we included collector plates on either side of the tank. These plates were made of 26 gauge galvanised iron sheet, painted black. They are screwed to the chipboard at the ends. Its open to question whether it may be better to use reflective material which

an alternative approach

This is a different type of Breadbox Solar Water Heater photographed during its construction. This design uses a secondhand copper water tank and an all wooden box.

While the box is insulated like the other design, this insulation is less important because the wood itself has some insulation value.

The tank is held in place by the same method as in the other design, chipboard support at either end of the tank. Timber panels to the rear of the tank are covered with reflective material which reflects solar radiation back onto the tank.



reflects the heat back to the tank or use these blackened sheets.

You are now ready to glaze the unit. We used two layers. The innerlayer was clear fibreglass sheet attached to the chipboard end supports. The outer glazing sheet is glass and is fitted to the top metal lip which runs around the edge of the box. The glass is secured by silicon sealant and the metal glazing strips go over the top and are screwed onto the side of the box.

It is important that air should be trappedbetween the inner and outer layer of glazing to keep the glass and fibreglass glazing tight fitting. (the out sheet should be sealed and waterproof).

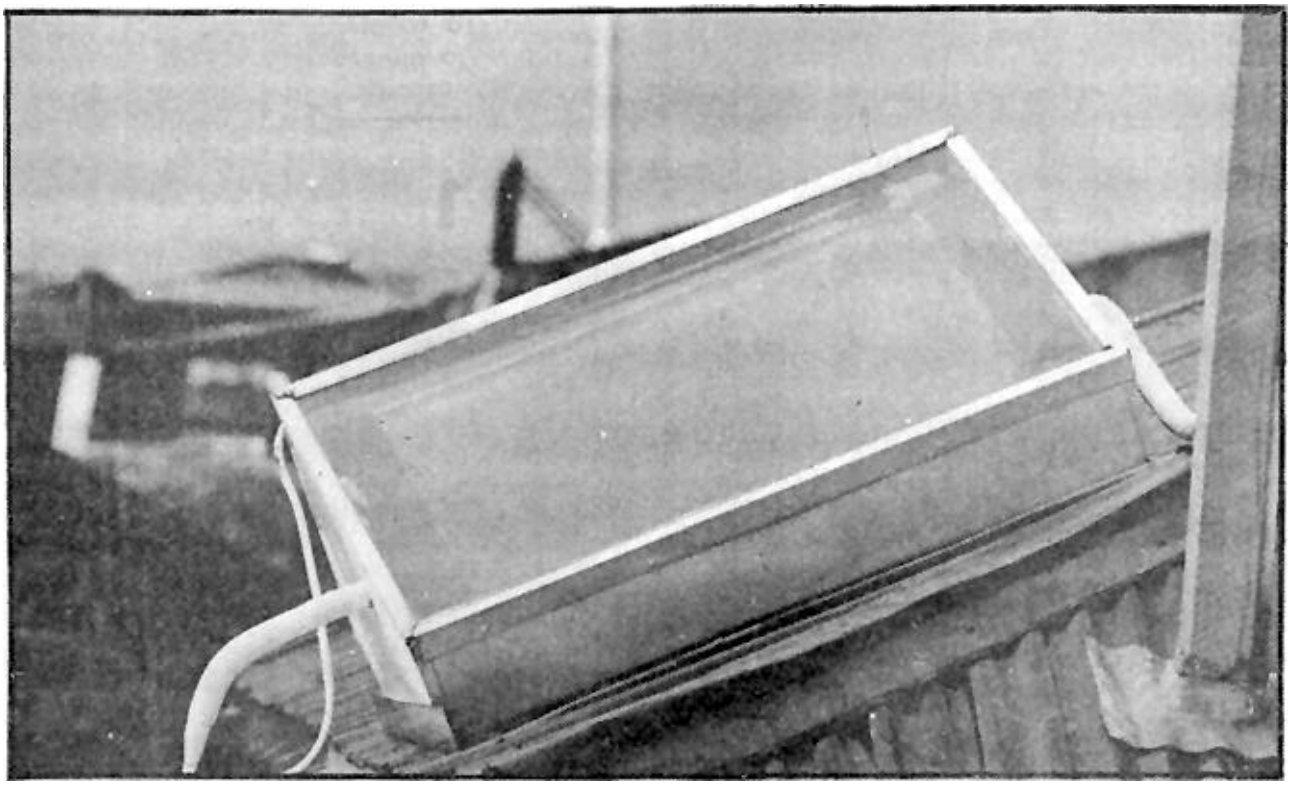
Insulate the inlet and outlet pipe with black foam rubber pipe insulation to about 1 meter from the collector. The hot outlet pipe should be insulated for the rest of its length to the tap by the use of standard insulated copper pipe. If you arebuilding a water heater which operates on low-pressure you use 3/4 inch copper pipe while l/2 inch copper pipe is adequate for mains pressure.

D. Installation

The unit should be mounted as shown in the photo. It is essential to have the unit facing to the North. We fixed it into place by having the bottom side supported by a 2 metre length of angle iron. The top end was held down by brackets fixed directly to the roof beams.

Connect the cold water supply to the bottom pipe and the top hot outlet pipe to the hot tap pipe.

The Breadbox Solar Water Heater provides a simple cost effective alternative to a conventional Solar Water Heater. Its biggest benefits are for people wanting to add solar their existing water heater and its associated plumbing.



AMORPHOUS SILICON

the shape of things to come.....

By Richard Corkish

Arco Solar, of California, hope that their planned new plant will be able to produce each year amorphous silicon solar panels capable of generating 70 MW of electricity at a production cost around $US1 per watt, This represents a significant cost decrease from the average 1985 cost of $US8 per watt. Currently, crystalline and amorphous cells cost about the same per watt.

In 1985, the combined generating capacity of solar cells sold was 27 MW, of which one third was accounted for by amorphous cells. Eight of the nine MW were produced in Japan, where the major manufacturers are Sanyo, Sharp, Fuji Electric and Taiyo Yuden. Main US manufacturers are Arco Solar and Chronar,

This article seeks to outline some of the aspects of amorphous silicon and hence suggest reasons for Arco Solar's big investment in that technology. The information is drawn entirely from References (1.4).

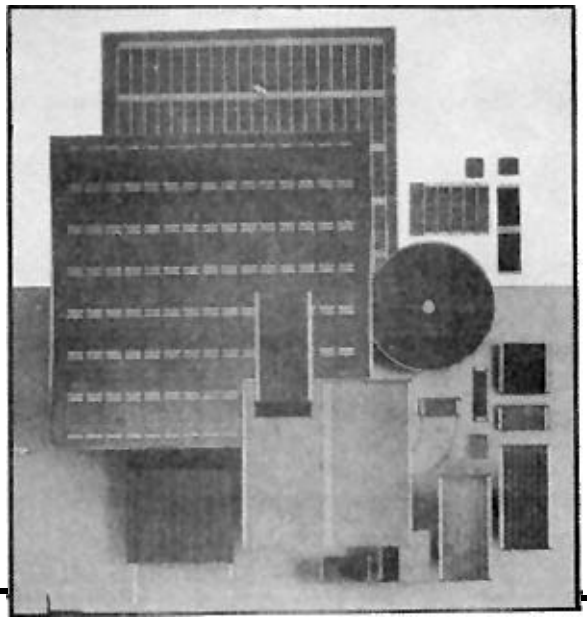
Amorphous Silicon

Crystalline silicon has a regular atomic structure in which each silicon atom is bonded to four others. Any impurities distort the regularity so extremely pure material is needed to make crystalline cells. Amorphous material does not have the same long-range regularity, although localised areas can have regular atomic structures. Such cells are produced by the deposition of silane gas (SiH-4) in an electrical discharge and hydrogen is incorporated into the structure to improve the electrical properties.

Amorphous versus Crystalline Silicon

Most sunlight energy is absorbed after passing through less than 1 micrometre of amorphous silicon, compared with approx 50 micrometres of crystalline silicon. This makes thin-film amorphous cells possible and these are being produced. Deposition of hydrogenated amorphous silicon onto a variety of substrates is possible. A flexible collector is made possible by the use of a stainless steel substrate, while a glass substrate can provide both mechanical support and a transparent protective cover.

Sections up to 40 cm wide can be coated with amorphous silicon whereas crystalline cells are limited to the diameter of the available crystal waters, commonly 12.7cm. Unfortunately, efficiency tends to be lower for large-area cells.



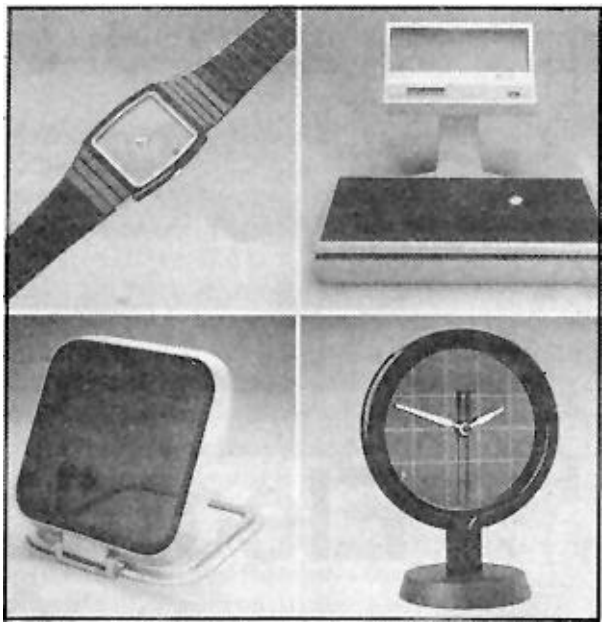
The US Dept. of Energy is sponsoring research aimed at achieving 18% laboratory efficiency for small cells and 13% over a square-foot area by 1989.

A transparent conducting oxide, textured to reduce reflection, is often deposited on the illuminated surface of amorphous cells and can be used instead of a metal contact grid over short distances, obviating the problem of blockage by a grid.

Tandem Cells

Photovoltaic cells absorb light energy in discrete quanta of magnitude equal to the forbidden band-gap of the material. Photons of energy less than the band-gap cannot be converted into electricity while those with greater energy lose the surplus as heat. The band-gap of amorphous silicon is approx. 1.6 eV (electron-volt) compared to 1.1 eV for the crystalline form. Photon energy corresponds to the wavelength of the light, so a more limited range of wavelengths in sunlight will generate electrical energy in an amorphous cell. One way to reduce the effect of this limitation is to build tandem cells.

