soft technology

Technology for a Sustainable Future No 51 April—June 1995 $4.95

Inside:

- Selling power to the electric company
- Chemical-free pest control
- D-I-Y solar-powered caravan
- Insulation buying guide
- Don't move! Try a solar renovation
- Build your own inverter

...and more inside...

Waterwheel-powered house

Gorgeous gardens with less water

Repair your compact fluoros

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Photo: Adrian Braun

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Technology for a Sustainable Future
No. 51 April to June 1995 $4.95 (rrp)

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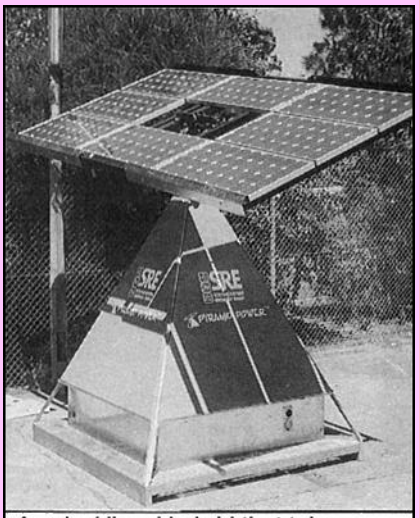

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soft technology

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Editorial

Soft Tech readers are an entertaining bunch. Well, that's our considered opinion after poring over the results of the Reader Survey!

I think we can honestly say that we enjoyed reading about you as much as you enjoy reading 'us'!
Many thanks to everyone who filled out and returned the survey. We were extremely impressed that most people were not content to just tick boxes, but took the time to write thoughtful comments. This kind of feedback is invaluable.

Almost all of the comments were useful, and the few others were it least entertaining. Our favourite answer for the question 'Where did you first hear about ST? was 'found it at yachties fish smoke house'. We don't even know what a 'yachties fish smoke house' is, but it conjured up all sorts of interesting images.

Of course. it wasn't until we received replies to the survey that some of its flaws were revealed. We asked readers, 'Is there anything you would like to see more of in ST?'. In answer to our next question, 'Is there anything you'd like to see less of? one wag wrote, 'Cats in my backyard' (Well, I guess we could have phrased the question more clearly).

And we're very sorry about those tiny little boxes, but thank you for persisting with them anyway.

There were many more fascinating details, but of most interest were your suggestions for improvements to your magazine. (We also loved all the ones who said, 'it's perfect now, don't change a thing!'.)

A common opinion was that some of the technical articles were starting at too 'high' a level – we will endeavour to include more 'background information' in future issues. We hope that this will make Soft Tech an even better magazine.

We had to laugh at one suggestion that we could have designed the survey so that it could have been scanned in to a computer. We actually agreed that it was a great idea, but unfortunately - as befits a non-profit community organisation - our production methods are fairly low tech, and a scanner is just one of many things that would make our lives easier, but is beyond our small budget.

Speaking of money, those readers who are not subscribers will have noticed that our cover price has gone up to $4.95 this issue. This small price rise is due to an enormous increase in paper prices - especially a 35% increase on recycled paper. Unfortunately it appears that this is just the beginning, as paper prices are set to rise again mid-year. We have been unable to get any indication of how much these will be (and if therefore they will be enough to affect our prices) so - if you're not already a subscriber - now could be a good time to subscribe just in case.

We believe that ST is still excellent value for money. But that's only our opinion - let us know what you think. If you've been meaning to send in your Reader Survey from ST#50, it's not too late. Although you will be too late to be in the running for the ATA publications pack, we still want to know your opinion!

Claire Beaumont

Again, thanks to everyone who has already sent in their Reader Survey.
The lucky winners of our $20 ATA publications gift packs are:

- Mary and Robert Stringer, Chippendale NSW
- Douglas Walker, West Leederville WA
- David Persson, Palmerston North, New Zealand
- JL McIntyre, Gympie QLD
- Juana Lauciria, Morphetville SA

ENERGY FLASHES

Solar radiation collected in pipes under the road surface is used to keep the same road ice free in winter.

Energy from roads

Do you remember Jim Thompson's entry *Solar hot water from roads* in our Great Untapped Energy Sources competition (ST#50)? Well, in Switzerland, they're actually doing it!

Road surfaces are heated by the summer sun to temperatures of around 60°C, but that thermal energy is eventually dispersed into the atmosphere, and wasted. A Swiss pilot project aims to store that energy ready to be used in winter to keep roads ice free.

A heat-conducting liquid circulates through a system of pipes under the road surface and transfers the heat to an energy storage system in nearby sandstone rocks. Thermal probes that have been sunk into the rock act as heat exchangers between the rock and the heat-conducting liquid.

Mathematical modelling indicates that a solar energy recovery rate of 70% is possible. This could mean an almost limitless source of alternative energy with a range of potential applications, including domestic hot water heating and heating large public buildings.

- CADDET Renewable energy newsletter, January 1995

Homes get star ratings

According to *Energy Victoria,* Australia's first Home Energy Rating Scheme (HERS) could cut Victoria's home energy bills by up to $50 million a year. By entering major design features into a computer, users can see where improvements can be made, and the effect of design changes on energy performance. Houses are assigned a star rating from 0 (poor) to 5 stars (good), similar to the energy rating system for household appliances.

Historic *Rippon Lea* was chosen as the launch venue for the scheme. The spacious 1860s home currently rates only one star on HERS. But with moderate changes - such as insulating the walls and ceilings and installing dampers for chimneys - it would rate five stars.

Other states are expected to introduce their own HERS schemes under a coordinated national program.

- press release, Energy Victoria

'Heathcliff happy at moors windfarm ban

Singer Cliff Richard has applauded a decision to stop a windfarm being built on the Yorkshire Moors near Haworth, the village home of Charlotte, Anne and Emily Brontë. Richard, who will play Heathcliff in a musical version of Emily Brontë's *Wuthering Heights*, said he was delighted that the voice of the people had been heard.

The government officer who headed the inquiry into the proposed windfarm said the windfarm's contribution to renewable national energy was 'tangible but limited' and that the proposal threatened harm to the character and appearance of the surrounding landscape.

- The Age, 09.12.94

Gearing up for the Olympics

The Homebush Bay site which will be the focus of the games sporting events for the Sydney Olympics, was used as a waste dump for most of this century. The 220 hectare area was used until the late 1980s as a dump for millions of tonnes of contaminated industrial waste, which was mostly put in old estuarine channels, obliterating the natural mangrove environment. The entire site is being capped with clean fill and landscaped.

According to *RUST PPK, the* company responsible for much of the cleanup, the new vegetation is flourishing and aquatic fauna is thriving.

-RUST PPK News, November '94

Solar-powered Olympics 2000 are proposed in a new plan from the University of NSW. Lighting, heat, hot water and electricity for the stadium, indoor sports venues and the Olympic village will all be provided by the sun if the plan is accepted by Olympic organisers and the NSW Government. The proposed 35,000 square metre solar array would cost between $10-20 million and deliver around 10 megawatts of power. Any excess power could be fed into the grid.

- The Australian, 05.12.94

Sniffing out landfills

A new method of measurement can trace smells emanating from landfills. Up till now, these odours have been measured by 'olfactometric' methods, in which testers stated whether they could smell anything or not. This subjective procedure, which gave no indication as to the source of the smell, led to problems when similar odours emanated from elsewhere, such as nearby farms.

A non-poisonous gas is mixed with the gases emitted by the waste. Measurements tracing the distribution and concentration of the gas can be taken at any point. The method, developed by the Austrian Research Centre Seibersdorf, is so sensitive that it can trace dilutions as low as one to a trillion.

- press release, Austrian Research Centre Seibersdorf

Solar to the grid in Sydney

Since October last year solar energy has been integrated into Sydney's electricity grid through a PV array at Little Bay, Sydney. The project is a combination of state-of-the-art commercially available technology developed in Australia, working side by side with Australian research prototypes.

The grid-interactive system includes a 4kW array of solar cells linked to Sydney's power grid and a 50kW-hour battery storage system to store excess solar-generated electricity during the day and deliver it to the network during times of peak demand.

The research is being conducted by the University of NSW with sponsorship from *Sydney Electricity* and Australian manufacturers of PV systems and energy appliances.

- Sydney Electricity press release, October 1994

Assistance for renewables

Energy Victoria has introduced a new *Renewable Energy Assistance Program* (REAP) financial assistance program for both installing new systems and upgrading existing RAPS systems.

Rural domestic customers are eligible for a REAP payment towards a new system if they have received a quotation of over $10,000 for connection to the grid.

People upgrading an existing system could be eligible for a payment of half the cost of renewable energy components. Solar water heating panels, batteries, inverters, petrol or diesel generators and system wiring are not included.

Certain other conditions apply. For further information contact the *Energy Information Centre,* ph: 1800 136 322 (toll free).

REAP Guidelines

Appliances ride the information highway

Appliances may soon be connected to the information superhighway. *Pacific Gas and Electric* (PG&E) in the US have begun testing energy management services through boxes located on the top of customers' TV sets. The boxes provide information on power usage of various appliances, and the system can be programmed to automatically turn appliances on. Energy use data is sent to utilities via cable lines.

PG&E is currently working on reducing the cost of the service to a profitable level. Customers would then pay about $10 to $15 a month for the service which should help them to cut energy costs.

- Investors Business Daily, 01/11/94

Bigger protection for small inventors

Proposed changes to the Petty Patent System could make a Petty Patent easier to obtain and provide more effective protection for Australia's small inventors.

Changes being considered by the Advisory Council on Intellectual Property include increasing the patent term from the current six years to ten years and reducing the level of inventiveness required to obtain a Petty Patent.

-press release, Lape & Partners PR

Power from the sea

Ocean Power TechnoIogy (OPT) in the US arc developing a cheap, clean method of harnessing energy from the sea. Electricity is generated by exposing piezo electric polymers to waves and currents. As the waves stretch and compress a piezoelectric material's molecular lattice, it generates a high-voltage, low-frequency electrical charge.

The hydropiezoelectric (HPE) generator consists of a network of polymer sheets, rolls or cables which are suspended in the ocean between floats and anchors. As the floats bob around, the electricity generated by the polymers passes into electrodes attached to the polymers. The electricity is conditioned by solid-state electronics into high-voltage direct current and is sent ashore via underwater cables. On shore, it is then converted to alternating current and fed to the power grid.

Small prototype systems are being developed, with a system scheduled to replace a diesel engine on an offshore oil rig in the Gulf of Mexico by the end of 1995. The company plans to develop HPE generators which would be built into the anchor chains of navigation and weather buoys and would be capable of powering the lights and other systems on the buoys.

According to OPT, floats for a 100-megawatt system - which could supply enough electricity for a city of 200,000 people - would cover about 7.7 square kilometres of ocean surface.

The piezoelectric polymers are impervious to the corrosive effects of seawater and can be reconditioned at the end of their expected 20-year life.

-New Scientist, 14 January 1995

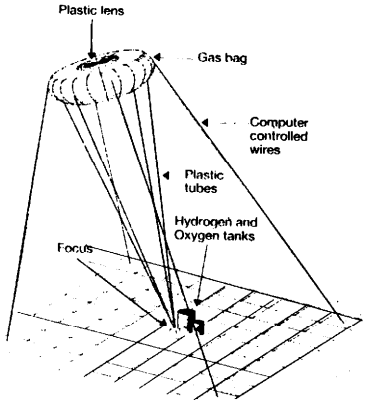
Lens solar power plant

A lens solar power plant has been developed in Finland.

The sun's beams are focused through a thin plastic lens supported on a 10,000m^2 gas bag. Reinforced plastic tubes hold the lens perpendicular to the sun. The gas bag is directed towards the sun by means of a computer-controlled system of wire cables.

A device at the focus separates water into hydrogen and oxygen. The hydrogen and oxygen can be passed between the electrodes in a combustion chamber where they recombine to form water and produce an electric current. The solar energy can be stored in hydrogen and oxygen tanks until it is required.

CADDET Renewable energy newsletter, January 1995



Solar Technology Designer's Catalogue 1995

Now in its 7th year, this authoritive 144 page guide is endorsed by professionals and amateurs alike as Australia's ultimate, non partisan renewable energy source book. A veritable gold mine of knowledge to save you time, money & frustration.

ESTIMATING YOUR DAILY ENERGY NEEDS * POWER SYSTEM SIZING & DESIGN * SOLAR PANELS * TRACKERS * SOLAR RADIATION MAPS * WIND GENERATORS * BATTERIES * INVERTERS * CONTROL SYSTEMS * ENERGY EFFICIENT LIGHTING & REFRIGERATION * WATER PUMPING * SEC INTERTIE SYSTEMS * WIND FARMING * PRACTICALLY EVERYTHING WORTHWHILE ON THE AUSTRALIAN MARKET INCLUDING COMPREHENSIVE PRICE LISTS

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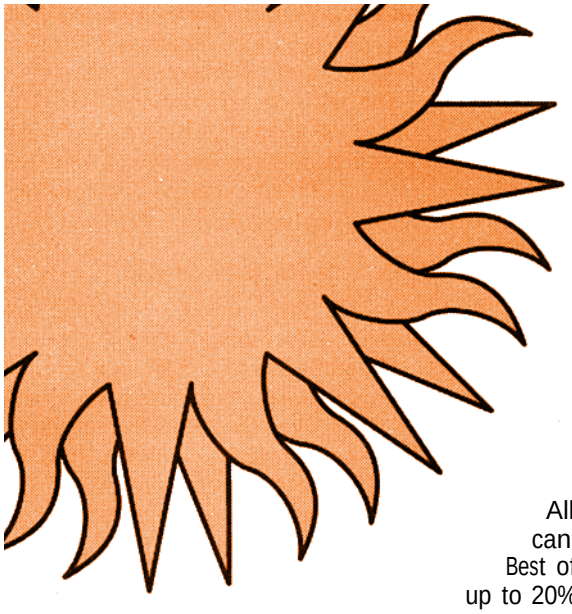

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To order your copy: For credit card orders call us on (03)650 7883 or fax your order on (03)650 8574 or (03)650 4175. Alternatively, you can send a cheque or money order to the Alternative Technology Association, 247 Flinders Lane, Melbourne 3000.