To do this, layers of material with different band-gaps are stacked on top of each other to allow more efficient conversion of the incident solar energy. The material with the greater gap is deposited in a layer thinner than normal on the top of the tandem cell, facing the incoming sunlight. This layer absorbs photons with energy greater than the band-gap while low-energy photons pass through the thin layer to be absorbed in another material with lower band-gap. Because the individual cells are connected in series to form the tandem cell, their currents must be equalised by selecting the correct layer thicknesses. The output voltage of the combination is the sum of the individual cell outputs, and the current is only slightly less than that of a single cell, so increased efficiency may be expected. Unfortunately, realising the



Some uses for Amorphous Silicon Cells including a solar powered watch, clock, scales and sun roof using the solar cells.

increase has been difficult. Conversion efficiencies of 12% in the laboratory have been reported.

Stability

One of the main drawbacks of amorphous cell technology is that present devices suffer degradation of their conversion efficiency over time. Much research is being devoted to this problem for which the cause might be the breakage of weak silicon-silicon bonds and which is apparently promoted by the presence of impurities.

Fortunately, the degradation is self-limiting and is reversible by annealing at 150°C for a few minutes. Some self-healing even occurs at normal operating temperatures, but the extent of this is uncertain.

Conclusion

While amorphous silicon solar cells are presently available at around the same cost/watt as monocrystalline cells, advances in technology and production methods are expected to rapidly lower the cost of amorphous cells.

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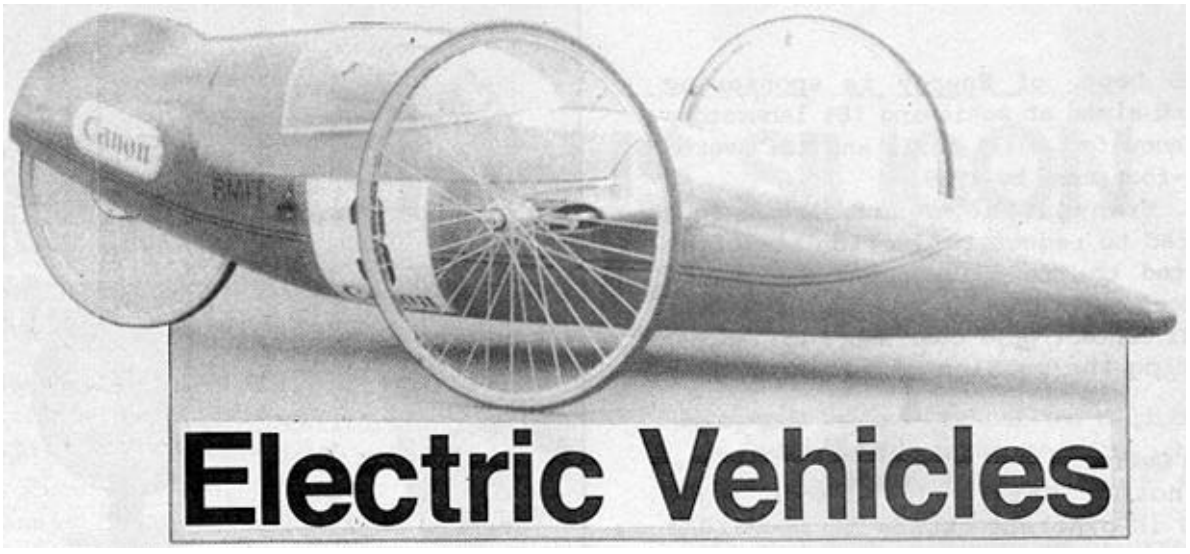


Electric Vehicles

Over the last few years the Victorian branch of the Australian Electric Vehicle, Association has been organising the "Electrathon", a race of speed and endurance for electric vehicles. Over a relatively short period the vehicles competing in the Electrathon have become quite sophisticated, although there still remains a number of rough and ready, weird and wonderful machines.

The electrathon offers a reward of $1,000 for the vehicle which can go the greatest distance in two hours. Vehicles are limited to 25 kgs. of batteries and are allowed to include solar cells to help keep the batteries charged during the event.

On the same day as the electrathon the Electric Vehicle Association run the Electrokana. This is a half hour obstacle course which includes dips, turns, stopping and starting etc.

Both the Electrathon and Electrokana are annual events and anyone interested in finding out more 'about them should write to:

The Secretary
A.E.V.A. Melbourne branch
9 Washington Drive
OAKLEIGH SOUTH Vic. 3167

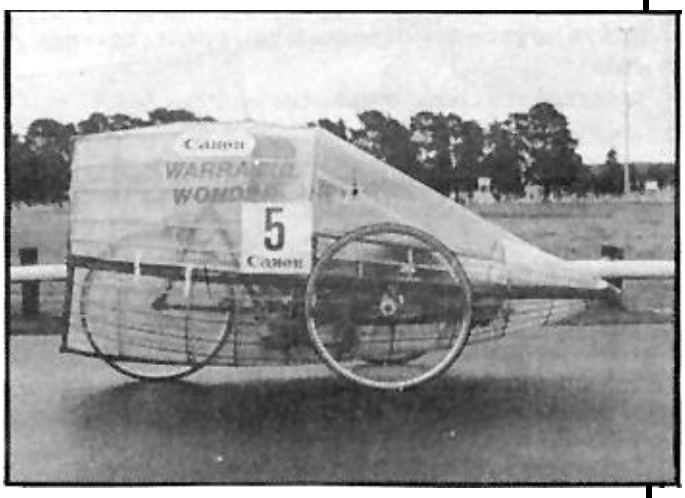
The following are a selection of the entrants from the 1986 Electrathon.

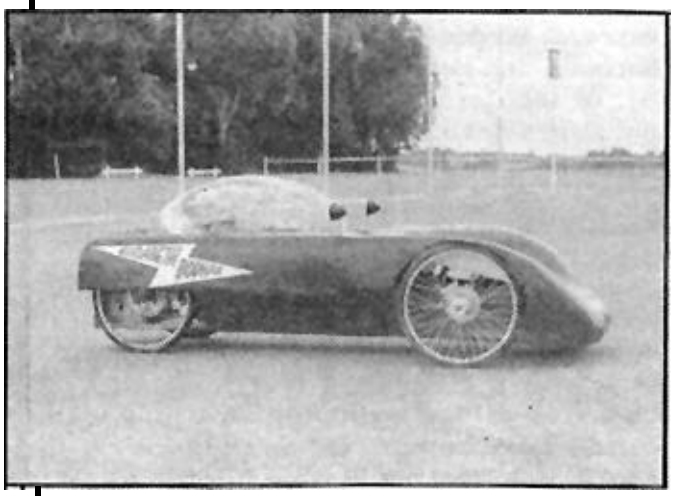
RMIT

Entrant: Theo Kangsanant, RMIT
No. of wheels: 3
Battery details: 11 off National LCR 12V6-SE
Motor details: A.S.R. Servoton SM 42-15 Permanent magnet servomotor 746W 120V 11.3KG
Control system: 5 position tap changing switch
Body construction: tubular steel frame, Kevlar body
Dimensions: length - 2.8 metres, width l.3 metres, wheelbase - 1.5 metres, track 1.16 metres
Type of wheels: front - 27" x 1 l/4" steel, coaster hubs rear - 27" x 1" alloy
Type of tyres: front - 27" x 1 l/4" Turbo specialised 95 PSI rear - 27" x 1" trim-line 100 PSI
Steering system: Tiller
Brakes: bicycle caliper on rear wheel
Drive system: 2 stage chain drive to rear wheel, free-wheeling clutch
Instrumentation: Bicycle computer digital current, voltage, charge, 2 way radio
Builder/s: Brett Reid, Stephen Bicknell
Driver/s: Anthony Labita, Paul Marks
Other information: body and frame supplied by Dept. of Mechanical and Production Engineering.

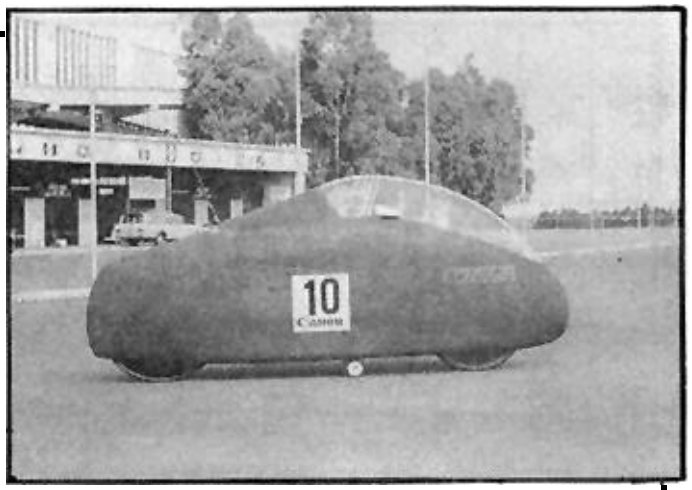
The Dart
Entrant: John Hill
No. of Wheels: 3
Battery details: Dunlop Pulsar 8 pair x 3
Solar cells: Solarex panel, 0.9 metre x 0.75 metre on loan courtesy of Warrigul Tech.
Motor details: Wheel motor, electronically commutated, permanent magnets spin, barrel armature fixed.
Control System: Electronic speed & commutation control, 6 phase, each phase independently current limited.
Body construction: Ex kayak (down-river type)
Dimensions: Length 2.8 metres Width 0.7 metres Wheelbase 1.5 metres Track .58 metres
Type of wheels: Front - special wheel motor (see motor details) Pear 10" Go-kart
Type of Tyres: 10" outer, 5" hub, go-kart slicks
Steering system: Tiller to front wheel motor assembly
Brakes: Tandem bicycle drum brake fitted to 1 back wheel
Drive System: Directly (see motor details)
Instrumentation: Ammeter
Builder/s: John Hill
Driver/s: Stuart Morton
Other information: Wheel motor specially built from an American Bosch motor.

Warragul Wonder
Entrant: Ted Mellor, Warragul Tech.
No. of Wheels: 3
Battery details: 2 gates SBS 30 in parallel with a series combination of 6 gates J cells giving 12 volts, 24.2Kg
Motor details: 2 Preslite Golf Buggy Motors
Control system: Series start, parallel run
Body Construction: Body - Timber Western Hemlock laths with heatshrunk plastic membrane
Chassis - 616 alloy aluminium tubing with carbon fibre reinforcing
Length - 2.1 metres Width - 0.6 metres wheelbase- 1.2 metres Track 1.2 metres
Type of wheels: 27" bicycle, steel rim
Type of tyres: 27" x 1 l/2 tube
Steering system: Billy cart tiller control
Brakes: twin cantilever foot activated braking system
Drive system: friction on rear wheel
Instrumentation: electronic speedometer, volt and amp meter
Builders: Warragul Tech. Yr 11 students
Rider/s: Darren Jackson, Craig Castles
Other information: rear wheel on rubber suspension system, seat construction Kevlar Sandwich, Windscreen 8mm Polycarbonate.



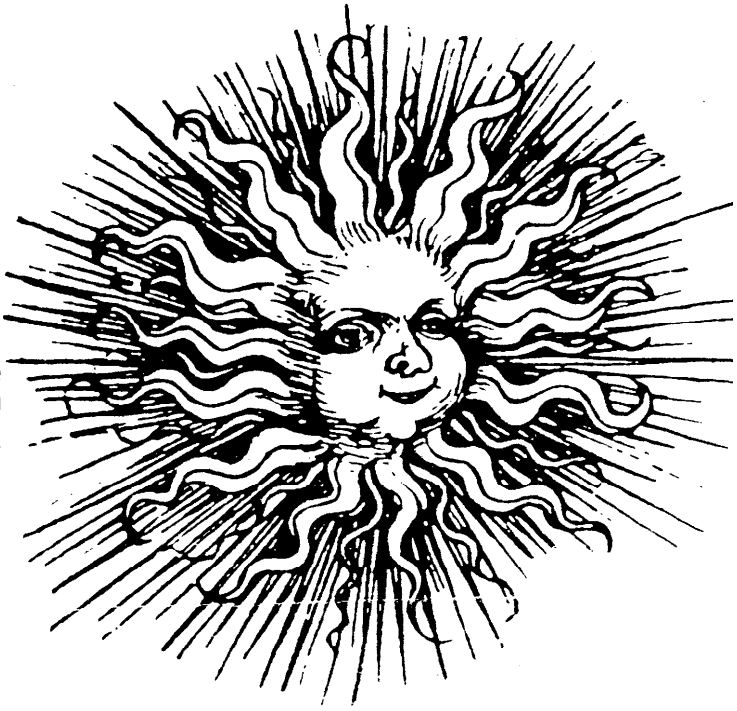


Elizabeth Bodnar
Entrant: John Bodnar
No, of wheels: 4
Battery details: Besco batteries
Motor details: l/2 h.p. Honeywell 24 volt
Control System: Series/parallel power switching
Body construction: tubular frame
Fibreglass body
Dimensions: Length - 3.0 metres, width - l.00 metres, wheelbase - 1.5 metres, track - 0.8 metres
Type of wheels: 2" x 1 3/8"
Type of tyres: Standard bicycle tyres 1 3/8
Steering System: standard
Brakes: 4 wheel disks
Drive system: direct from motor to rear wheel
Instrumentation: amp meter and volt meter
Builder/s: John Bodnar
Driver/s: Elizabeth Bodnar



Entrant: Anthony Mott
Vehicle name: Omega
No, of wheels: 2
Battery details: 3 off Pulsar 8 pair
Motor details: 36 V 3600 RPM permanent magnet
Control system: Mark/space chopper
Body construction: Epoxy/glass streamlining on steel chassis
Dimensions: Length - 2.66 metres, width - 0.53 metres, wheelbase - 1.67 metres
Type of wheels: front - 24" diameter, steel rim, h.d. spokes; rear - 27" diameter, steel rim, h.d. spokes
Type of tyres: Front - H.P. treaded
Rear - H.P. Racer
Steering system: handle bar
Brakes: internal expanding shoe Drum brakes, front and rear
Drive system: gear primary reduction and chain to rear wheel
Instrumentation: Amps, volts, amp/hours consumed, laps
Builder/s: Anthony Mott
Rider/s: Anthony Mott

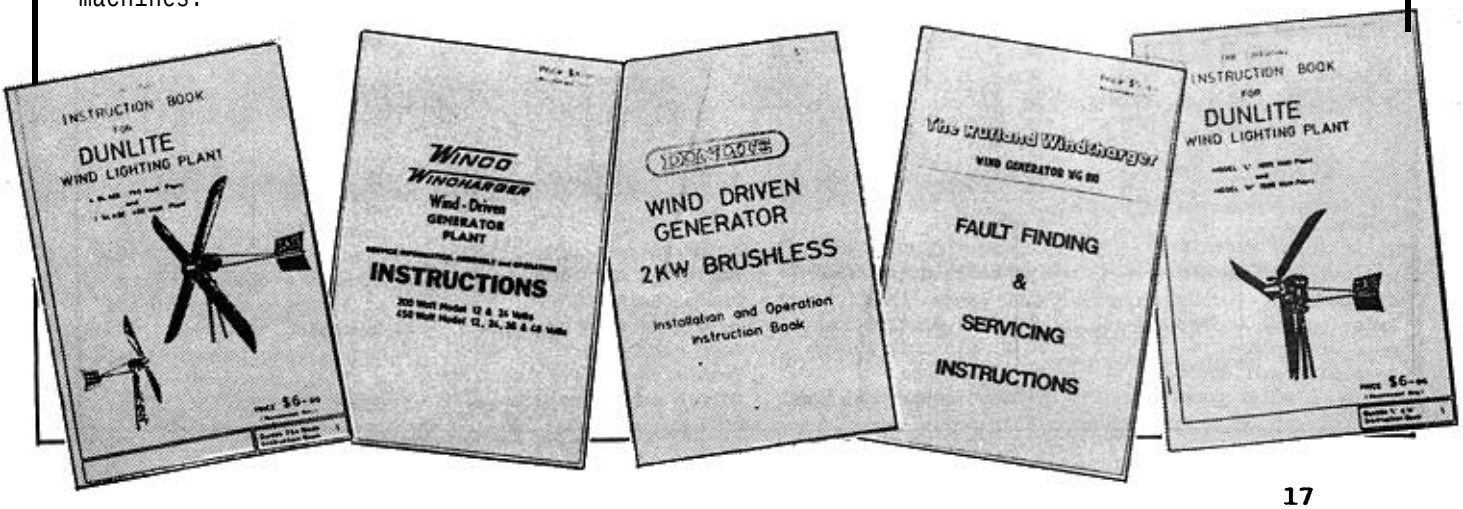
Solar Energy Resources Catalogue



This Catalogue has been produced by the **Alternative Technology Association (ATA)** The ATA is a community based involved in the promotion of technology which works in harmony with the environment. The group runs a wide range of activities including meetings, film nights, field trips and practical workshops. The ATA also produces a quarterly magazine **Soft Technology** and a monthly newsletter. It built and manages the Solar Workshop and maintains the Alternative Technology Resource Library. If you wish to contact the group write to the ATA at the address at the back of this catalogue.

Windpower Information

These booklets give technical details of individual windgenerators, They give information on installation, maintenance and basic repairs. A must for owners or people reconditioning old generators but who have no printed information on the machines. The booklets cover the range of Australian made Dunlite windgenerators as well as the imported "Windco" and "Rutland" machines.



Soft Technology:

Back Issues

Soft Technology magazine contains current Australian information on the whole range of renewable energy sources and alternative technologies. It includes a balance of practical construction articles and reports of Alternative Technology developments both in Australia and overseas. A limited number of back issues are still available.

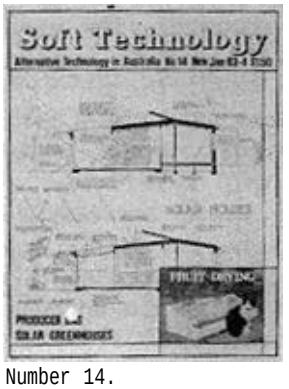
Number 8.
Appropriate Technology.
Methane Digestion.
Electric Vehicles.
Wind measuring methods.
Electric moped race.
Solar ponds.

Number 10.
Solar Mudbrick flats.
Rowing Bike.
Storage Batteries.
Solar Electric Fridge.
Solar power station.
Australian Centre for appropriate Technology.

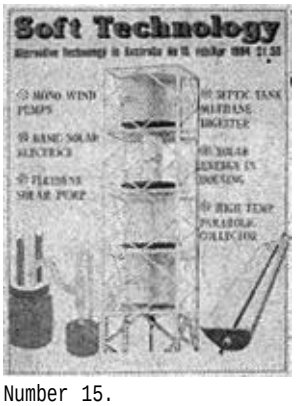
Number 11.
Build a cheap solar water heating collector.
Wind generator towers.
Human powered vehicles.
Natural cooling for summer heat.
Energy saving checklist.

Number 12.
Savonius Rotor for water pumping.
A Coolgardie safe.
Solar, water and Wind powered house.
Debuzzing inverters.
How to make an old house energy efficient.

Number 13.
Home made water wheel.
Window box air heater.
Simple solar pumping.
A Solar Controller.
The Wind turbines of Rottnest Island.



Number 14.
Producer Gas.
solar greenhouses.
Suburban Solar Houses.
Blacksmiths bellows.
Solar Fruit Dryer.
Meekatharra Solar power station.
Solar Pumping.



Number 15.
Basic solar electrics.
A Septic tank methane digester.
Solar energy in housing.
Mono wind pumps.
Parabolic collector.
Fluidyne solar pump.

Number 16.
Community built and run solar greenhouse.
Bicycle trailers.
Nepalese watermills.
Solar electric system in a suitcase.
Siddons Solar Heat pump.

Number 17.
Solar retrofitting.
Realities of solar house design.
Home made wind generator.
keep cool desert style.
Batteries, Fuses, Volts & Amps
Simple solar projects.

Number 18.
Biotecture.
Alternate energy politics.
Alice Springs appropriate technology centre.
Fuel saving in vehicles.
A Simple electronic power supply.