PRODUCTS

The 55 litre Mark II portable refrigerator.

Drive-about refrigerators

Down South Refrigerators of Christies Beach, SA have a range of portable refrigerators ranging in capacity from 35 litres to 150 litres. These may be recharged using alternative energy sources such as solar power. The refrigerators are also ozone-friendly as both the refrigerant and insulation are CFC-free. These fridges are designed for installation in vehicles and boats.

Down South also have a range of ozone friendly refrigerators and freezers for houshold use. These range in size from 80 litres to 220 litres, and run on 12 or 24 volts DC, making them suitable for low-voltage renewable energy systems.

rrp $999 for the basic 35 litre model to $1,050 for the 150 litre model. $1,450 for the 60 litre Eutectic model, For further information contact Marten Forrestal ph:(08)384 8618 or (018)842 742.

Plant Professor

In Soft Technology #49 we introduced the *Permaculture Pro* software which was being developed. The software has now been launched as *Plant Professor*.

rrp $850 or $30 for a demo version. For more information contact Peter Suter ph:/fax:(057)952 573.

Louvre window system

LWA of Brisbane has a louvre window system which is totally weatherproof. This has been achieved by a number of design characteristics, including a wiper type action against the aluminium channel, a clip shroud which overlaps and seals the clip below, and blades that fit neatly into the holding clips to form a tight seal on both sides.

The blades are available in either glass or timber. Clip sizes are limited to 102mm or 152mm.

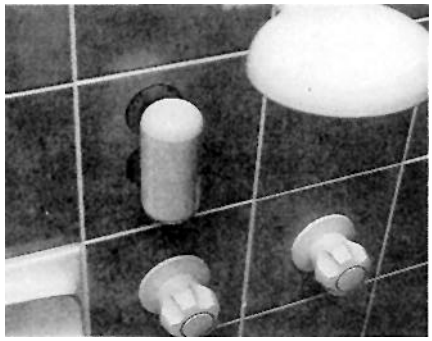
rrp approx. $100 per square metre For more information contact Dennis McCarthy ph:(07)394 1622 or fax:(07)397 8643.

Shower timer

Gum Leaf Energy Savings Systems is marketing the *Gum Leaf Shower Timer.* Inventor David Whitby came up with this concept in an effort to outwit three teenagers who were in the habit of using all the hot water taking long showers!

The timer can be attached to the wall of the shower stall and is sensitive to the sound of water movement. The timer gives a short beep every minute for the first four minutes. After that, the timer will give repetitive beeps for eight seconds on and eight seconds off until the water is turned off and has been left off for about one minute.

rrp $34.50 including battery, plus $3.90 packing and handling. For more information contact Gum Leaf ph:(03)663 7227 or fax:(03)663 7202.



The *Gum Leaf Shower Timer.* A great water saving idea.

The Electric Phantom - much less pollution with this electric-powered bike.

Electra-cutie

The *Electric Phantom* is a bicycle powered by an electric motor, minus the pedals! It is Australian designed and manufactured in Shepparton, Victoria. It does not need to be registered and you do not need a licence to ride it. The Phantom has a range of 45km at full speed and will carry a load of 100kg.

The accelerator is a twist grip type similar to that on a motorbike. The machine runs from 4kph on first speed up an incline to 24kph on fourth speed on the flat. The motor power is 198 watts at 24 volts DC and runs off two lead acid batteries of 12 volts each.

Widespread use would help reduce space used on roads and for parking and would assist in the reduction of fossil-fuel consumption.

rrp is $1,950 For more information contact Helen or Ray Russell ph:(058)21 0163 or fax:(058)22 2122.

Solar Pathfinder revisited

In Soft Technology #49 we introduced the *Solar Pathfinder* which, at that time, was only available from the USA. This product is now available in Australia from *Quirks Victory Light Co. Pty. Ltd.*

rrp $285, including metal case and tripod stand, $195 without case or stand (hand held model). For more information contact Quirks on ph:(02)371 0077 fax:(02)371 49l7 or write to PO Box 440 Rosebay NSW 2029.

Power monitor

The VF-100 Mains Monitor is a small hand-held or wall-mounted instrument designed to allow alternative energy users to easily monitor the quality of their locally generated 240 volt AC power.

The front panel of the unit has two vertical LED displays that give an indication of both voltage and frequency. The voltage increments from 220 to 260 volts in two and four volt steps and displays true RMS voltage. The frequency range is from forty to sixty hertz in two hertz steps.

The VF-100 will work equally well on generators, square- or modified-square-wave inverters or sine-wave inverters, as well as on conventional mains-grid-connected systems. The unit requires no special wiring, it just plugs into any conventional 240 volt power point.

rrp is $170 plus tax if applicable.
For more information contact
Callignee Electronics ph: (051)95 5503 or write to PO Box 483 Traragon VIC 3844.

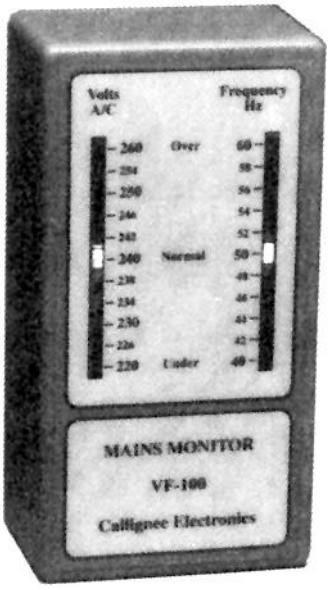
Energy saving computers

Computers use a lot of power, on average about 200 watts or so, not including peripherals such as printers and the like, Computers worldwide are estimated to use about 240 billion kilowatt hours of electricity each year, as much as the country of Brazil.

Clear Technology is the Australian distributor of both *Philips* and *Unisys* energy efficient PCs and monitors. This new range of computer products contain energy saving circuitry that will put the device to sleep until it is required. This can result in huge energy savings.

Clear Technology claim that by using energy saving computer equipment such as the Philips and Unisys machines, customers can save up to 70 per cent of the power drawn by this equipment. If these and other similarly energy-efficient products captured about two-thirds of the world market, around 20 million tonnes of carbon would be prevented from entering the atmosphere every year.

For more information contact Clear Technology ph:(02)310 3077 or write to: 28 McEvoy St, Waterloo NSW 2017.



The *VF-100 Mains Monitor.* It can help save expensive equipment from damage due to wrong voltage or frequency.

A cleaner backyard

Worms 'R' Us have just released a new product with the unique name of the *Doggy Do-Do Disposer*. Suffice to say, it is fairly obvious what this device is supposed to do, and as you would expect with a product from Worms 'R' Us, worms have a great deal to do with the process.

The DDDD is similar in concept to a worm farm and uses worms to turn the rather unpleasant dog waste into odourless worm castings, just the thing to make those plants thrive.

Available in two sizes and made from treated, locally grown, plantation pine, the DDDD is an environmentally sound solution for the problem of backyard landmines.

rrp $107.50 including 2000 worms for the small unit plus handling and transport.
For more information contact
Worms 'R' Us on ph: 1800 064 458.

Non-toxic coating

Emer-Clad is a water-based non-hazardous coating material for waterproofing a variety of materials including roofing. The material is suitable for concrete, brick, structural steel, asbestos concrete, canvas and tarpaulins among others. Emer-Clad can be applied like paint using brush, roller or airless spray. The material can also be used on plywood coverings for dome structures and waterproofing of shower stalls.

The recommended usage is about two to three coatings and the material covers three square metres per litre per coat. The recommended usage varies with the material and users should contact the company for detailed information.

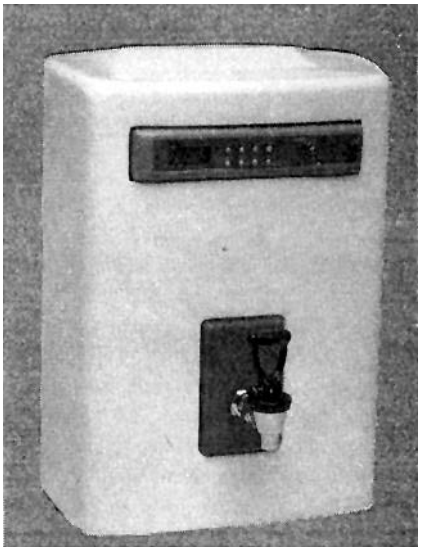
rrp $48per 4 litre can
For more information contact
Sales and Technical Enquiries on ph(02)519 4722 or fax(02)519 4434.

Environmentally friendly hot water unit

Laurie Whelan Industries of Geelong has introduced the *Timerboil* to provide boiling water on tap. It differs with other conventional electric units in that the Timerboil has a seven day timer which enables you to shut the unit off automatically when it is not in use.

The manufacturers claim that the unit pays for itself from the energy savings. The Timerboil would be useful for offices, schools and other establishments where boiling or near boiling water on tap is required continuously but not twenty-four hours a day, seven days a week.

rrp from $810 for the 2.5 litre model up to $1,465 for the 160 litre model plus tax
For further information contact
Boyd Zimmerman ph:(052)21 7399 or fax: (052)22 4436.



The Timerboil can save a lot of energy by only boiling water when needed.

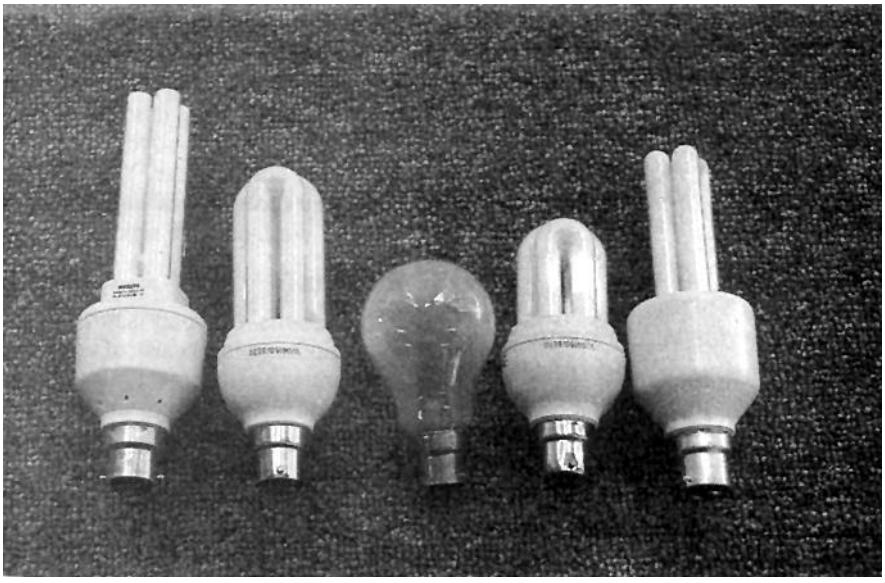
Long-life globes

Mirabella has released a new range of stylish compact fluorescent lamps that have been designed to more easily replace conventional incandescent bulbs than many of the current lamps on the market.

By reshaping the tube so that there are three loops of glass instead of the usual two, the lamps have been made shorter and more rounded. This allows them to fit a greater variety of lampshades without protruding from the shade.

As with most other compact fluoros, these lamps have a power consumption of only 20% of the incandescents they replace, and last eight times longer. They also have an excellent power factor rating of 0.95. Our samples came from the local *Kmart* store, but they are also available from other outlets.

For more information contact Mirabella Imports Pty. Ltd. on ph: (03)335 3633.



These new *Mirabella* compact fluorescent bulbs are much shorter than their conventional counterparts and approach the size of incandescent bulbs. The Mirabella bulbs are on either side of the incandescent above and are rated at twenty and ten watts.