Number 19.
Solar cell buyer's guide.
Suntrac tracking solar water heater.
A solar still
Wind power on French Island
Planning for the sun.
S.E.C. goes solar.

Number 20.
Battery buyers guide.
Flying Foxes.
Solar car project.
Australia's Solar Future.
The Wales Centre for Alternative Technology.

Number 21.
Adelaide's Solar Village.
A low technology waterwheel
Solar power 12v timer.
Designing cities for people
High efficiency solar electric pumping.
Journey of the Solar Seeker.

Number 22.
Windpower in the future.
Building a Solar Car.
Darrieus Wind Rotor.
An Electric Go-Cart.
Low-Tech solar water heater

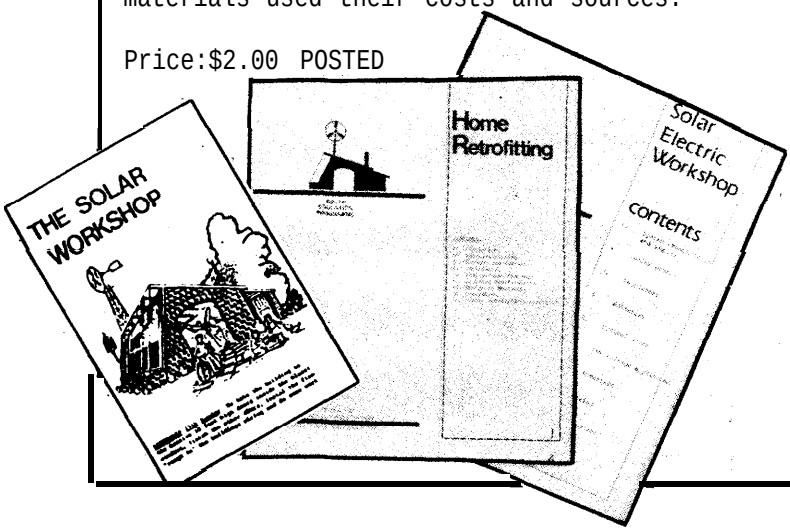
Number 23.
Run your car on Alcohol.
Pumping with Windmills.
Wood for Heating.
A Portable Wind Farm.
SHEPPARTON: Solar City.
Pedalling for Power.

Number 24.
A Low Tech Water Turbine
Clivus Multrum.
Sunbottle Solar Water.
Solar School Camp.

The Solar Workshop

A detailed description of the Solar workshop including information on the wind generator, solar electric system, water turbines, solar water heating and the buildings passive solar design. The booklet includes diagrams with detailed explanations of the various features of the workshop. It also contains details on materials used their costs and sources.

Price:$2.00 POSTED



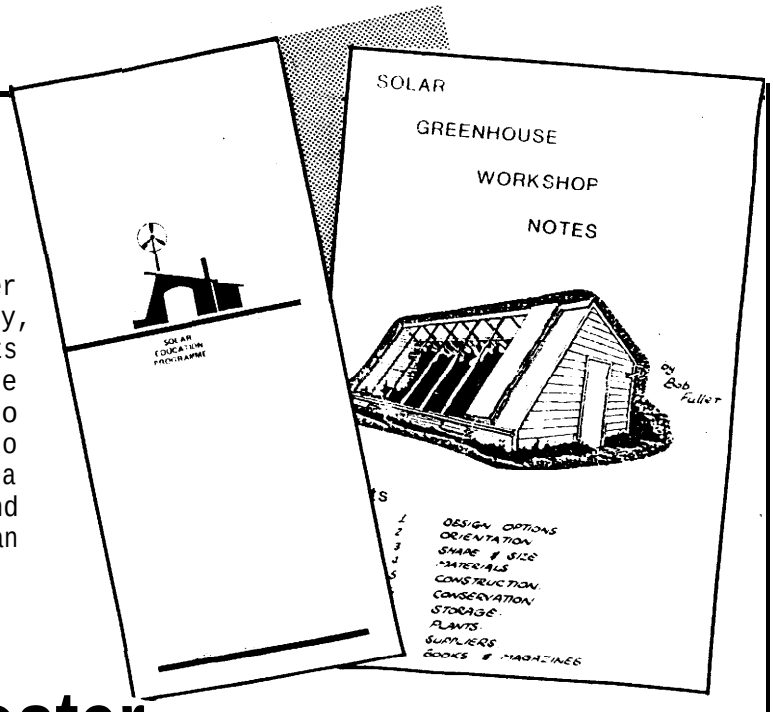
Information Kits

Solar Electricity

Everything you could ever want to know about setting up your own solar electric system. Solar cells, batteries, wiring, inverters and appliances are all covered. How to design and size your own system and once its put together how to maintain it with the minimum effort.

How to make your existing home save energy by adding features which will improve its thermal performance, Includes information on insulation, weatherstripping, building modifications, landscaping, energy use of appliances and emergency measures to save energy.

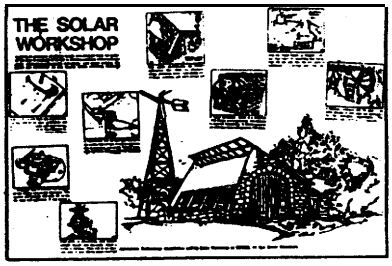
Solar Greenhouses



Standard greenhouses overheat in summer and are to cold in winter. A correctly, designed solar greenhouse gives the plants the best conditions all year round. The kit describes in simple terms how to design a solar greenhouse, materials to use and where to get them. It also gives a recipe for a small Solar Greenhouse and information on a simple greenhouse you can build into your home.

Price: All $3.80ea. POSTED.

The Workshop Poster



An attractive poster showing the Solar Workshop and its features, Includes illustrations and basic explanations the solar cells, wind generators, waterwheel, back-up generator, wood heater, water supply system, solar water **heater and the buildings design.**

Price: $1.50 POSTED

Order Form

NAME.....**ADDRESS**.....

.....**POSTCODE**.....

Quantity	**Item**	**Price**
Windgenerator Instruction Books.....	Dunlite 400 & 750 watt.	$ 6.00
	Dunlite 1,000 & 1,500 watt.	$ 6.00
	Dunlite 2,000 watt, brushless.	$10.00
	Windco Windcharger	$ 8.00
	Rutland Windcharger	$ 5.00
Soft Technology: Back Issues		
	* Individual copies, specify no's	$ 2.00 each
	* Full set of 16 available issues	$25.00
The Solar Workshop Booklet		$ 2.00
Information Kits:	*Solar Electricity	$ 3.80
	*Home Retrofitting	$ 3.80
	*Solar Greenhouses	$ 3.80
The Workshop Poster		$ 1.50
Total cost including postage.....		$.....

Send your order with payment to: ALTERNATIVE TECHNOLOGY ASSOCIATION, 366 Smith Street, Collingwood, Melbourne, Australia, 3066.

A.T.A. REPORT

A rather extended Christmas break and renewed burst of energy in efforts to get the Solar Workshop operating are the twin reason for this issue of Soft Technology being a bit late. However the good news on the magazine front is we are already half way through producing the next issue, which will come out quite quickly.

Some useful grants have allowed us to equip the workshop with tools, which include a drill press, benches, vises, oxy and arc welding, bench and hand grinders, a variety of power tools, a large selection of spanners and sockets and numerous other hand tools.

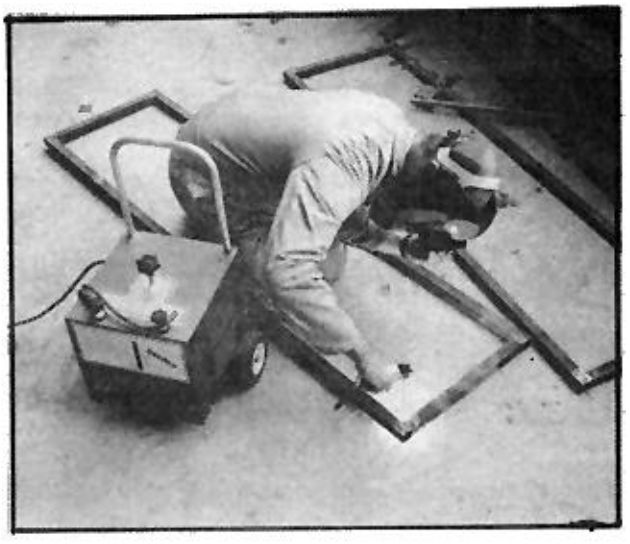
We hope to have the workshop open for regular use of members and the general public within the next few months.

Some other good news is we have received a grant for $3,000 for to a trailerto house a display on alternative technology. This should make life much easier for our yearly rounds of displays we do at the various venues.

We have also received a grant to help with research into Victoria's electricity needs in the 1990s. Our submission which will concentrate on energy conservation and methods of making greater use of renewable energy sources and will be considered by a Senate Standing Committee looking into this matter.

The other big news is we have finally bitten the bullet and employed someone to control our paper work. The lucky person is Libby who is currently in the office every Thursday. If anyone has any trouble with their membership or subscription they should drop Libby a line at the office.

Before the next magazine is out we are likely to have moved. For many years we have rented space from Friends of the Earth. Now they are moving in with a number of other groups in bigger and better premises and we will be joining then at their new address. Don't worry about continuing to send us mail at our current address as our mail will be redirected to the new address when we move.



At work in the workshop with the new welder and drill press.

The Amazing Bicycle Wheelbarrow Part 1

"The Ho Chi Minh" - a 10 Speed Wheelbarrow

A new variation on an Asian theme greatly extends the carrying capabilities of the bicycle. What is more it can be made in a home workshop and can save you lots of money throughout its working life. It's easy to ride too.

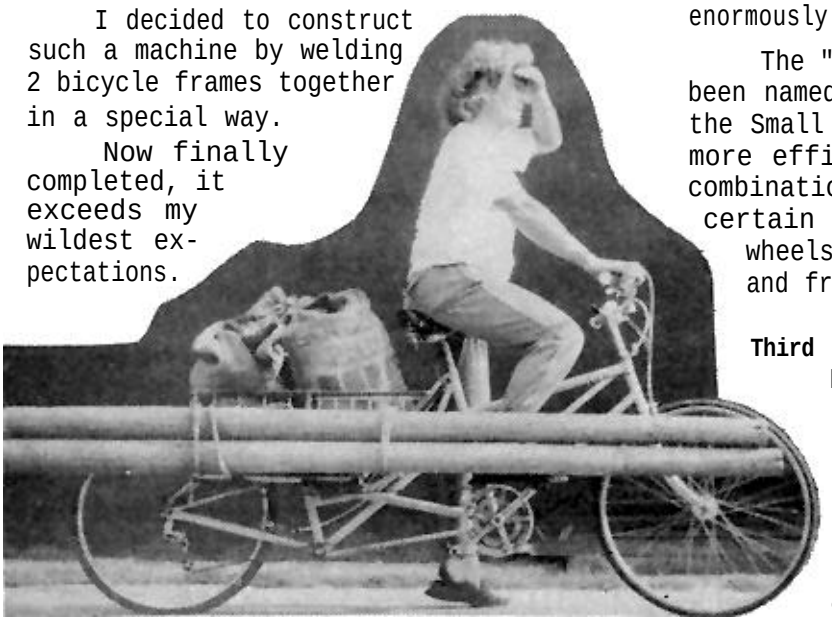
by Ian Grayson

The more I thought about it the more I became convinced that bikes are too short. They cannot carry all that needs to be carried and pulling trailers is hard work. The other option, a tricycle as used extensively in Asia for transporting bulky loads, is cumbersome. It is slow and difficult to manoeuvre in city traffic.

A hybrid came to mind - a cross between a tandem and a trailer, a sort of bicycle ute. Something that could carry cheap vegies from the central market 7 kilometres away by the boxload without breaking my back.

I decided to construct such a machine by welding 2 bicycle frames together in a special way.

Now finally completed, it exceeds my wildest expectations.



It is such a practical machine that I have all but abandoned riding my regular 10 speed in favour of it.

Luggage capacity on a normal bicycle is poor. Bikes are built primarily to carry the rider - luggage is an afterthought,

The mania for short wheelbases originates in the guest for stiffness and hence a marginal gain in efficiency, by racing cyclists. It has nothing to do with functionality for commuting or touring.

I decided to weld a basket along the length of my long bike - a big basket, "sculptured" around the rear wheel.

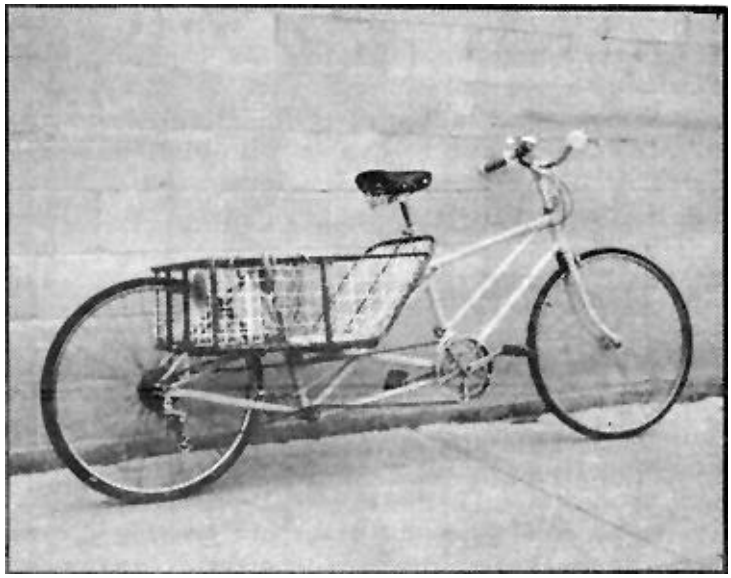
Although heavier than a normal bike, the trade off for functionality, carrying capacity and comfort make it well worth it. In any event the revolving weight, the weight that really counts, is not that greatly increased - just some extra chain. For a long bike it is also very stiff, the welded basked itself stiffens it enormously.

The "Ho Chi Minh" as the machine has been named, fulfils all the criteria for the Small is beautiful philosophy. It is more efficient than a bicycle/trailer combination and a tricycle for carrying certain loads by still having only 2 wheels on the ground - thus less drag and friction.

Third World

During my extensive bike travels throughout India and Asia, (having hardly had my bum off the saddle for six months during one stretch), I observed closely all the numerous and ingenious applications of pedal power.

Single speed roadsters are either loaded to the hilt or a long tricycle is used. There is nothing in between. The concept of lengthening a bicycle to increase its carrying capacity has been completely overlooked, despite the obvious need for such a machine. As a delivery vehicle it is ideal. (Posties and couriers in the city give it more than a second look!).



Its third world applications could be considerable. Its ability to greatly increase the range for much load carrying would greatly assist village life and inter village trade. Firewood collection and water carting would be made simpler and easier. Many of the loads being pedalled around in China and Africa for example, by cumbersome trikes, could be moved with less effort, more speed and more manoeuvrability by a machine of this nature.

It is this application which interests me most and I would be interested to hear from anyone or any organisation experienced or interested in promoting such an example of intermediate technology in the less "developed" countries where it would be of most use.

Long lengths such as ladders, timber lengths and bamboo poles can also be carried in a simple manner. By strapping them to the outside of the long basket along the length of the bike, from the front forks to beyond the rear wheel, they are thereby held rigid, and the leg stroke is not interfered with. 20 foot lengths can be carried in this manner - even whilst riding through city traffic.

A small child can also be carried around sitting in the basket, which is much safer being lower down.

As a workhorse on farm or commune it is a virtual 10 speed wheelbarrow. Bricks, building materials and timber can be hauled along narrow tracks. Not to mention fruit, vegies, firewood or compost.

A house or shack could be built in an area inaccessible to motor vehicles.

(For those like myself who abhor the motorised society with its casualties, waste and pollution, this opens up interesting possibilities...).

Bulk shopping once a week for an average family is literally a breeze on the Ho Chi Minh. We shop once a week only at the Adelaide central market and really load it up. The 14 kilometre round trip is easier on the Ho Chi Minh than on any other pedal powered option.

Another important feature of this machine, The most important feature, so far as any appropriate development applications in the third world are concerned, is its ability to be locally manufactured and maintained,

A single person with oxy-acetylene welding equipment and basic metal working tools can make this machine from basic old bike parts and scrap in about 3 weeks. I made my first one without any electrical tools - in fact without any electricity at all!

The only high tech. vulnerable and difficult to replace part of the bike is the gearing system (and possibly the cable technology).

Presently I am working on a 3 speed gearing system which is robust, maintenance-free, everlasting and can be made from recycled materials with no cable technology. (Comprising of 3 old different sized chainrings bolted together with a crude spring tensioner for the chain and a rod-operated changer.)

Self-sufficiency

For country dwellers a couple of these machines can offer real self sufficiency. Nearly all the self sufficiency advocates are car dependent. This car dependency is the Achilles heel of the self-sufficiency movement. This is not to deride all their useful projects, but in my experience the transport problem and the question of car dependency is always given least priority and often ignored completely.

Yet it is a fact that the motor vehicle is the single most wasteful consumer item.

Six million cars are scrapped in the USA alone, every **year**. How much acid rain and nuclear waste is spewed over the planet in order to feed such obscene consumption? For it is consumption that is at the heart of environmental crisis, nothing else. And the locomotive force, the prime mover in the economy which keeps consumption rising, is ever increasing motorisation of society - a force which has continued unabated in Western industrialised society since the end of the second world war - along with its multitude of by products. Highway construction, freeways, motels, drive in shopping centres, multi-storey carparks, the urban sprawl...The list goes on.

That is why an energy efficient house

with a car in its driveway (and more often than not 2 cars!) is but an empty gesture. It avoids the heart of the environmental problem which is car dependency.

To me, using a bike for my everyday transport needs (as opposed to leisure rides) is a form of political statement, a statement of my beliefs. (As well as being good fun of course!).

Development of the Ho Chi Minh was an extension of this statement.

Low down weight.

This long bike has another attribute to its carrying capability - the weight is carried low down, a very important factor.

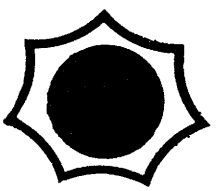
On a regular bike the load is carried too high, causing more rocking and swaying - this requires constant compensatory body movements therefore more effort. 60 kilos of luggage can easily be carried on this bike. (With stronger spoking in the rear wheel, even more. I have not yet tested its limits).

Incredibly, such weights actually feel much less than they are. Friends even claim it is easier to ride partly loaded than empty! This is due to the weight being carried not only low down, but also in between the wheels. It stabilises and lowers the centre of gravity compensating for the riders high up weight, thereby improving handling.

Drawbacks

Most readers would by now be a little cynical about the numerous claims I have so far made for the Ho Chi Minh and to be sure it does have just one short-coming over a regular bike. But only a minor one. Due to its length and larger turning circle, wheeling it around in crowds when walking is a minor hassle. Otherwise there are no drawbacks. All I can say is make one for yourself and try it out.

Don't let the extra length of the bike put you off. It rides like a regular bike in city traffic. If anything the Ho Chi Minh is certainly a more comfortable ride as the rider is no longer sitting so near to the top of the bumpy back wheel. The slight reduction in the turning circle due to its length is hardly noticed. On a regular bike I never perform sharp turns anyway - its a bad habit in traffic. My turning circle is always kept within that of the Ho Chi Minh no matter which bike I am riding.



In the next issue of Soft Technology we will be featuring the construction details of the Ho Chi Minh.

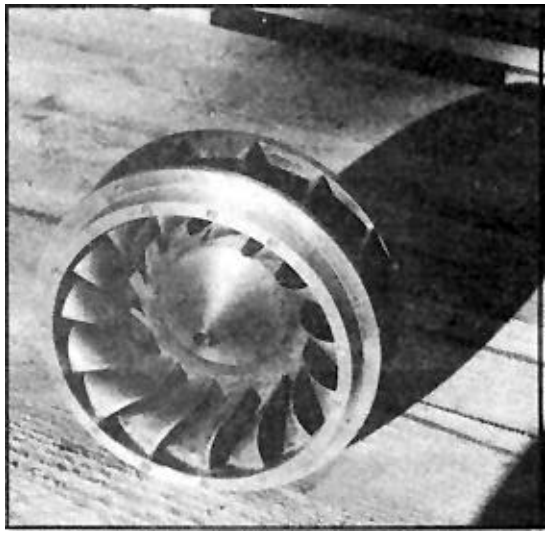
TALK TO US !!