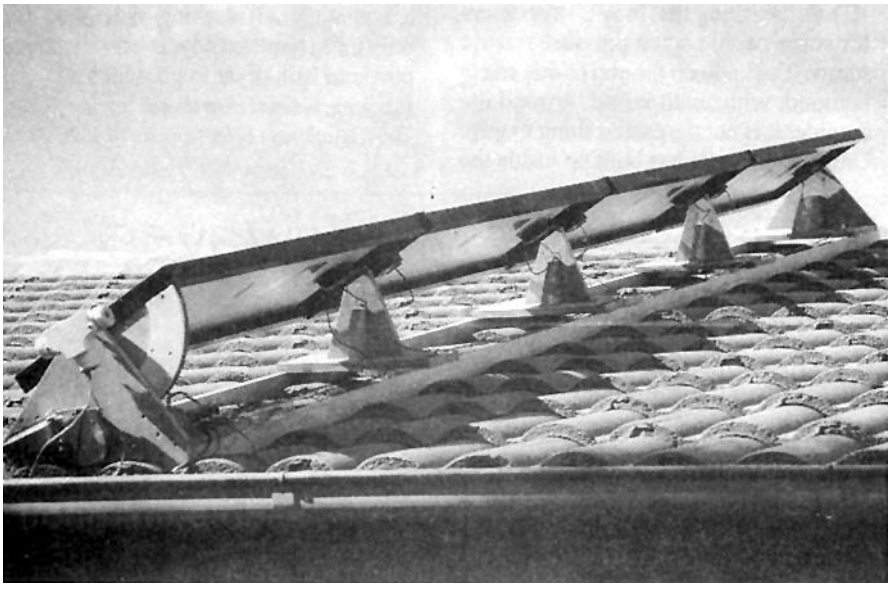
Solar tracking controller

The *STC365* is an electronic controller which will operate a DC motor to allow solar panels to track the sun. It can also be used with mirrors/dishes. The controller thus optimises the amount of solar radiation falling on the PV panels or mirrors.

The STC365 comes with a separate sensor, which includes tilt switches and requires a motor and back-up battery to make a complete tracking system.

The kit is being put together by *Peter Bachman,* who states that up to thirty per cent more power can be gained by having the panels track the sun. The controller is rated at 12 volts DC and will switch a maximum motor current of eight amps.

rrp Sensor $50, Controller $80
For more information contact Peter ph: (06)290 1639 or fax:(06)273 3977.



The SK365 controller is a simple to install and low cost option for solar tracking.

Cleaner rainwater

SafeRain is basically a diversion valve which provides cleaner rainwater. The basic principle used is that' the main bulk of soluble as well as insoluble pollutants in the atmosphere are washed down by the initial downpour of rainwater. SafeRain diverts the initial downpour of rainwater to the drain and only keeps the latter portion of rainwater for the storage tank.

SafeRain provides a three-month money-back guarantee as well as a two-year warranty.

rrp $75 to $95 depending on outlet size and configuration.
For further information contact Trent Church ph:(03)894 3302.

Battery-free bike light

Red Alert is designed to increase your security by adding a flashing light to the existing rear reflector of your bicycle. It uses a magnet in conjunction with coils of wire to produce an electric current as the magnet, attached to the wheel of your bicycle, rotates past the coils attached to the light. The flashing red light warns other road users of your presence.

rrp $35.39 from all good bike stores.
For further information contact David Tompkins on ph:(03)587 2344 or fax:(03)587 6951.

Wonder Wash hand-operated washing machine

Review by Lance Turner

The *Wonder Wash* hand-operated washing machine can make life much easier for anyone without a washing machine. It really is an amazing little invention, consisting of a heavy-duty (but lightweight) plastic 'barrel' which is mounted so that it can rotate inside the base frame.

The barrel is topped with a lid that has a separate pressure plate inside it. There are four suction cups on the base so that the washer will not slide around. On one side, attached to the barrel's pivot, is a handle so that the barrel can be easily spun on its axis. The whole unit is about the size of a 26 litre Esky and is very portable.

Operation

So how does this unit work and how well does it work? Well put simply, it's bloody amazing! You put in the dirty washing, up to a maximum of around 2.2 kilograms, put in the appropriate amount of hot or warm water and a very small amount of detergent (I generally use no more than a teaspoon). The lid is then fixed in place, and the pressure screw tightened down.

After rotating the barrel for a maximum of two minutes, you release the pressure by unscrewing the pressure screw, remove the lid, and empty out the water. You can then either rinse the washing in the Wonder Wash or in the sink.

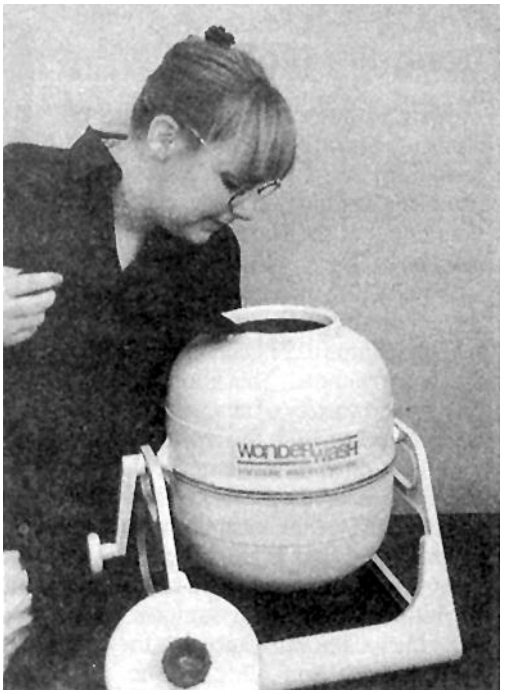
Results

The results of your effort is clean clothes with the use of very little water or detergent. Collar grime that just would not shift for me in an electric washer has virtually disappeared after a couple of washes in this machine.

The secret to the Wonder Wash's ability to clean clothes so well lies in the pressurised system it employs. Because the barrel is completely sealed while washing, the hot water in the barrel heats up the air trapped inside, causing it to expand and produce a build-up of pressure. According to the makers of Wonder Wash, the increase in pressure forces the water and detergent through the clothes and extracts the dirt in a very short time.

There are, however, a couple of points that do detract from this excellent device, the first being a base frame that is a little more flexible than I would like. I also found that the six small plugs that cover the slots in the frame after assembly tend to fall out and required gluing in place.

The other thing that may be a problem for some people is the pressure release screw. The knob on the end of this screw is round, with small bumps around the outside. It is not the easiest thing to grip. Once the pressure has built up inside the barrel, the screw becomes harder to turn and may even defeat some people who are not so strong in the wrists.



No electricity, much less water and detergent and very rapid washing. Just some of the pluses for Wonder *Wash.*

Summing up

This handy little device is well suited to anyone living without a conventional washer, including campers and people living in small flats.

I am very impressed with this device and will continue to use it despite having a conventional washing machine. The only thing required now is a mini human-powered spin dryer to go with it. ☼

For your nearest distributor contact: The Cleanhouse Effect on ph:(02)698 2033.

Washing machines and Microwaves

Here at Soft Tech, we get many requests for information regarding the types and brands of electrical and electronic equipment that can be used with particular power systems. One question that keeps on popping up involves the effects of using various devices with square-wave or modified-square-wave inverters. Will the appliance run properly? Could it be damaged in some way? Will it draw too much power for the inverter to handle? What about surge currents?

These are all questions that are asked of us. Although they involve all sorts of appliances, the most common enquiries are about washing machines and microwave ovens.

We would like any of you who have had experiences, either good or bad, regarding either of these appliances, to write to us at the address below and let us know how you went. Information pertaining to particular brands and model numbers is particularly important, as we hope to publish this in a future issue.

The address to write to is: Soft Technology, 247 Flinders Lane, Melbourne Vic 3000.

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WHAT IS SOLAR DESIGN?

Solar design means designing to ensure that a building that is warm in winter and cool in summer.

If you are looking for a building **site** or an existing house to buy, the first thing to ascertain is whether your winter sunshine will be blocked by houses, trees or steep slopes. This does not mean that you must buy a north-facing site. On the contrary, since most of our building sites are long and narrow, there are definite advantages in having one of the long sides facing north, as every room can get winter sun.

The view and the winter sun do not have to be on the same side, but in places where winters get really cool, a southerly view can cause problems, since the south side should preferably be of heavy masonry to keep out the cold. However, in coastal areas where the weather is mild, even southerly views can be accommodated.

Provided a westerly view is well-shaded against the hot afternoon sun, a western view can be a delight.

The next step is to **design** the house. As many rooms as possible should

DON'T MOVE HOUSE! try a SOLAR RENOVATION

Eve Laron

RENOVATE or move? This dilemma is a perennial problem for many people. The family grows and the need for space increases...maybe another bedroom, space for another car or a rumpus room for the kids so the adults can have some peace and quiet. Even when the size is right, many houses are dark and cold in winter or become hot-boxes in summer. Sometimes houses are just not comfortable to live in.

Looking for another house is a difficult and time-consuming exercise, and it is also likely to cost a lot of money. The likelihood of finding the perfect house in the right location and for the right price is fairly remote.

If you are basically happy with the location and the neighbourhood, it is certainly worthwhile finding out how much your home could be improved.

Start with getting expert advice. A good solar architect will be able to assess the potential of a house and tell you whether your house can be successfully transformed to become the home with which you would be really happy.

A transformation

Sylvia and Rob wanted a new house. Sylvia, in particular, knew exactly what she wanted: a house that was full of sunshine in winter yet cool and breezy in summer, with bagged brickwork and soaring, timber-lined cathedral ceilings.

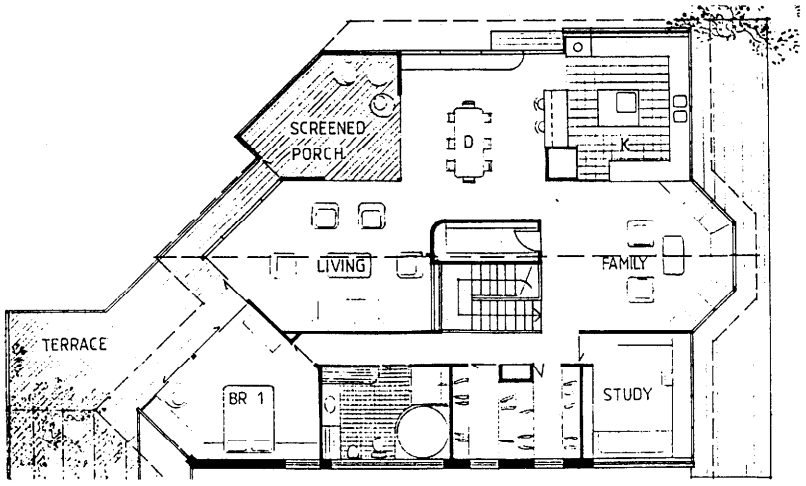
There was only one problem: the budget. It was a respectable sum but, because of the size of house they needed, it would not have been sufficient to provide all the accommodation in such a luxurious style.

Though small, dark, sunless and ugly, their existing house was nevertheless full brick and quite sound. This–together with the fact that their requirements could be easily separated into two distinct and separate groups - pointed the way to an unusual solution.

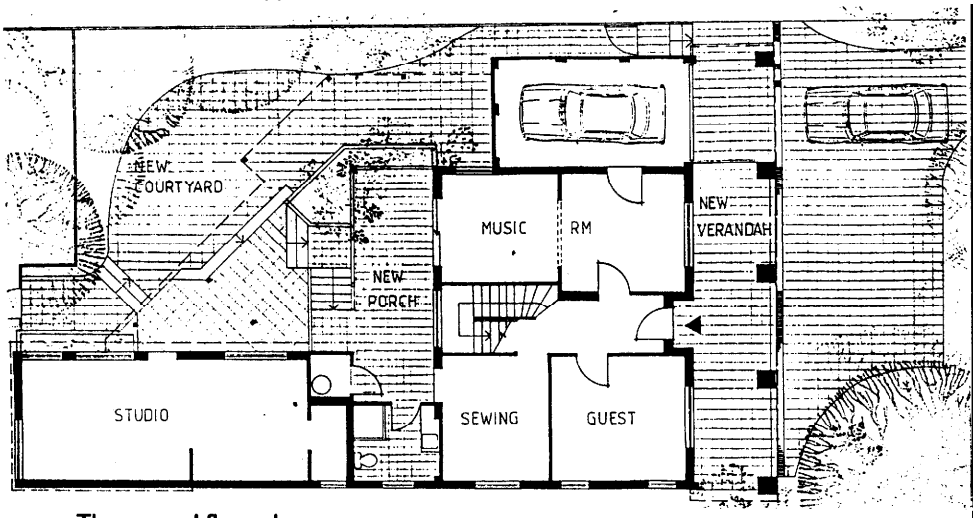
Rob is a musician. He needed a large practice room but, absorbed in his music, he doesn't take much notice of his surroundings. So I suggested turning the existing living and dining rooms into a music room for Rob. All other existing rooms were assigned to secondary uses, providing plenty of space for a studio for their artist daughter, a guest room, and even a sewing room.

Having accommodated all the extra requirements within the existing house, we simply removed the roof and built a platform to carry Sylvia's dream home on top.

Now that this area had to be designed for only the two of them, we could afford to build it exactly as Sylvia wanted it. It contains a beautiful big open living/dining/kitchen/family area with a soaring cathedral ceiling and



Plan of the new upper floor.



The ground floor plan.

to allow the winter sun to warm the house. All of these glazed areas should have overhanging eaves or other sun-shading devices carefully calculated to screen out the hot summer sun. This is easy on the north, but more difficult elsewhere.

As far as the eastern side is concerned, opinions differ. I always allow for plenty of morning sunshine, since I think it's essential for about ten months of the year and, skilfully handled, not too hot even in midsummer.

The southern and western sides are the most difficult. The south needs to be closed off against the winter cold, yet it is essential to have enough openings to admit southerly winds to cool off the house in midsummer.

The problem with the west is that summer afternoons tend to be the hottest part of the day, so one is inclined to just lock it out with solid masonry. But on chilly spring and autumn afternoons, the warmth of the sun is most welcome. Adjustable awnings or sunscreens are a good idea on these sides.