Soft Technology relies on its readers for fresh exciting and interesting information. We are always on the lookout to find out what you, the reader has been doing and would like to hear about. So talk to us! Let us know about the fresh, exciting and interesting things that you are doing so we can let other people know. Don't worry about being able to write we have trained experts who can decipher the most obscure scrawl.

Remember Soft Technology is a non-profit magazine produced by unpaid volunteers. To function it must have the support of its readers. So make the job of those hard working souls who produce Soft Technology a little easier by sending something in .....anything....as long as it isn't dirty or smells bad.

Talk to us!!

New Developments in Water Turbines



A Francis turbine runner.

This information was recently sent to us by Tamar Designs in Tasmania. If you want to find out more give them a ring on (003) 947353.

Basically, water economising governing systems have been made since the previous century, but they were always expensive mechanical or mechanical and hydraulic systems, that are far too expensive to make for small water turbines.

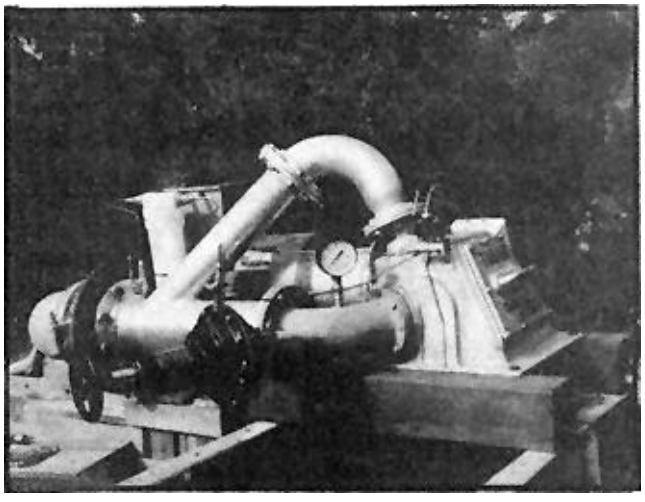
The basic shunt load governors made by us, regulate the speed by sensing the frequency and applying an appropriate amount of shunt load. With this simple system, the water flow remains constant, which is fine for run of the river systems that do not have any storage capacity.

However, in many cases, with our long dry periods in Australia, we need a simple water economising system that regulates the water flow to suit the load. This is achieved by adding an extra circuit card to our shunt load governor that controls two small solenoid valves, that operate a water operated diaphragm or piston on the spear rod or guide vane mechanism. The spear valve or guide vanes slowly close until only a very small amount of shunt load is in service, thus saving an enormous amount of water.

When a large load is applied, the spear valve or guide vanes quickly open to give the required load. If the load is suddenly taken off, the governor immediately applies an equivalent amount of shunt load, until the water flow has been slowly reduced.

Where extreme economy of water is required, another circuit card, two more solenoid valves and a small sealed battery are added. This system is described in our book, where you will see that the turbine shuts down and uses no water at all, when nothing is switched on.

These new systems of ours, completely change the situation when considering water power. Sites that were formerly totally inadequate can now be quite viable. Examples are ponds or dams at a high level, with only a small inflow. The turbine can be situated well below the dam and only uses the water when required. The greater the fall below the dam, the less water will be used for a given power requirement, as will be seen from the tables in our book.



A Pelton wheel generator incorporating the new governing system.

Solar Heat Pump

By Peter Brown

The Siddons solar-boosted heat pump which was described in Soft Technology No. 16 (July 1984) is now available to domestic consumers. Known as the "Solar Plus", it is the result of more than seven years of R & D. This particular application of a heat pump was patented by researchers at Melbourne University, and Siddons have developed the heat pump into a marketable product.

Definition: heat pump: a motor-driven pump, circulating fluid which absorbs heat in one place and transfers it to another place, where the heat is released.

The domestic refrigerator does exactly this. It pumps heat from inside the cabinet to the outside (feel the coil at the back when it's running!). The reverse-cycle air conditioner is a **reversible** heat pump. In summer it can pump heat from inside the building to the outside. In winter it pumps "heat" from outside the building to the inside. "It's not hot outside in winter!" you must be thinking. The explanation will become clearer later..,.

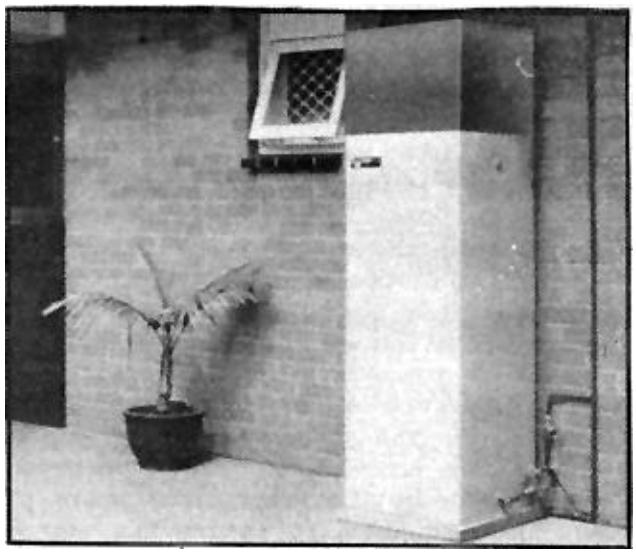
What does the Siddons heat pump do? It converts low grade heat (in the form of ambient air to high grade heat, i.e. to a temperature useful for producing hot water. For the technically minded, see "How it works".

In the Solar Plus system there are three lightweight aluminium solar evaporator plates mounted on the roof. In common with most solar systems, they use a northerly aspect, however they can be mounted at any angle from horizontal to vertical.

The hot water service (H.W.S.) consists of a tank with the heat pump mounted above it. The tank is a conventional 270 litre mains pressure, vitreous-lined, steel tank as utilised by many H.W.S. manufacturers. There are two copper tubes connecting the solar evaporator plates on the roof to the heat pump which circulates the heat transfer fluid (R 12) around the system. R12 is the refrigerant commonly used in domestic refrigerators,

The collectors on the roof of a house.

Low grade heat from the air, wind and rain is absorbed by the plates. The R12 in the plates vaporises and carries the heat to the compressor stage of the heat pump where its pressure and temperature is raised. It then circulates through the coil wrapped around the outside of the



The water tank and heat pump.

water tank (the condenser), giving up its heat to the water, and returns to the evaporator plates. If the sun is shining, solar boosting occurs at the evaporator plates and this greatly improves the heat input into the system.

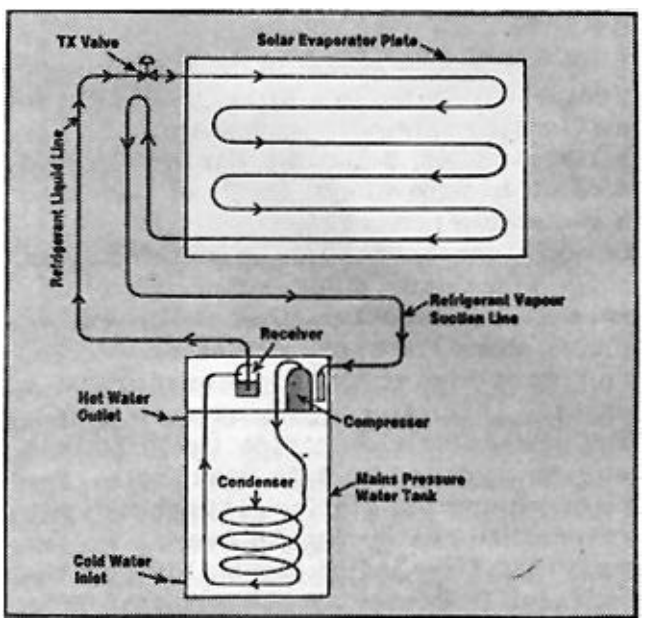
The important point is that the Solar Plus does not require sunny conditions to produce hot water, and in fact continues to work at night. It will even produce hot water when the air temperature is down to -10 degrees C, though obviously not as rapidly. Icing of the plates does not present a problem.

The Solar Plus requires electricity to run the compressor, however it pumps more energy into the water than it consumes from the mains. Extensive tests have shown that even the most severe conditions result in 1.5kW of heat in the tank for 1kW of electricity supplied to the compressor. In summer that same lKW of electricity can pump 7kW of heat into the Lank.

The measure of this is called Coefficient of Performance (C.O.P.).

How Energy efficient is it?

A conventional electric hot water service has a C.O.P. of 0.75, i.e. for 4kW supplied to the element, 3kW is delivered in the form of hot water. C.O.P. = 3/4 = 0.75. This is because 25% of the energy is



HOW IT WORKS!

The Solar Plus is a vapour compression heat pump. The majority of domestic refrigerators utilise the same principle. The difference between the two is that the refrigerator is designed to use the "cold" part of the circuit (the evaporator) while the heat pump was the hot part of the circuit "the condenser",

Liquid R12 entering the roofmounted evaporator plates is vapourised by energy absorbed from the atmosphere and radiant energy from the sun (when available). The vapour is drawn into the compressor where its pressure and temperature are increased. The hot vapour then passes through the condenser coil wrapped around the outside of the water tank, where the vapour condenses, rejecting its heat to the water in the tank. The pressure in the condenser then forces the cooled liquid refrigerant through a flow control valve, the TX value and back to the evaporator plates. The cycle is repeated.

The simplicity of the evaporator plates is an important feature. Because the plate temperature is reduced below ambient during operation, there is no requirement for an insulated container. In fact, insulation would reduce the efficiency of the plates. The evaporator plates are manufactured by the "Rollbond" process, the same way that refrigerator ice cabinets are made.

The condenser coil around the outside of the tank has advantages. It doesn't suffer fouling problems so dirty water in the tank is not a problem. The large heat transfer surface of the condenser has a low heat flux density so damage to the vitreous tank lining does not occur,

"lost" to the surroundings (remember the old airing cupboard - it cost money to run!)