On sticky hot summer days and nights, **cross-ventilation** often obviates the need for air-conditioning. Every room should have openings from at least two, but preferably three, directions and a ceiling fan.

Tightly packed **insulation** in the roof and walls helps to reduce both summer heat and winter cold. Heavy, double-lined curtains or shutters are essential for winter nights to keep out the cold.

Light-coloured exterior finishes are extremely effective as they reflect heat in summer.

Solar-oriented design should not cost any more than normal building costs. Good design is always cheaper than bad, simply because it doesn't waste space or materials.

To dispense with artificial heating and cooling altogether, the next step up the ladder is **passive solar design**. *Passive* in this context simply means that there are no active moving parts.

Passive solar design is based on the fact that dense materials – like concrete, brick or stone – absorb heat far more effectively than less dense materials (such as the human body). If you have a house with heavy concrete floor slabs and thick masonry walls, on a hot summer day the floor and walls will keep absorbing the heat from the atmosphere inside the house, keeping you cool and com-

fortable. At the end of the day you open all doors and windows and the heavy floors and walls will disperse the heat overnight.

Combine heavy masonry with large areas of northern glass, and presto! You have a passive solar house and perfect conditions all year round.

The more mass the merrier. Concrete floors are essential – preferably paved with dark tile or slate to increase heat absorption. If the concrete is laid straight on the ground – with a moisture barrier of course – then all the better. You have, in a sense, borrowed the mass of the planet itself to store heat for you.

The walls should be masonry of some kind – brick, stone or mudbrick – and at least 230mm thick instead of the usual 100mm. Masonry walls are particularly effective, because apart from just storing heat, you also get the benefit of the stored heat of the wall radiating directly onto your skin, increasing year-round thermal comfort. The inner skin of cavity walls should preferably be increased to double-thickness as well, and should be insulated on the cavity side for greater thermal efficiency.

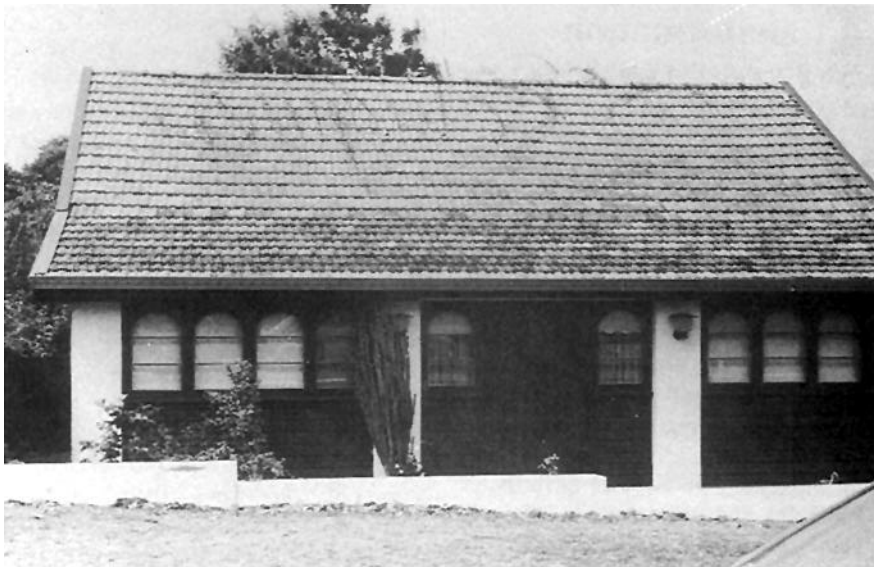
All this heavy mass will be somewhat more expensive than conventional construction, but not significantly so. Furthermore, it is not necessary to build the whole house with such heavyweight construction. There is a great deal to be said for building the bedrooms in lightweight materials. We can let them heat up during the day when the room is empty and take advantage of the quick heat loss of lightweight construction – with plenty of cross-ventilation, of course – for a lovely cool bedroom overnight. My favourite bedrooms are practically screened porches with sliding glass forming three sides. It's like sleeping outdoors under a mosquito net!

There is only one absolute 'no-no'. No brick veneer anywhere, anytime. Brick veneer has the dense mass of the brick on the outside of the building instead of the inside: in effect, trying to air condition the countryside. The only way it would make sense is to put the brick inside and the timber framing outside!

If every house and renovation were a solar design, we would all live far more comfortably and save a great deal of money at the same time.

It definitely pays to go solar. ☼

– Eve Laron



Recognise it? This is the house on page 14 before it received the Cinderella solar-renovation treatment.

cedar-lined walls - high, airy and full of light.

Large sliding doors open the living area into a beautiful screened verandah, turning the whole area into a breezy pavilion in summer. The eaves are carefully proportioned to allow the house to be flooded with winter sun but exclude all the hot summer sun.

The bedroom wing has the same finishes as the living area and it also opens out to the northern terrace.

We were even able to satisfy Rob's desire for a house with no-eaves gutters - cleaning the gutters is his pet hate. In-ground drainage is of course always preferable to eaves gutters. For new houses this is rarely a problem, but old houses are a different matter. It is usually rather difficult to change over to a new system. On this particular site it was possible to transfer the gutters into the ground where they belong.

The only alteration we made to the original ground floor was to move a bathroom to make way for new stairs.

All the exterior needed was the removal of the enclosure around the existing front verandah. This exposed the original handsome columns, and with the new floor on top and a new coat of paint, nobody would recognise Cinderella in her beautiful new finery. ☼

The new living room has views over the tree tops.

Changing the FABRIC of society

Warren McLaren

A JACKET made from soft drink bottles? Surely it would be as stiff as a board. No! It is in fact very soft and cuddly. It is also tough, durable and warm. More importantly, it is a visible sign that some textile merchants are waging a largely unheralded war on unsound textile materials and processes.

Changing containers into clothing

Around. the middle of 1993, three American companies launched an unusual assault on the apparel marketplace. *Wellman Inc*, one of the largest recyclers of PET in the world, had produced a yarn from 100% recycled polyester two litre drink bottles. They called the yarn *EcoSpun.* A textile mill known as *Dyersburg* took this EcoSpun and blended it with some virgin polyester, to obtain a soft double-sided fleece fabric they dubbed ECO – which stands for Environmentally Correct Origins. Dyersburg then worked with one of the most respected outdoor apparel manufacturers in the US to get the fleece to a standard suitable for their retail customers. The garment that was finally released was a Patagonia PCR Synchilla Sweater. (PCR stands for Post Consumer Recycled). It sold like proverbial hot cakes.

By the time Santa arrived in 1993, the Australian outdoor equipment company, *Paddy Pallin*, had garments made from EcoSpun yarn available in their chain of stores. When winter 1995 arrives, nearly all producers of fleece clothing selling to the outdoor industry in Australia will have part or all of their range in a recycled fabric.

The original garments had a 80% post consumer recycled content but these days they are 89%, and in August last year Dyersburg announced a 100% version. The recycled fibre is being used

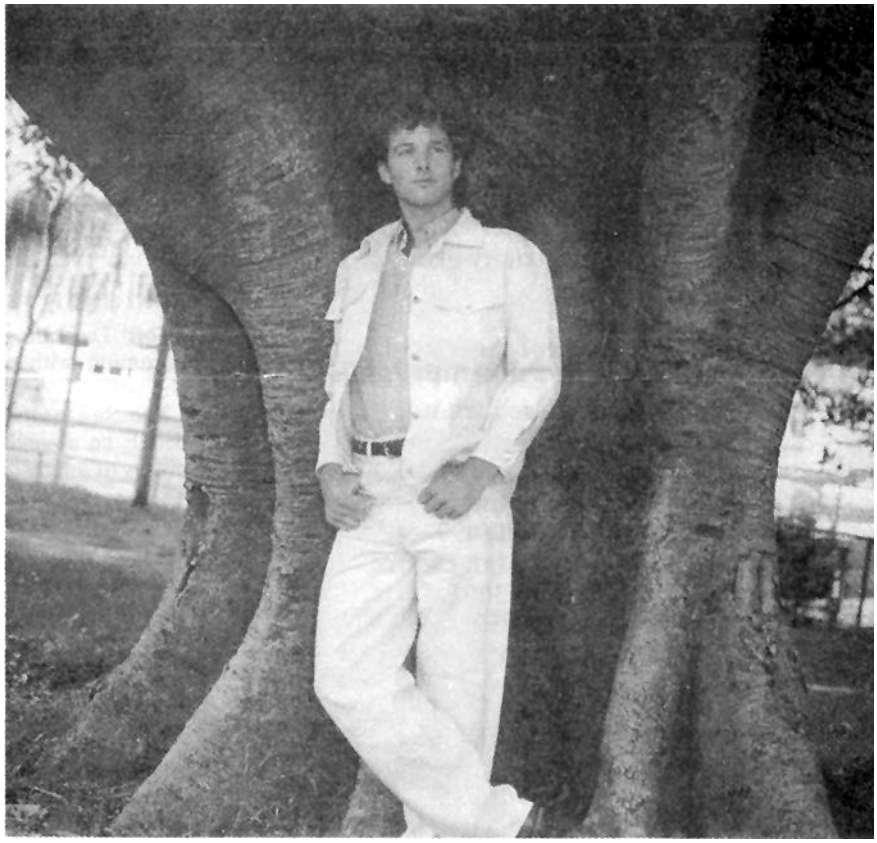


Photo from *Cannabis Clothing Company* catalogue (Australia).

Cannabis hemp produces more fibre than cotton and can be grown without chemicals.

What's all the fuss about hemp?

'Cannabis hemp has been used for humanity for at least 12,000 years to supply fibre for essential goods including clothing, paper and oil products.
The cannabis hemp prohibition was instigated in 1938 by petrochemical companies in the United States to gain an unfair advantage for their new synthetic fibre nylon.
Hemp produces two to three times more fibre than cotton per hectare and can be grown entirely without herbicides or pesticides.
For a better, cleaner, greener world – buy cannabis clothes'.

– slogan from a Cannabis Clothing Company T-shirt

In addition to textiles, cannabis hemp can be used to make paper, building materials and a seed oil. Hemp contains over 70% cellulose – the material from which paper is made. Wood, by comparison, is only 25% to 50% cellulose so far more chemicals are required to remove impurities.
Hemp is also lighter in colour than wood and therefore requires less bleaching. It is much easier and faster to grow than wood, taking only four months to reach maturity.
Although low-drug cultivars of cannabis have now been developed, opposition to hemp cultivation is fierce. Many people believe that growing hemp will lead to 'hordes of stoned out pot growers' and addicts.

– Tranet #91, November 1994

for everything from futon filling to shoelaces. Being a very high grade of polyester, which is also used for food grade containers, PET is no second-class textile material.

Organic cotton

But reincarnated lemonade bottles are only one of the new green fabric warriors getting a toe-hold on the public's imagination. For example, southern Queensland has become a centre of interest for the resurgence in organic cotton. Of the world's crop, cotton represents about three per cent yet it consumes about 25% of the world's pesticides.

Organic cotton producers avoid this over-use of chemicals by using such non-toxic materials as chook poo for fertiliser, as well as biological pest controls such as bollworm attacking wasps. Another method is to plant attractive crops beside the cotton to distract pests (a bit like putting chocolate bars at supermarket checkouts). The cost of these procedures makes organic cotton garments seem expensive compared to traditional processed cotton.

The hidden costs of traditional crops can be seen in the blue/green algae of the waterways.

Organic cotton growers are the small-scale commandos to the huge conventional cotton market, with *Greenpeace* and ***Esprit's Ecollection*** offering what back-up they can.

Organic wool

Organic wool is an emerging force that New Zealand has been exploring. In recent times the ***Australian Conservation Foundation*** and ***David Jones*** stores have been offering jumpers made from Australian organic wool and knitted locally.

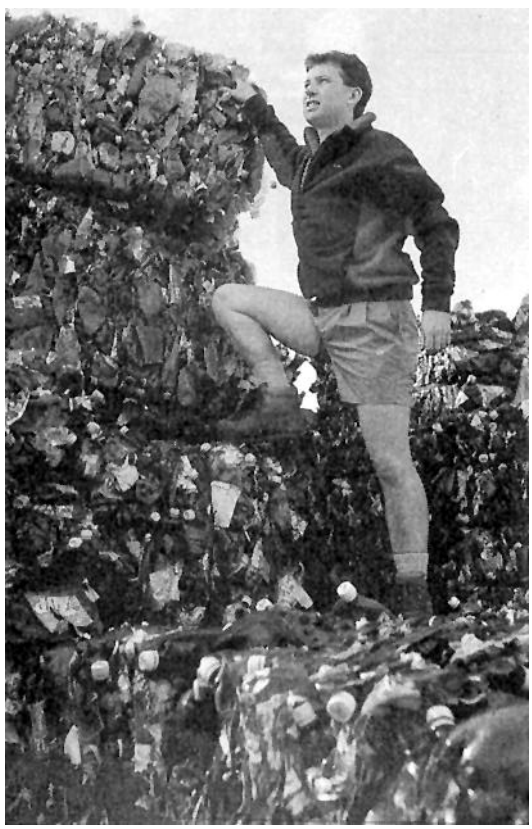
Photo from *Collection Esprit* catalogue (USA).

The organic wool for this cardigan from the Esprit Ecollection comes from New Zealand sheep which are bred for natural resistance to parasites.

Hemp fibre

A fibre that can grow without heavy reliance in pesticides and herbicides is *hemp.* Derived from the cannabis plant, hemp fibre has been used for thousands of years for paper, rope, money and fabric. It is four times stronger than cotton, it is more absorbent than cotton, it grows at a phenomenal rate and makes a good rotation crop for the likes of soy beans.

The list of positive attributes of hemp is so long, it seems weird that it is currently only available in fringe products. The hope is, now that seeds have heen developed which contain no more than 0.33% of THC (the narcotic component of cannabis), that the use of hemp fibre will once again become widespread. Trial crops are underway in Tasmania for paper production. *The Cannabis Clothing Company* and *SLAAM* in Melbourne have hot-selling lines of streetwear made domestically from imported hemp and hemp-blend fabric. According to The Cannabis Clothing Company, the first Levis were made of hemp canvas.



He's standing on old plastic bottles, and he's wearing them. Ecofleece is made from recycled PET softdrink bottles.

Tencel

If Grace Bros is considered a mainstream store, then one of the new breed of eco-textiles has managed to break through and reach the broader market. ***Tencel*** is a cellulose fibre derived from sustainable harvested tree farms. It is processed in such a way that it can be manipulated like a synthetic even though it is of natural origin. The solvent process used has built-in recycling so that the solvents are reused for future production. Tencel has made. its major foray onto the Australian market in a denim fabric in baggy jeans under the *Dachet* label. It looks just like cotton denim but feels and behaves like silk.

Under the name *Deja Shoe,* a company in the United States offers shoes made from a range of unusual materials, including the recycled polypropylene trim waste of disposable nappies, recycled cotton wastes, recycled wine corks, wool, wetsuits, rubber gaskets and car tyres. They also have a material made from Amazonian rubber bonded to cotton, and shoes with hemp uppers.

Deja Shoes will soon be available in Australia at ***Hyland Shoes*** in Sydney, and nationwide distribution will start around June.

An English enterprise, Evergreen, collects unwanted garments from charity organisations and strips them back to their fibres, sorts them into colours, creates new yarn and knits new garments using a miniscule amount of the energy required for virgin garments.

'Greener' dyeing

Strong efforts are being made in other areas of green textiles and textile products. *The Australian Dyeing Company* has introduced a cold batch dyeing process using their *Smart Cotton Colours* process which eliminates the use of salt, uses approximately 37% less water and 48% less energy while reducing effluent.

A clothing library

The Upper Yarra Community Centre in Victoria has established a clothing library to lend clothes to unemployed people who are attending job interviews. The library has about 80 outfits available through the help of local fashion houses.

Deja Shoes are made from some unusual recycled materials including cotton wastes, wine corks, wool, wetsuits, rubber gaskets and car tyres. This is just one of many designs.

The beachhead forces have landed in the battle to get people more sensitive about their textile purchases. They need all the support that can be mustered in order for them to establish safe ground for others to follow. ☼

Warren McLaren is responsible for introducing recycled PET fabric to the Australian market. He is currently a design consultant for INOV8, a company dedicated to providing its clients with opportunities for sustainable design practices. Reprinted with permission from the newsletter of SRD, The Society for Responsible Design. For further information contact SRD on: (02)281 4095.

NON-TOXIC PEST CONTROL

Jackie French

WHEN I was a kid there was a myth floating around that the only beings to escape the Hiroshima explosion were cockroaches. Actually, humans are much tougher than cockroaches - you only have to tread on them to hear them go 'squish'. We're tougher in other ways too. Cockroaches 'cark it' at about 44°C. We can survive, albeit unhappily, at much greater extremes.

Most pest control is, in fact, unnecessary. We've been conditioned to hate insects; to kill them just because they're there. But most of us know very little about them. Once you do, you can work out ways to avoid them, deter them (I love ants, as long as they're not in my jam) or, if necessary, hit them where it really hurts. (What dingbat thought up the idea of spraying codling moth *inside* an apple? As soft, soggy caterpillars and moths they're just waiting to be trapped!).

I digress - back to household pest control. Most pests come from outside. Install screens, place sealers under doors or use a sealing gun from the hardware store to seal cracks and crevices in floors, skirting boards and around windows. Vacuum often.

All-purpose pyrethrum spray

Even with the best of screens, occasionally a fly or mosquito spray is needed. For this, home made pyrethrum spray is best. You can grow your own or buy dried flowers. An even better idea is to purchase plants from your local nursery. You'll need about 20 plants (don't panic, they're small and you can grow them on the windowsill) for a good supply. Pyrethrum has about a twelve-hour toxicity.

The active ingredients in pyrethrum flowers are relatively insoluble in water - though a low-potency fly spray can be made by covering the flowers with boiling water, leaving them to steep and spraying as soon as mixture is cool. A much more effective spray is made by covering the flowers with kerosene, mineral oil or alcohol - brandy also works well - and leaving them overnight in a dark place, then adding six parts of water for every one part of strained liquid. Use it at once, as the spray will deteriorate on contact with light.

Pyrethrum flowers should be picked when they have just opened early in the morning. The main active ingredients are in the immature seeds. Pyrethrum flowers should be dried in a dark, well-ventilated place, as they lose their potency on contact with light.

Pyrethrum has been used as a mild sedative - and the flower heads been shown to have mild antibiotic properties - but it is rarely administered. Allergic reactions to pyrethrum include dermatitis, asthma and sinus problems.

Ants

Repel ants rather than kill them if you can. Any strong-smelling substance will repel them, including cloves, eucalyptus oil, lavender oil or - even better - squashed leader ant. You can kill them with a bait of one part borax or den-is dust mixed with icing sugar, cake, mince or whatever food your ants like. (Different ants like different foods and even the same ants may like different foods at different times of the year.) You can destroy ant nests by pouring kerosene down them. Alternatively, use one part kerosene, one part water, one part washing detergent and one part cooking oil - this sticks in the soil longer and makes it less likely that ants will recolonise close by.

Borers

If you live in a borer-prone area, paint wood surfaces with half borax and half methylated spirits mixture. Repeat every six months. Borer damage can be fast and lethal so inspect regularly.

Cockroaches

Baits made from borax and icing sugar aren't very successful. It's more use sprinkling borax wherever cockroaches put their feet - like along the back of shelves and cupboards. They lick it off and die. (Note: this is a long-term control - it will take about three weeks of licking to have much effect).

You can also trap them in an old butter container (nice and slippery) with red wine and a bit of cake in the bottom. They'll climb in but won't be able to get out again and will drown in the wine.

However your best bet is to seal up all crevices where they get in, install fly screens on doors and windows - most roaches come in from outside - and wipe surfaces around sinks, etc with eucalyptus oil - which both kills the young ones and repels adults.

Cockroach putty

This is excellent and is one of the best long-range controls I know.

Mix six parts white flour (after all, you're trying to kill the bastards) with one part borax or derris dust, and enough water to make a dough.

Don't leave this lying around - it looks edible, but isn't. Press into crevices behind cupboards and especially in skirting boards. The cockies guzzle it and die.

Crickets

Mix bran, borax and powdered milk and leave where crickets are chirping. (Alternatively, put on Beethoven's *Pastoral* and let the crickets chirp with the music - you too can learn to love the sound of crickets!)

Earwigs

Crumple up some newspaper and let it get damp in the dew. The earwigs will shelter in it during the day. Collect the paper the next night, stick it in the rubbish, compost or worm feeder and replace. Soap spray also kills earwigs.

Ferment flies

Ferment flies are the little flies that zap around your fruit bowl. Fill a jar with fruit juice, a pinch of yeast and a little oil. Leave it out of sight near the fruit bowl. The ferment flies will die trying to investigate.

Fleas

Camphor mint flea powder

This is more effective as a repellent than a killer, though it will kill some fleas.
Dry the following:
3 cups of camphor mint leaves
3 cups of lavender flowers
1 cup wormwood leaves
Pound to a powder when very dry and ruffle through your pet's hair.

Home made flea powder

1 part pyrethrum flowers, dried and ground
1 part talcum powder
1 part dried fennel or pennyroyal leaves
Combine. Dust onto the animal's fur at once - outside, as fleas may abandon ship before they die - or store in a sealed, dry container.

Fennel vinegar

You can use this in salads or dab it on your dog. The fennel will help repel - but not kill - fleas, while the vinegar may soothe flea-induced eczema. Just stick fennel in a jar and add hot vinegar. Leave overnight and dab.

Pyrethrum flea powder

Combine one part dried and pulverised pyrethrum flower with one part talcum powder. Keep in a sealed jar away from light. Dust on your dog once a week out of doors. It is excellent.

Derris flea powder

Mix one part derris dust with two parts talcum powder. Again, apply out of doors. Wash your hands well as derris is mildly toxic - you need a very large dose for a severe effect and derris dust itself is a very dilute concentration of rotenone bark.

Feeding garlic to cats and dogs is said to help repel fleas. About one clove a day is the dose for a medium sized dog; about a quarter of that for cats and about twice that for very large dogs.

Flies

Fly paper

Cut strong brown paper into strips, ironing it flat if you've crumpled it in the bottom drawer. Heat one tablespoon of castor oil with three tablespoons of treacle or golden syrup till sticky and thick. Dip and dry in an airy place outside.
Alternatively, mix one part pine tar and one part molasses or, alternatively, one part roofing tar and mastic with molasses.

Anti-fly potpourri

Combine in a bowl:
½ cup orris root
½ cup salt
rind of 3 lemons
½ cup peppercorns
3 cups dried-lemon verbena leaves
This potpourri will be most effective on sunny window ledges where the heat will draw out the perfume. When the perfume fades, refresh it with a sprinkle of brandy.

Fly trap

These can be incredibly effective in fly plagues. The effectiveness of fly traps depends, however, on good bait and you need at least six around your house - more in fly plagues or if you don't have fly screens.
Cut the shoulders and top off an old plastic bottle. Insert the bait using either a commercial bait, which can be bought from most hardware stores, or a few old prawns or tuna with a broken egg -meat isn't as good as you'd think. Cover with water so it doesn't dry out and stop smelling.
Stick the top of the bottle down like a funnel, tape it well and cut a couple of holes in the top. Thread string through them and hang the trap up *high* - the stink will rise and attract the flies but it'll be away from your nose. Wait a few hot days for it to start to work. Empty when necessary, adding more water if it starts to dry up.

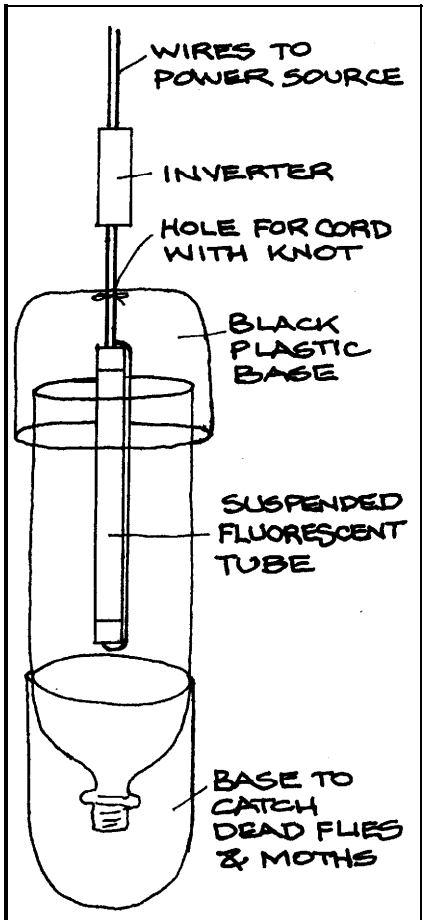
The fluorescent fly trap

Collect several empty plastic soft drink bottles - both large (King) size with black bottoms, and the 1.25 litre size.
Dismantle a fluorescent fitting from a torch by removing both the inverter and the tube with its wiring. Some wires may have to be lengthened and re-soldered. Remember that the wires to the power supply must be connected with the correct polarity, otherwise the inverter will be damaged.
Arrange the tube inside the bottle as shown in the diagram. Use some sticky tape around the tube to hold the lower wires in place. Tie a knot in the upper cord or, alternatively, use a clothes peg to hold the top black plastic shade in place.
It is important that the black plastic base be positioned as shown at the top to minimise light reflection off the ceiling, thereby ensuring that the insects fly to the brightest source of light.
Insects will eventually climb inside the top to get at the light and fall through the narrow neck into the lower bottle. The neck may be trimmed off if you have particularly big moths.
The sections of bottle can be either wired, stapled, pinned or glued together. A convenient fastener is the old-fashioned brass paper pin with the fold back tabs.
The base at the bottom should be made easily removable to empty out the deadies.
There are lots of possibilities for variation in design, depending on individual ingenuity.

Insect repellent

Add two tablespoons of epsom salts to two cups of boiling water. Stir in one

Design by Bryan Sullivan



Fluorescent fly or moth trap

Insect repellent

Add two tablespoons of epsom salts to two cups of boiling water. Stir in one cup of eucalyptus oil. Shake well and spread thinly.

Alternatively, mix:
1 part pennyroyal oil
1 part lavender oil
1 part cider vinegar
1 part methylated spirits
1 part baby oil
Smooth on as needed.

Lemon grass is also an effective insect repellent. Keep the lemon grass oil in a sealed jar in a dark place till needed. It is most effective when mixed with an equal part eucalyptus oil.