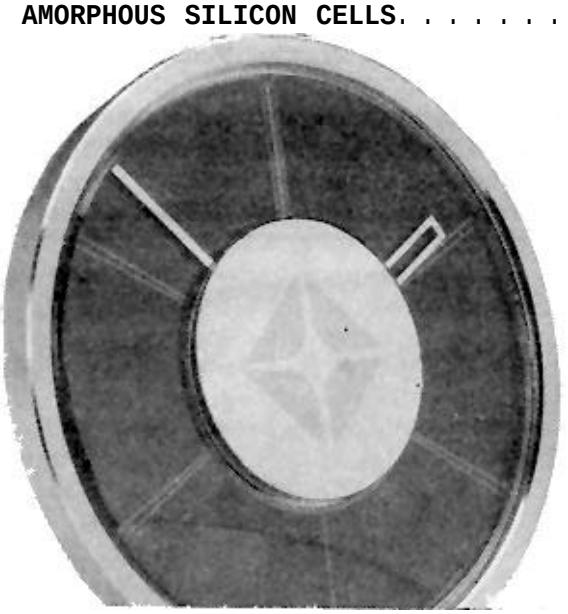
Tests by the University of New South Wales indicate **an annual** C.O.P. of 3.0 for the Solar Plus. It can be seen that it takes **4** times as much energy to heatwater by elements as by heat pump. Clearly it is an energy-saving appliance but the amount of money saved depends upon the cost of energy in your area.

The Solar Plus is clearly not "alternative technology" but it is without doubt appropriate technology. There is increasing community awareness of the need to consider the energy consumption of appliances, not judge them solely on price tag.

The water plumbing is standard domestic stuff. The refrigerant work needs to be performed by Siddons own people because of their specialised knowledge, though the methods and materials are in everyday use in the refrigeration and airconditioning industry.

In describing the Siddons Heat Pump in Issue 16 of Soft Technology, Mick Harris commented "..if it cannot be made cheap enough it may just be another newspaper headline of a great new solar breakthrough which will be here today, gone tomorrow." The good news is that the system is available commercially and is known as the Solar Plus.

AMORPHOUS SILICON CELLS. . . . . **Continued from page 13.**



The glass face of the clock is actually a solar panel which powers it.

The ability to make useful solar cells from very thin layers of silicon allows the production of flexible panels and the use of glass, plastic or metal substrates. One Japanese manufacturer has even incorporated solar cells into transparent roofing tiles. Tandem cell technology offers the promise of greatly increased efficiency, and researchers are presently working to realise this.

Of course, these advantages are accompanied by some problems. Stability over a period of about twenty years is required to encourage large-scale commercial use, but this is yet to be achieved. Also, conversion efficiency must be improved over large cell areas and high-volume production methods must be applied to amorphous cell manufacture before the full potential of the material can be exploited.

General References

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How to get it up and down, without getting into trouble!

I was recently asked by Ralph, a member of the A.T.A. to rig up some information on methods of pulling down and putting up wind generators. While Ralph who is the proud owner of a couple of the smaller Dunlites, probably knows more about these machines than most of us his knowledge does not include methods of handling the larger 2 kW machines.

In particular Ralph wanted to know how the late Tony Stevenson of Survival Technology used to handle the 2 kW units. After some digging around this is what I came up with.

When you are 60, 80 or even 100 feet up in the air accidentally dropping a 2 kW wind generator is not a good idea, It could give someone a very sore toe, not to mention what it would do to the generator. They are so heavy that there is no way you can lift them yourself, so you need an arrangement that can do the lifting for you.

Here is the simplest way of lifting this heavy bit of machinery down from the heights. This method was reportedly used by one of the Dunlite technical people a few years ago. (Incidentally for people who don't know Dunlite no longer manufacture Wind Generators or supply. complete spares for those they did).

Upon arriving at this particular dead, wind generator, the Dunlite guy after glancing up at the tower said "right, we'd better pull it down". The fact that the guy had no lifting gear, no poles or gallow, arrangement didn't seem to worry him. Instead he disappeared in a puff of dust

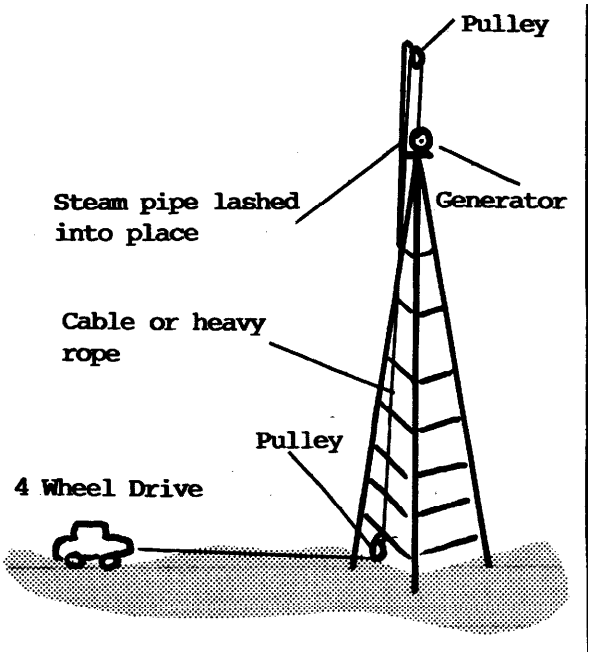


Figure 1. Basic lifting arrangement.

off to the closest town. He soon returned brandishing a 10 foot length of 2" steam pipe.

Next he dug around and came up with a coil of rope and a few pulleys. Heclimbed the tower and lashed the steam pipe securely onto the tower so that about 5 feet of pipe extended above the top of the tower. He then hooked one pulley over the top of the steam pipe. He hooked the other pulley onto the bottom of the tower. The rope was attached to the front of the car and run through the bottom and top pulley and secured to the wind generator.

The tail and propellers should be removed prior to removing the actual generator. After unbolting the pant for removal the car at ground level moves a little away from the tower to lift the pant free from the rest of the wind generator. Next the vehicle slowly drives back to the tower, lowering the generator pants. A 4-wheel drive is best for this or it is a bit hard on the clutch of a two-wheel drive vehicle.

Without too much trouble you can build a set of gallows which makes it easier and safer to work with these heavy wind machines. With the approach previously described very nasty things would happen if the bottom of the steam pipe clipped off the cross beam of the tower. Also because of the position of the pipe, the top pulley is not directly above the resting position of the generator. This means when you are installing a generator you must leave it over, away from the pulley, to get it into position.

To solve these problems a set of gallows can be built. They basically consist of the 10 foot pipe plus an arm at the top with a hook for the pulley. This brings the pulley position out to be directly above the generator, A small metal tab is welded into place half way along the length of the pipe. This has a hole drilled into it and is used to fix the pipe securely to the tower cap at the top of the tower. The final feature of the gallows is at the base of the pipe where a number of approaches can be used to improve the fixing of the pipes base to the cross bar. This could include the use of a scaffolding clamp or adding a bar which runs at a right angle to the main pipe making it easier to secure to the cross bar.

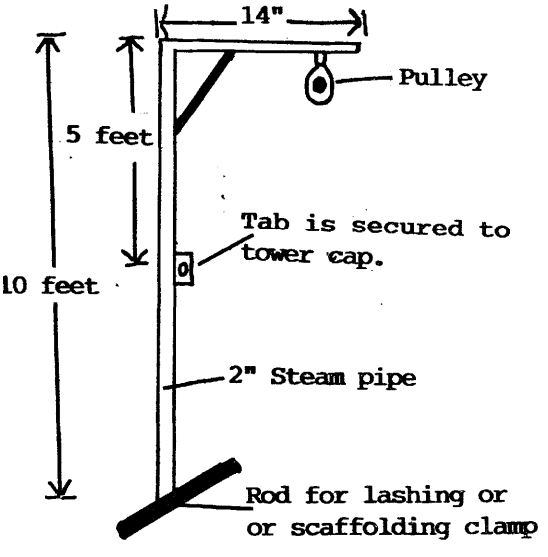


Figure 2. Heavy duty Gallows.

Whenever handling a 1 kilowatt or large machine it is important to use the pulley at the bottom of the tower. If you don't you will probably bend your steam pipe and might end up dropping your beloved generator. With large generators it is also better to-use a steel cable. The cable-needs to be more than double the height of the tower so that when the equipment is lowered, there is enough cable for the run from the car up to the top of the tower and back down to the bottom.

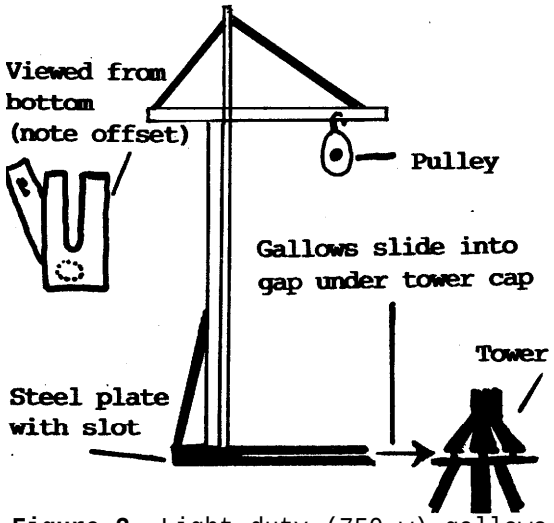


Figure 3. Light duty (750 w) gallows

There is another set of gallows which you can use for smaller wind generators, (up to 750 watt Dunlite size). Its small and easy to use, but don't make the mistake of trying to use it on something too big.

If you have a look at the top of a 750 watt Dunlite tower you notice at the top of the tower is the tower cap. It is a cast metal thing bolted to the three steel angle legs. The top of the tower cap is flat and has four bolts which poke up from this flat face.

The base of the wind generator turntable assembly is fixed to these bolts. However, they are not bolted tightly together and there is a gap of about 1cm,

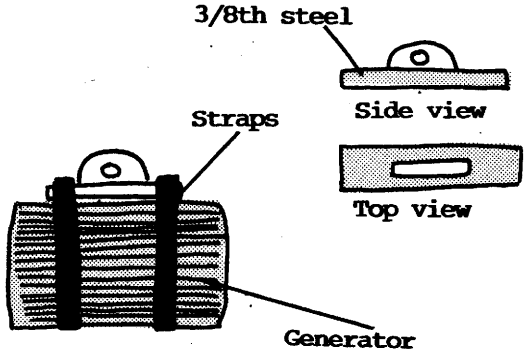


Figure 4. 2KW. Generator lifter.