Lice and nits

Pyrethrum gel is probably the best repellant in this case. You can make your own by combining half a cup of undiluted pyrethrum spray with one part jelly - made by combining one tablespoon of gelatine with half a cup of boiling water. Add one teaspoon tea tree oil, one tablespoon olive oil and massage into the hair. Leave for half an hour covered with a towel and wash out with hot water and shampoo. Rinse well and comb with a fine-toothed comb. Repeat the next day, then ten days later.

No matter how effective the treatment, re-infection is common from pillows, towels, hats, sofa covers etc. These must all be washed in *hot* soapy water and left to dry in the sun. Ironing kills any you might have missed.

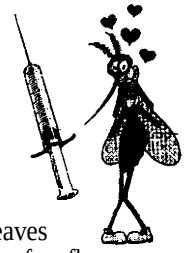
Eyebrows can also harbour nits (especially a la Robert Menzies). Suffocate these nits by rubbing in petroleum jelly and leaving overnight.

Mice

Mix equal parts of flour, icing sugar and plaster of Paris and leave where mice can find them. The result: terminal constipation.

Millipedes

A thick barrier of talcum powder around the house will keep out millipedes - either home- made powder or the sticky stuff Aunt Glad gave you for Christmas. A barrier of eucalyptus oil thickened with liquid soap also performs well.



Mosquitoes

Anti-mosquito candles

Mix:
1 part dried basil leaves (sacred basil if possible)
1 part dried wormwood leaves
1 part dried pyrethrum or feverfew flowers
1 part saltpetre
1 part candle wax, melted

Form into a cone shape or the traditional circular mosquito coil shape. Light the end -this may take some time - and let it splutter and smoke. The scent will keep away mosquitoes.

Mosquito coil mixture

Combine:
1 part dried wormwood leaves
1 part derris dust
1 part dried pyrethrum flowers

This could be added to incense. Alternatively, melt a candle and add one part wax to the dried herbs, then remould over the wick and bum. The candle will splutter but don't worry about it.

Mosquito coils only protect where the scent and smoke flows. Since it flows upwards, ankles and knees are usually unprotected.

Mosquito light trap

Attach a funnel to a light - preferably a fluorescent light - then put the bottom of the funnel in a jar of water. Leave the light on at night. Mosquitoes will zoom up to the light, into the funnel and drown in the water. This also works for pesky moths and night zooming flies.

Mosquito repellent

Combine:
1 part lavender oil
1 part pennyroyal oil
1 part eucalyptus oil

This may be combined with three parts moisturiser or olive oil - or three parts sunscreen - depending on whether you are using it during the day or at night.

Moths

Moth proofing carpets is one of the major sources of organochloride contamination of fish in rivers, seas and estuaries. Sprinkle with lavender oil to repel them instead. Use a pyrethrum spray when you discover an infestation. Vacuum often and clean up dead flies by the window - they attract carpet beetles.

Moth repellent rinse

Cover any of the following with boiling water: wormwood, lavender flowers, rosemary, santolina leaves, lemon rind, lemongrass, lemon balm. Cool, strain, add one tablespoon of eucalyptus oil or lavender oil for every six cups of rinse.

Pomanders

These clove-studded fruits can hang in cupboards to keep away clothes moths, in drawers to keep away silverfish, or simply hang over the dressing table or bedstead to help sweeten the room. Take any citrus fruit, wrap a ribbon or string around it, then fill in the remaining space by pressing whole cloves into the skin. Leave to dry. You can roll the fruit in orris root to preserve the scent for longer and to add a faint violet perfume, but this isn't necessary.

Pomander bags

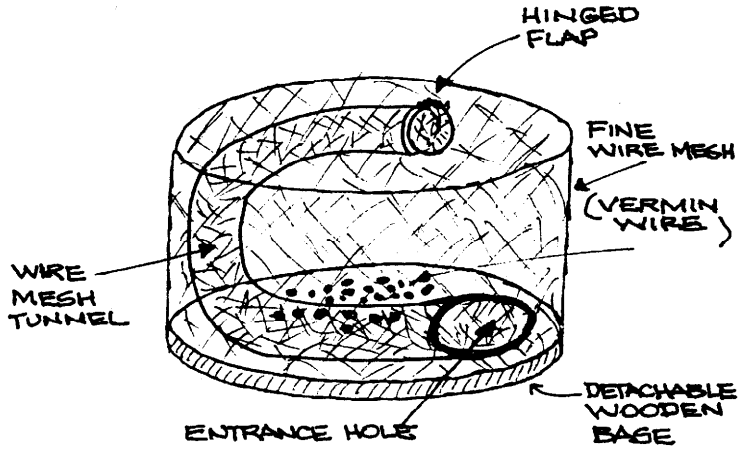
Mix:
½ cup ground orris root
½ cup powdered cinnamon
½ cup whole or ground cloves
2 cups of finely grated orange peel, dried in the sun or the oven till rubbery. Place in small bags made of an old sheet or pretty cotton, tie up the tops and hang in wardrobes or leave in drawers to repel moths and sweeten musty odours.

Clothes moth sachets

Make sachets out of any of the following dried herbs: wormwood, cloves lavender, rue, santolina, marigolds. Mix with a little orris root, valerian root or citrus (rock rose) leaves to help preserve the scent.

Rats

Put food out for the rats for two or three nights. When they are eating it regularly, stick the trap over it: see illustration. You can either drown the rats inside, let them out somewhere well away from you house, or put them in a box and fill it with carbon monoxide from a lawn mower - a painless death.



This trap allows you to catch more than one rat or mouse at a time - and get rid of them without touching them.

Drawing, design, and inspiration by Bryan Sullivan.

Sandflies

Fill a jar with lemongrass and pennyroyal, add one part meths and one part olive oil - or replace the oil with sunscreen for a dual-purpose screen. Let the herbs and meths marinate for three weeks, then strain and add one part solution to one part sunscreen. Note: This will thin the sunscreen and you may have to let it dry then apply another layer for equal effect.

Silverfish

Any strong scent will repel silverfish. Try using cloves, lavender or eucalyptus oil. However, if they are hungry, it is hard to repel them - silverfish have to eat. To make silverfish bait, scatter diatomaceous earth or borax along shelves. The diatomaceous earth will grind away their exoskeletons and the borax will stick to their feet and slowly kill them as they lick it off.

Spiders

Spray places where spiders like to hover or make their webs with either powdered sulphur or Bordeaux spray. Replace when the spray wears away. This won't kill spiders -just repel them.

Weevils

Store dried garlic cloves - there is no need to peel them -with dried beans or grains to repel weevils. The dried garlic won't make the food stink, although the container will smell slightly when you take the lid off. Spreading dried garlic cloves along bookshelves will also repel silverfish - though more attractive repellents like lavender are as effective.

Weevil trap

Trap the moths that lay the weevils. Fry something in bread crumbs. Keep the crumby oil and place it in an open jar in the cupboard. The moths will be attracted to the smell and drown in the oil. Replace every six months.
Note: For best control, make sure all food is in sealed containers. Packets are often contaminated by weevil-infected residue from open packets, so clean them well before storing.

The pièce de résistance

This is for every male who dreams of being a great white hunter.
Take an old soft drink bottle, cut it off at the shoulders, tape the top into the bottom so it becomes a funnel. Put two holes at the side and slip in some string so it can be hung up. Label it *Fly Trap.*
Add two prawns and a raw egg and cover with water. Place high up under the eaves so it doesn't fill with water when it rains. Wait four days and watch it fill with flies. The flies are attracted to the scent, fly down the funnel and can't get out. A couple of these fly traps really do make a difference to the flies around the house - and the scent goes up, not down, as long as you place it fairly high up. ☼

Jackie French has written over 30 books. She is heard regularly on ABC radio around Australia, appears as a regular on Burke's Backyard *and writes for* Women's Weekly *and* Earthgarden.

THE LOW-WATER GARDEN

Imelda Evans

AUSTRALIA is the driest settled continent in the world. Prolonged and devastating droughts are common, and in most places, evaporation exceeds rainfall. This is not news to most people, but our use of water continues to imply that it is an inexhaustible resource. *Beautiful gardens with less water* estimates that in urban areas of Australia, domestic water use represents about 52% of all water consumption, and of this about 40% goes onto gardens. Other sources say the figures are higher still.

That's a lot of water that could be used for drinking and keeping cattle and crops alive.

But if the farmers and the environment aren't enough to move you, consider user-pays water charges. Very soon, if not already, a water-saving garden will be a very good friend to your hip pocket.

A garden full of cacti?

I can hear the wails already (in fact I did, from everyone I spoke to about this article), 'but I don't want a garden full of cacti and drab Australian natives!'

Well you don't have to have one. You don't have to sacrifice beauty - or even all of your water-hungry exotics - to have a water-efficient garden.

There are six key factors in the creation of a water-saving garden:

- designing to suit your conditions and needs
- rationalising lawn areas
- choosing and grouping plants appropriately
- watering efficiently
- mulching
- maintenance

Photo: Lorna Rose, from *Beautiful Gardens with Less Water* (Lothian, 1994)

Above right: Think low-water gardens are cactus-filled dust bowls? Take a look at *Tipperary Church*, a private garden in York, Western Australia, and think again!

Design

The three most important elements when designing for a water-efficient garden are climate, soil and how you want to use it.

Soil

Get out in your garden and get to know it. Dig up a few handfuls of soil from several different places, and study it. Is it clay or sand? After rain is it wet, dry

or waterlogged? Does it differ from place to place?
Your soil is what carries the water that falls on your garden to plant roots and makes it available to them. It makes sense that the better your soil is able to do that, the more water-efficient your garden will be. Unless you are lucky enough to have a garden full of well-drained loam with heaps of rotting organic matter and worms in it already, chances are your soil could do with improving. There are any number of books on this subject, but a good rule of thumb is that any soil will be improved by the addition of heaps of organic matter. Sand will hold water better, and clay will allow better penetration of water to plant roots. So start mounding up the compost heap, or read up on no-dig gardening.

Climate

Observe the climate in your garden - during the day and during the seasons. Start with the overall climate - for example, if you live in Perth, you live in a 'Mediterranean' climate. This classification will help you identify other parts of the world which have native plants that may suit your garden. And it's not just the plant types -learn from the garden design of places with a climate similar to yours. Open your mind to aesthetics different from the English country garden style that has historically dominated our garden design in Australia, but which is singularly inappropriate to our weather.
But don't stop there. Look at climatic elements specific to your area. For example, you may live by the coast and get strong salty breezes, or in a valley that is always more humid than the surrounding hills. These local variations can be crucial to the amount of water a plant needs to survive and thrive. A simple rain-gauge in your garden can also yield useful, and sometimes surprising information.
And finally, there are micro-climates within your own garden. Do you have a long shady strip by the side of the house that never dries out, or a brick wall facing north that is always warm? Micro-climates can modify the overall environment and make it possible to grow plants that may otherwise struggle. And best of all, you can manipulate them -which is more than you can say for other climatic influences!

Usage

Finally, decide what you want out of your garden. Do you want an area for kids to play, an area to work and store things, an area to hang washing and an outdoor entertaining area, or do you just want something pretty to look at while lying by the pool? You may find that a paved courtyard with a grape vine is all you really want out of a garden, which makes it pretty silly if you are watering and fertilising vast areas of camellias, rhododendrons and lawn.
And speaking of which...

Lawn

Lawn is good for kids and picnics, but it is very water and maintenance-hungry - a poor performer in a water-sensitive garden.
The key with lawn is to rationalise it. Have a good hard look at the places you have lawn now, and see if there are other, more water efficient ways to use those areas. The ubiquitous suburban front lawn is a good place to start. What do you used it for? If you park cars on it, your lawn is probably half-dead anyway, so why not replace it with a no-maintenance hard surface? If it is just for looking at, it would be much more water-efficient, not to mention more attractive and easier to look after, if the area was filled with drought tolerant groundcovers, or a native garden. In entertaining and other traffic areas, hard surfaces are more practical and safer than turf, as well as more water efficient.
Even where you do decide to have a lawn, you can do a lot to minimise its water needs. Grow a grass type that suits your soil and that is tough and drought resistant. Unfortunately, many of the toughest grasses are also the invasive ones, but there are many varieties around these days. A good nursery should be able to help you choose a variety, or a blend, that will suit your needs.
If you have chosen carefully, a little maintenance will go a long way to helping your grass stay healthy. Don't traumatise it by cutting it too short, keep the blades on your mower sharp, and don't try to grow it under trees. Make the shape of your lawn one that is easy to water - so you don't end up with water lapping onto garden beds that don't need it, or awkward corners that never get watered. And keep in mind that your backyard is not the MCG. Water enough to keep your grass alive, but don't worry if it goes brown in the summer occasionally - it will revive when it rains.
And unless they're dangerous, don't worry too much about the occasional weed. Some of them (some kinds of clover, for example) are actually beneficial to the soil.

Plants and maintenance

Those who think that only cacti and gum trees are drought resistant will be pleasantly surprised by the number of plants - including a plethora of flowering ones - which can be grown in a

USEFUL RESOURCES

Beautiful gardens with less water, John Patrick
Lothian Books, 1994 $12.95

Water-saving gardening in Australia, Kevin Walsh
Reed Books, 1993 $34.95

No garbage, Allen Gilbert
Lothian Books, 1992 $12.95

The Reverse garbage garden, & *The Reverse garbage mulch book*, Sandra Clayton, Hyland House, 1994 $16.95 each

Permaculture International, PO Box 6039, South Lismore NSW 2480
ph:(066)22 0020

Diggers Seed Club, Heronswood, Dromana VIC 3936
A great source of information on tough, drought-resistant perennials. Mail-order seeds.

The water utility in your state.

This beautiful low-water garden makes use of gravel rather than lawn; a drip-watering system; low-water-demand plants and heavy mulch.

water-efficient garden. The box on this pages has a short list of my favourites -not least because they are mostly idiot and neglect tolerant, as well as drought resistant! - but there are many more. The two water-saving gardening books mentioned in this article are both excellent sources of information and guides on plant choice.

Another excellent source of information is a stroll around your neighbourhood looking at neglected gardens. Make a note of the plants that are in riotous bloom, and/or taking over the garden - this is information about tough plants that suit your particular area that no book can give you.

Once you have chosen your plants, group them according to their needs. Putting a plant that likes a wet, heavy clay soil next to a West Australian native that flourishes in free-draining sand is a recipe for at least one sick or dying plant and a bed that is impossible to water efficiently.

Zone your plants (and therefore your water use) to reflect your use of the garden. Near the house, lush plants can help modify the temperature of the house, and help create a cool escape from the summer sun. Lead run-off from down-pipes and paving in this area onto the garden to minimise supplementary watering. Further away from the house, where lushness isn't needed, the plants can be tougher and able to cope with little or no extra watering. This kind of plan provides an ideal opportunity to plant local natives and encourage wildlife. If your neighbours follow a similar plan, you can create a wildlife corridor through your area.

Finally, when you have planned and planted your garden, look after it. A little bit of regular maintenance goes a long way towards keeping your plants healthy and happy. A healthy plant is a lot more able to resist all sorts of stress - pests and diseases, as well as a low water regime -than one which has been allowed to suffer unnecessarily.

Watering and mulching

If you are not mulching your garden to a depth of at least 5cm, you are losing precious water to evaporation, making it much easier for weeds to grow, and losing a great opportunity to improve your soil. There are hundreds of things you can use for mulch. Organic mulches that rot down, such as pea straw, are generally preferable, as they enrich the soil, but anything is better than nothing. The books listed in the 'Useful Resources' box can enlighten you on their relative merits. Make sure that whatever you use is not forming a barrier to water penetration, and don't crowd it too close to plant stems, such as tree trunks, or they can develop collar rot. That done, mulch with abandon!

Light, frequent watering encourages shallow root growth, which leaves the plant gasping when it is called on to cope with drought. It may also be providing much more water than the plant actually needs. Encourage deep root growth and toughness with less-frequent, deeper waterings. Many plants can be gradually weaned onto a low-water regime using this method.

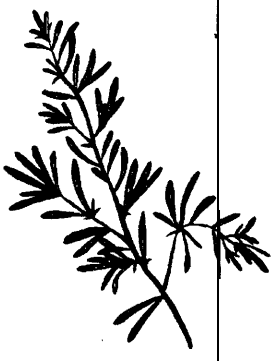
Be aware of wastage in your watering system. Make sure that sprinklers are covering the area effectively, without spilling water onto paths, roads or beds that don't need it. Don't water with spray systems or sprinklers when it is windy, or with anything during the heat of the day, or you will lose substantial amounts of water to evaporation. Generally, drip or weeping systems are the most efficient and they are suitable for most plants, but avoid set-and-forget timers, which could have you watering when it is pouring with rain, Also check the system regularly for blockages, holes or other problems.

Other tips

There is an increasing number of products on the market to help you save and re-use water. Consider installing a *Suldi* valve (see Products, ST#49) and take a look at the new compact rainwater tanks. Even something as simple as keeping a large jug in your sink, and washing your vegies over it can re-use an astonishing amount of water. Be open to the possibilities - and look forward to enjoying a flourishing, water-efficient garden. ☼

Some water-saving favourites

Lavender
Evening primrose
Geraniums and pelargoniums
Marguerite daisy
Nasturtiums
Geraldton wax
Hibiscus
Comfrey
Rosemary
Seaside daisy
Pot marigolds
Potato vine
Roses
Wisteria
Oleander
Alyssum
Sage
Thyme



POWERFUL POSSIBILITIES

If you've ever felt you had the right ideas on clean energy, but needed documented evidence to support your argument, have a look at Gavin Gil-Christ's book The Big Switch. *Elizabeth Walton went to talk to the man who has recorded the details of every thwarted attempt to get renewables up and running in this country.*

Elizabeth Walton

SPEAKING at the ABC TV studios in Sydney where he is the national Science and Health Reporter, Gilchrist is ever the optimist and remains convinced that Australia is ready for renewables. As he says in *The Big Switch*, 'In this country, we are so blessed with amounts of sunshine and wind - and now we're seeing that we're blessed with large amounts of geo-thermal energy as well. We've got it all sitting there just waiting to be tapped into'.

Gilchrist believes the only thing needed to connect the consumer to the green producer is a distributor with vision, 'If that green producer can just find one electricity distributor who is sympathetic to these things, and realises that this is where the market will be, then it will be up and running within six months.'

Electricity companies can work very fast when they want to because their structure is very hierarchical, he says. 'If the head of *Pacific Power* said, "We're building a solar power station at Cobar, it will be gas boosted, it will feed into the grid, and construction will begin in a year and a half', it will happen - it's as simple as that.'

Missed opportunities

The problem is that regressive directives from industry heads are approached with blind dedication. One poignant example is the abandonment of a plan to upgrade fourteen remote Torres Strait Islands with solar technology, which would have replaced many ageing, noisy, polluting and expensive diesel generators on the Islands.

Solar was originally chosen for the upgrade because it was found to be the cheapest option. Problems began to emerge, however, when the Queensland *Electricity Commission* (QEC) took control of the project. 'As a result, the [solar network] was never built. Instead, the QEC installed diesels on all fourteen islands: conventional systems with no advanced batteries or electronics, just diesels chugging away 24 hours a day.'

What should have become a leading example for renewable technology in Australia became nothing other than more of the same. 'It's a tragedy', says Gilchrist. 'This whole industry is riddled with case study after case study of lost opportunities.'

Rigged figures

Gilchrist took leave from the ABC to write the book, after he realised that renewable energy had quietly matured into a cost-effective, commercially viable industry during the 1980s. 'Suddenly it became clear to me that these things were cost effective - now!'

In a sun-drenched country like Australia, you would think that makes sense. 'But not if you compare the cost of electricity at the power station with the cost of solar electricity where it's produced', says Gilchrist. 'All the figures are rigged.' *The Big Switch* explains how traditional ways of calculating electricity production costs have excluded the price of delivering electricity back to the consumer. 'If you look at the consumer and work backwards', Gilchrist says, 'rather than starting at the power stations and going forwards, then you realise that the economic formula is quite different'.

Distribution of electricity produced by large, remote power stations means that up to two-thirds of energy created in burning coal is lost. It is vital that the method of calculating costs includes the cost of distribution, so that smaller producers can compete. This is the only way to create a level playing field, which would be expected, if not demanded, in any other industry.

It's not all bad news

While it's true that there have been countless instances of lost opportunities, Gil-Christ hastens to add that there are many positive developments as well, such as a proposal to install solar collectors along a Victorian freeway, similar to a system in Switzerland. '*Citipower* in Melbourne [have been] working to put in quite a large solar system along the Tullamarine freeway...it will feed into the grid', he said.

Other promising developments have been the result of Dr Andrew Blaker's research at the Australian National University (ANU). 'The ANU announced about a month ago that they had the world's most efficient thin film technology', Gilchrist said, and Andreas Luzzi, another ANU researcher, is looking at ways of storing solar energy to delay use, 'He's hoping to make an announcement early next year...that it does work'.

Gilchrist says that Pacific Power conducted studies five years ago, which reflect the general public's enthusiasm for converting to clean power, 'That enthusiasm spills over into a desire to actually cough up'. The results of this study however, have never been publicly released.

The Big Switch and the ensuing publicity, which included an interview on the *Four Corners* TV program, may help to prompt the industry into action. If the industry or the government did respond to his work, it would not be the first time that Gilchrist had received such attention - his expose of the Medicare industry in 1986 lead to a Federal Inquiry into Medicare fraud.

Convincing government

Publicity may prove to be the catalyst for change in the industry, but it's going to take a visionary leader to put those changes into action - someone like David Freeman, who transformed a US power company from a nuclear producer to a clean producer in just four

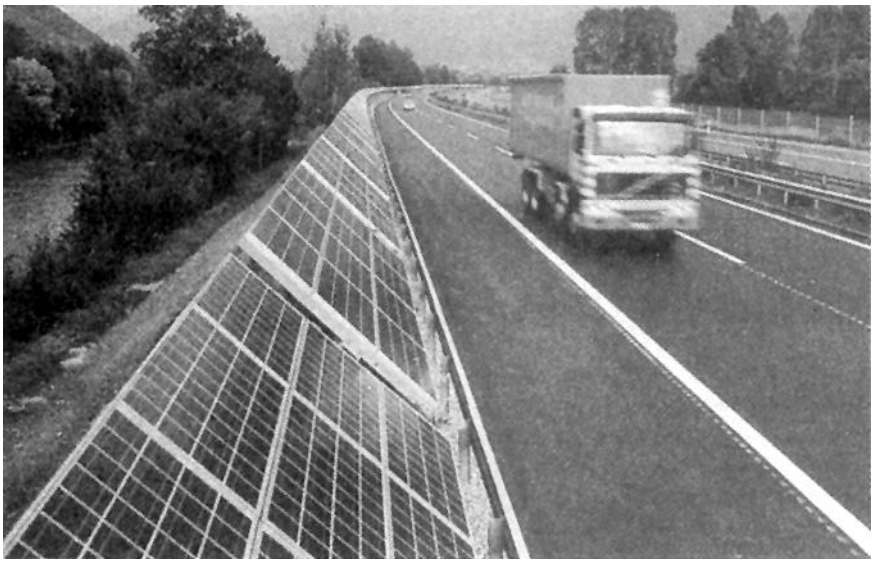


Photo from *The Big Switch*, courtesy University of NSW.

Generating solar electricity beside a highway in Switzerland. A similar development is proposed for a Melbourne freeway.

years. The key to his success was in changing the company's focus from being an electricity producer to being an energy service. This included creating a high-profile energy advisory service, which changed the face of the electricity company profoundly. Gilchrist's book says, 'Sacramentans had by March 1993 received 21,000 home energy audits, had 758 solar hot water heaters installed and had 72,000 shade trees planted. They had traded in 46,500 clapped-out, energy-wasting fridges.'

The only thing stopping a similar attempt in Australia he says, is the lack of a leader with the conviction to take on the role.

'It's not as though anyone has to create a market', he continues: 'The market is there.' But that doesn't mean green power producers have any easier a job of convincing the Government that it's time to change.

Gilchrist says that Australian Governments have a preference for implementing seemingly fail-safe recommendations from the traditional power producers, and disregarding innovations from all other sources.

This occurs at both State and Federal levels, 'I've tried to document right through the book the appalling quality of advice that State and Federal Energy Ministers have been getting through the years,' he said. 'I think if the [Federal] Minister realised that his department has what the Auditor General described as an "incredible malaise in energy efficiency", then he would fix that.'

Gilchrist says there is little potential for fixing the problem at present, since other important issues such as the drought are higher on the Minister's agenda: 'It's the classic case of the short term being more important than the long term - obviously the drought is very important, but the long term is important too.'

Change or be forced to change

If the Australian Government does not hastily administer a solution, then the country may come under increasing international pressure from countries who have signed the climate convention, which Australia has also signed.

'There's obviously going to have to be a phase two strategy', Gilchrist says. 'We can't seriously go to Berlin to the convention next March with what we've done so far.'

Gilchrist hopes he has helped to remove the perception that because Australia is remote and diffusely populated, it is difficult for the country to clean up its act. 'There's no evidence for it', he says, 'Just because we're a far-flung country, it's got nothing to do with our emissions, the simple fact is we are hopelessly inefficient in our energy standards, and we clear far too much land every year.'

'The point is', he continues, 'we have signed this convention. Other countries have signed and are moving ahead.... A lot of European countries have committed themselves to targets much more difficult than our own.'

Gilchrist says that we may soon find ourselves in a situation where we have specific CO_2 restrictions imposed on us, as well as formal international monitoring to ensure that those restrictions are strictly observed. 'The targets are not going to get easier. Whereas there were vague references to cut backs and stabilisation before, probably within a year or two there will be real cuts with specific deadlines and...an international police force that will enforce that.'

Overseas inspiration

According to Gilchrist, Australia could easily meet the Toronto Convention goals within five years, just by following overseas examples such as California, which has over ten years' experience in producing cost-effective, green power. 'In California they built 80MW in ten months', he said. 'We could have each state generation company, all building similar power stations, each building 100MW per year for the next five years, plus they could be putting in solar panels on the roofs, plus having massive energy-efficiency campaigns - so we would easily make the Toronto goals.

'But don't take my word for it', he says. 'The SEC said that they could meet the target by 2005 with a 2.1% increase in power prices each year, above business as usual...and the technology has improved significantly since then - so if they reckon we could do it, why wouldn't I?'