By sliding a metal plate (complete with a pole and gallows attached) into this gap you instantly have the gear to erect or pull down one of the smaller wind generators.

If you are planning to do some work up a wind generator tower, don't forget safety. Falling from a 60 foot tower, the ground feels mighty hard, If possible use a safety harness, otherwise, lash yourself securely into place before you start work. Also take a bag for tools as it is important to have your tools readily accessible.

Good luck.

Hanging safely from the tower thanks to the safety harnesses

More Ideas on SOLAR WATER HEATING

In this we include some ideas from A.D. Fuller on low cost solar water heating,

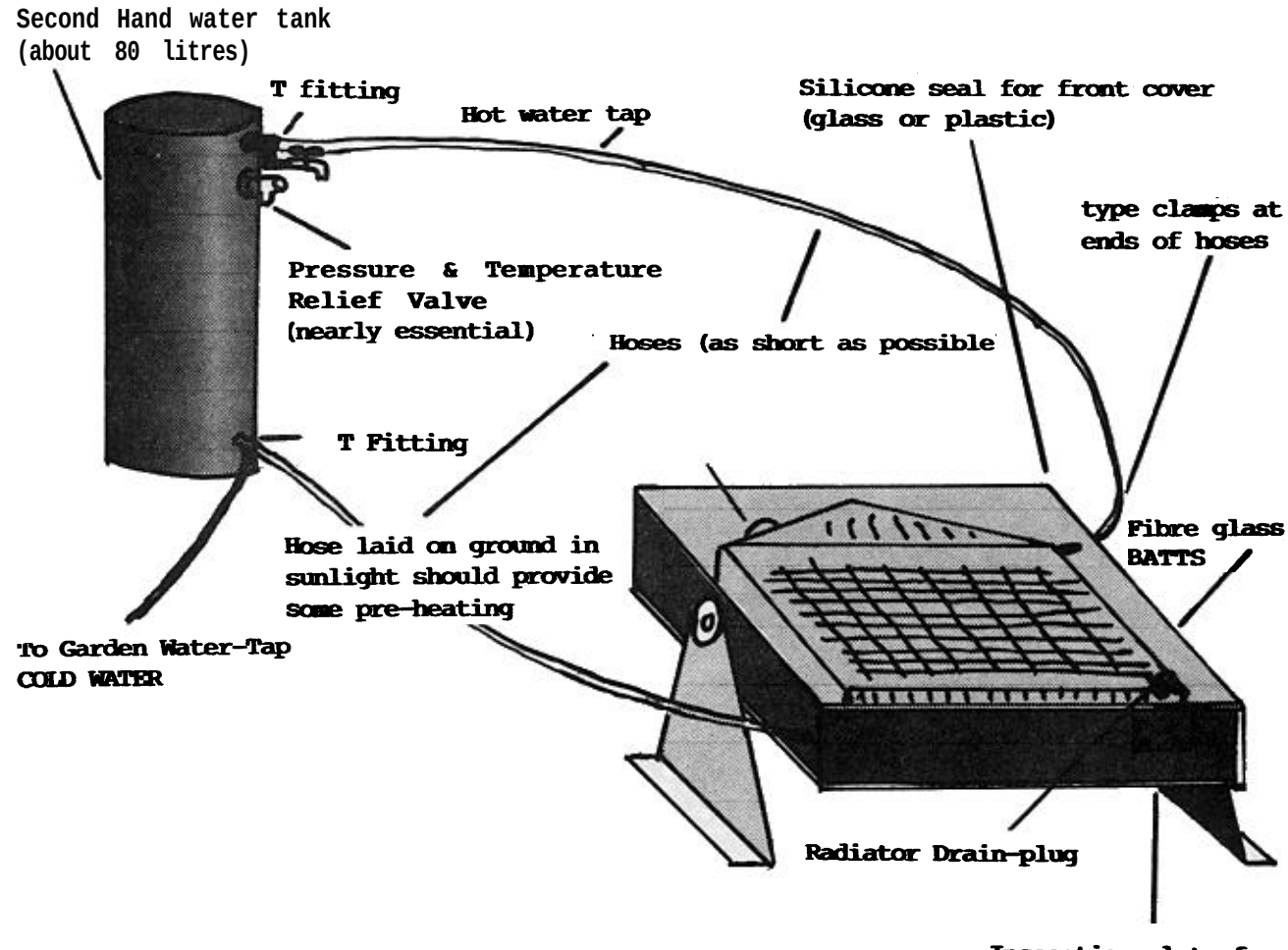
It is a method that should give significant improvement in efficiency over the Sunbottle Solar Water Heater detailed on page 22, No. 24 issue, at some increase in cost (ingenious as the cheaper model may be).

While not yet tried out, I have no reason to doubt that my method would work well. I have some knowledge of Solar Hot Water Systems, since I built my own Solar System about 30 years ago when such systems were not very common.

There are three main parts, a large second hand truck (or bus) radiator, a small second hand hot water tank (about any kind), and an absorber box mounted on a simple adjustable stand, to face the sun. More than one radiator may be used. I suggest adding two more later to make a full size solar heater after experience is gained from the first.

The rough drawing should make clear how these items are put together.

I am not sure of Council regulations, but I can see no objection to an item not



MINIATURE SOLAR HOT WATER SYSTEM

permanently connected to mains pressure. pipes. In any case a gravity feed tank could be used, for any local tank water. This item seems to me to be a good way to bypass restrictive work practices of the plumbers.

The Tank used can be either gravity feed or Mains Pressure type and must be insulated. It should be as close as possible to absorber box and about one metre higher up than this box. The tank, may be mounted outside if fittings are made waterproof with silicone, but would be better inside.

The hot water tank I bought is a Braemar 80 litres with electric heater 3600 watts (not used), Mains pressure type, with pressure and temperature relief valve,

Fibre glass batts behind the radiator are used for insulation. Also insulate the sides of box almost up to front glass or plastic.

The Box should preferably made from' aluminium angle with thin aluminium sheets at bottom and four sides. All these pieces are sealed with silicone, narrow pieces of mirrors may be put inside box, to reflect sunlight onto radiator. Leave liberal space in the box around radiator.

This water heater may be added to with two more radiators and absorber boxes mounted side by side, with the first one. The three joined in parallel. Tilt box to face sun (more towards vertical in summer).

The radiator drain plug usually installed at back but shown in the diagram on front for clarity. Make sure the radiator is well cleaned out if hot water is used to make tea, coffee etc.

Use a large truck or bus radiator. choose one as narrow in construction from front to back as possible, and as large as possible. COST Radiator about $100

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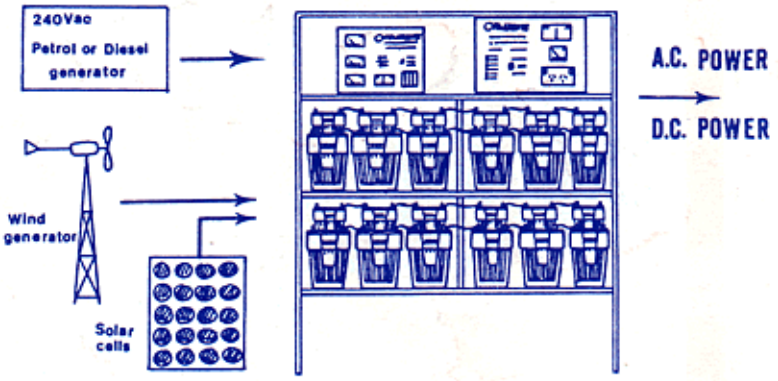

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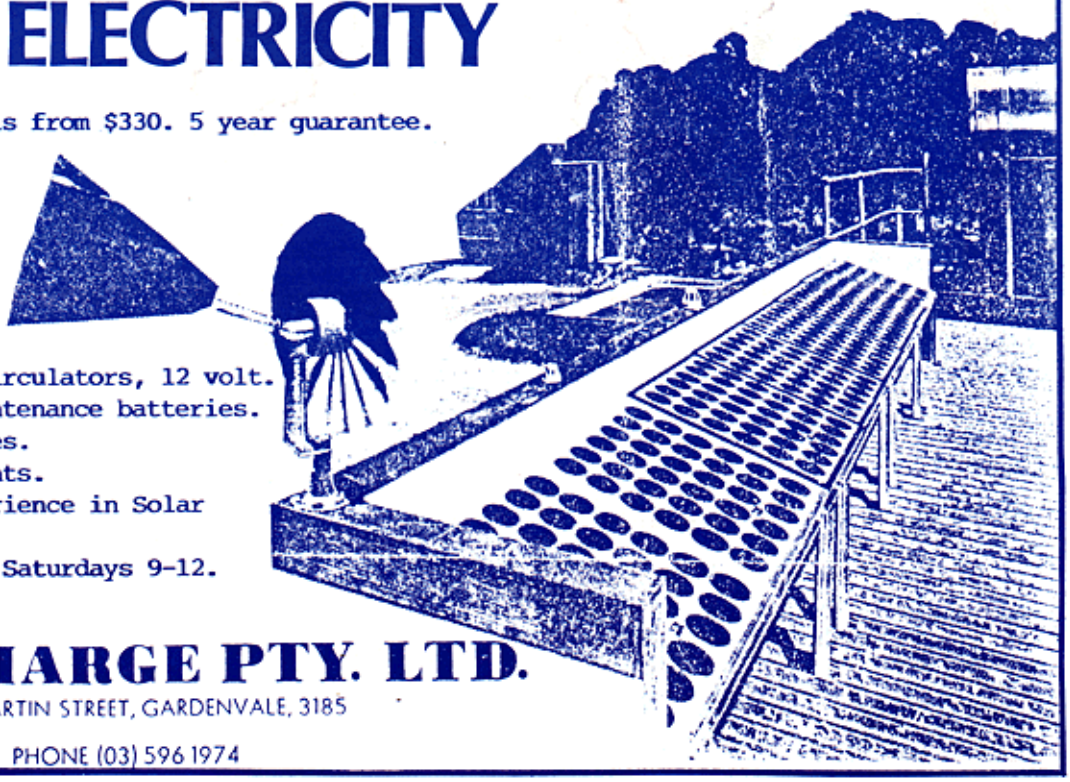

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