Green technology in Australia has suffered its share of setbacks and disappointments during its quiet development. But Gilchrist firmly believes the industry has flourished in adversity. He believes Australians are ready to take the plunge, and he's optimistic the technology is ready to take them into the next century, 'I think we can make the Big Switch by the turn of the century without any trouble at all'. ☼

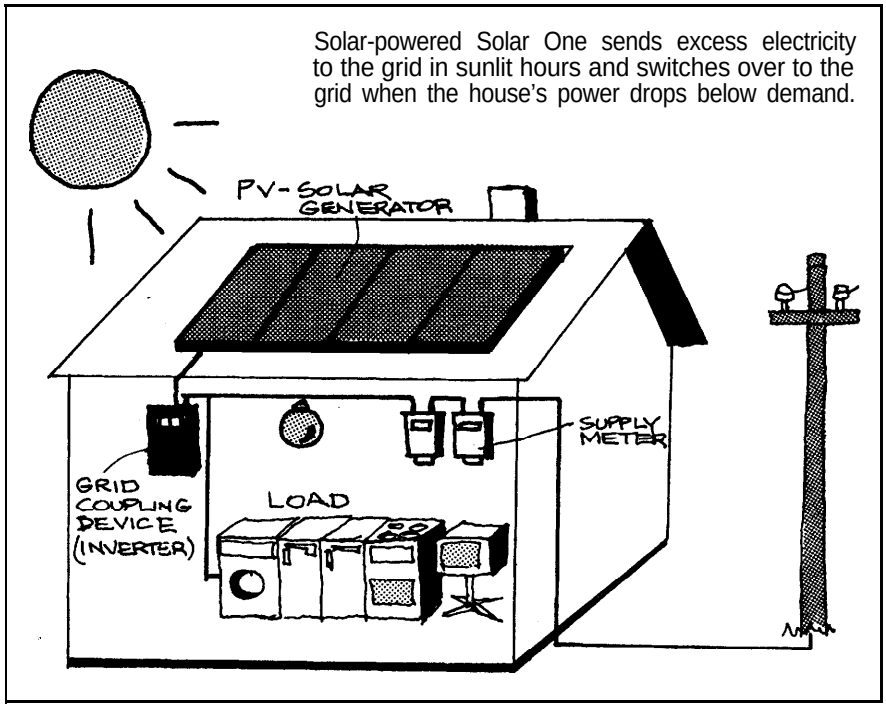
The Big Switch by Gavin Gilchrist is published by Allen and Unwin, $16.95rrp.

SELLING power to the electric company

A solar-powered house is many people's idea of the perfect home. Solar *One, at Mt Coolum on Queensland's Sunshine Coast, goes one step further...*

Ben O'Loughlin

Research by Paul Edwards



Solar-powered Solar One sends excess electricity to the grid in sunlit hours and switches over to the grid when the house's power drops below demand.

Diagram of *Solar One*'s solar electric system. (*Powercorp Ltd.*)

SOLAR One could be the renewable energy industry's big break. In an Australian first, an alliance has been formed between *Solarex, RF industries, South-East Queensland Electricity Board (SEQEB)* and the *Australian and New Zealand Solar Energy Society* (ANZSES) - to name a few of the twenty sponsoring companies - in an effort to create a project that tests their different products together in the one home, rather than in isolation.

There have been many projects where installers and companies have offered their services in isolation; including solar passive design, greywater management, alternative power supply options and 'green' construction materials. In the past these companies marketed their products to 'stop the energy gap' in your home or business. Never before have the players in the renewable energy and energy-efficiency industry come together from the beginning to produce a complete product.

One of the results of this ground-breaking cooperation is the successful completion of Australia's first energy efficient, environmentally low-impact home-powered by grid-interactive photovoltaics that sells power back to the grid. Can you imagine receiving a cheque from the power company instead of a bill?

Selling electricity back to the regional distributor might sound a bit like selling sand to the Sahara. Yet, when you think about it, SEQEB's development of interactive grid technology to supply excess current back to the grid actually makes good business sense.

From as far back as 1989, the Queensland Government was aware of the future dilemma awaiting the power industry. Fed by an ageing dinosaur of a power system, the government realised that by winter 1998 there would be serious energy shortages throughout the state. The options at the time were to either buy power across the border from New South Wales, or to patch together the existing system of old and inefficient generators with new highly-expensive but smaller generators. Either would have resulted in locking Queensland into a dependence on a very inefficient and expensive system for the next thirty years.

So it seems in promoting grid interactive technology and energy efficient appliances, SEQEB has forgone maximum short-term gain and has gone for the intelligent solution of reducing massive capital expenditure by reticulating cheap, locally-produced electricity through the grid to burgeoning supply. Not only is this good for the Government's Balance of Payments and the economy generally, but the benefits to the environment of a solar-boosted grid are beyond measure.

So innovative was this project that it forced the utility to completely redraft part of its environmental policy and safety procedures; institute a pricing schedule for small cogenerators; and undertake a complete critical analysis of the Electricity Act of Queensland. Obviously, SEQEB anticipated that the Solar One project was the vanguard of an emerging wave that will radically alter the way we generate and supply energy.

World interest

Solar One opened at an opportune time. It acted as a display centre showcasing some of Australia's best renewable energy technologies when a delegation of high-ranking Indonesian officials visited Australia in late July last year. The delegation announced the success of President Suharto's solar energy initiative: a pilot program designed to bring power to remote rural homes by installing 40W photovoltaics. This program attracted the attention of the World Bank, which strongly encouraged the initiative as it directly addressed the nation's long-term agenda to develop human-resource-based industries and

Solar One, near the foot of Mt Coolum on Queensland's Sunshine Coast. The area is beginning to support one of the fastest growing urban corridors in Australia.

wipe out poverty. The delegation invited the Federal Government and solar cell industries and research institutions to form trade and technology links across the Timor Gap and assist in the realisation of a $615 million plan to install 50 megawatts of photovoltaics into the homes of.6 million people in remote rural communities.

Solar One: when, where and how

Situated near the foot of Mt Coolum on the Sunshine Coast, Solar One is located in an ideal environment for testing and promoting solar energy. Not only is this area famed for its high number of sunny days, but it is beginning to support one of the fastest growing urban corridors in Australia. This should help annihilate the stereotype that renewable energy systems are only applicable to remote area applications, some large industries or the terminally eccentric.

Solar One incorporates passive solar design, maximises the efficient use of energy and materials, implements recycling and reduces indoor and outdoor pollution.

The structure has an east-west alignment with north-facing windows. The window area equals twenty per cent of the total floor area, and a 900mm overhang eliminates intense summer radiation while allowing the winter sun to penetrate and warm the house.

The materials used in the structure range from compacted earth to aggregate concrete walls. It was built using sands and clays from the site.

Non-toxic, low-allergenic, foil-faced *Green Butts* were used as insulation. Low formaldehyde veneers, and recycled and plantation timbers (hoop pine) were used for roofing beams and windows.

Hot water is generated by an LPG-boosted solar hot water system: the *Solarhart Natural Wonder*. LPG is also used for cooking.

Shower and bath greywater is reticulated through a *Hydrosave* unit to the three/six litre low-flush toilets, reducing water usage and sewage production.

All appliances have been selected for energy efficiency and bear the five star rating.

The solar/grid system

Power is generated by a 1.3KW photovoltaic array consisting of 16 *Solarex MSX83* panels configured in a series parallel array. The 12 square metre array produces 96 volts DC and averages 6kWh per day. Power is then conditioned to 240 volts AC via the 'smart' *Butler/Siemens Sunsine Sinewave* inverter to supply the household load and the grid.

There are no batteries in the system. Because the house is connected to the grid, the grid itself acts as a storage system. On sunny days, the house produces excess electricity which is fed into the grid. At night or when electricity production falls below supply - in stormy weather, for example - the inverter shuts down and grid current kicks in. For this reason, income from generated power is not expected to be high. But since Solar One opened (in June 1994) it has never been sent an electricity bill, and the meter is currently running well in credit.

Remote sensing equipment tracks outside weather conditions and the performance of the energy-efficient house. The excess current exported to the grid is measured alongside the grid current that is imported.

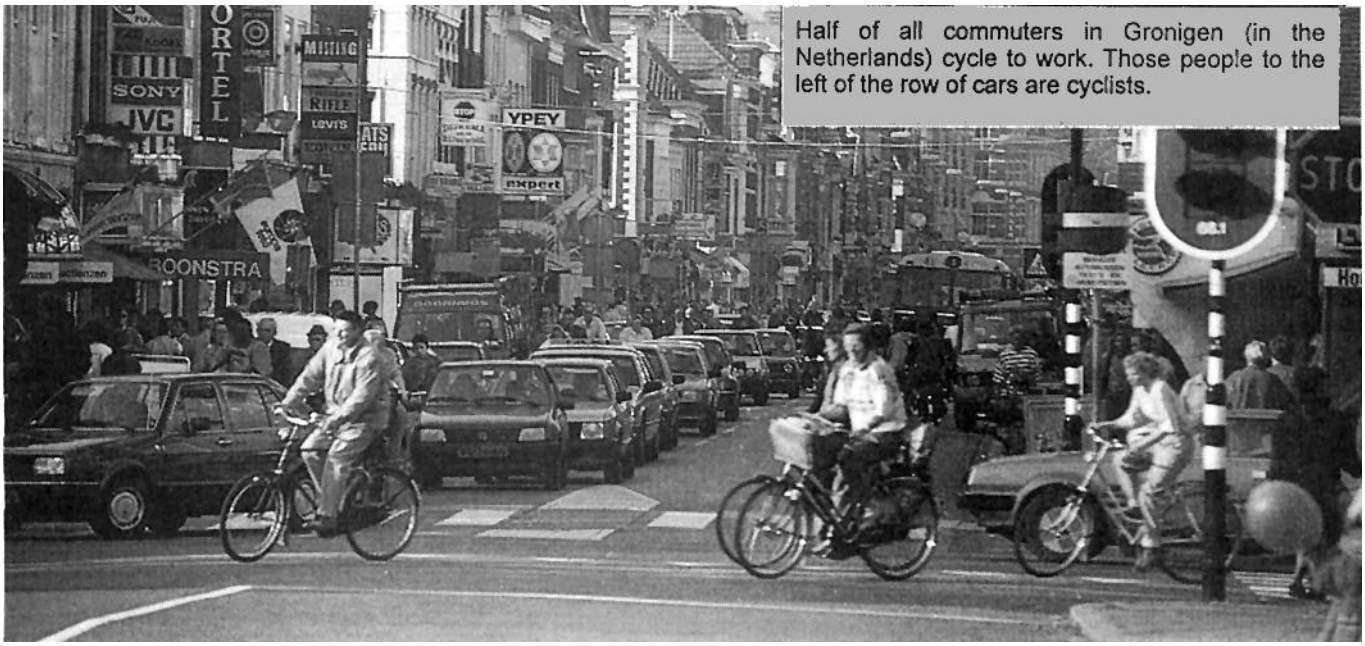
In a recent reading of the import and export meters, it was found that the house had supplied 100kWh more than the house had imported from the grid. The combined effect of all the design elements existing in the house has resulted in an energy consumption that is one third of the Queensland average.

It is hoped that the house will, at the end of the two year testing period, be opened as a renew able energy guest house, where people can experience living in a low-impact house that could even generate electricity as a cash crop. ☼

To arrange a visit to SoIar One, contact Paul Edwards, RF Industries ph:(07)252 7600.

Paul Edwards installing solar panels on the roof of Solar One.

THE SUSTAINABLE CITY and THE GREEN MACHINE



Half of all commuters in Gronigen (in the Netherlands) cycle to work. Those people to the left of the row of cars are cyclists.

Alan A Parker

THE bicycle is the truly green machine. It does not pollute, and cycling has an ergonomic advantage over walking so that we can go more than three times as far for the same physical effort. It is the in-between machine that for the same effort as walking provides access to ten times the area, and is usually a quicker alternative to the short urban car trip of less than three kilometres.

For households, bicycles can stretch the usefulness of the family car and avoid the purchase of second or third cars. For those without a car, it makes railway stations far more accessible.

In the Netherlands and Japan, partnering bicycles with public transit in outer suburban areas is a quick way of getting to express bus stops and stations. The Netherlands rail authorities are increasing train travel solely by encouraging bicycle access through providing secure bicycle storage. By the year 2010, storage for 200,000 new bike/rail patrons is planned.

In Japan, there are now 3.25 million bike/rail patrons and there will be 5 million by the year 2005. Encouraging bike/rail travel is just one of the very many ways the Japanese are constraining car use and implementing their commitment to reduce carbon dioxide emissions, which are already much lower than ours.

City transport systems can be sustainable if able-bodied people are encouraged to use bikes in Australia's bicycle-friendly climate. The enhancement of public transport accessibility by using bicycles as a feeder service is shown in the table below. With some intelligent transport planning we could do away with freeways and smog-laden cities!

The problems of motorisation and urban growth are common to all countries. As cities grow, outer areas are suburbanised, commuter trips get longer and road-based decentralisation of employment isolates existing rail transport systems from their patronage base.

A much greater use of bicycles to access electric trains can reduce the

Station catchment area data for constant output of physical effort
(75 watts for 7.6 minutes)

	[pedestrian]	[cyclist]	[racing cyclist]
Effort advantage	1.0	3.1	3.8
Speed (kmph)	6.1	20.0	23.0
Distance (km)	0.8	2.5	3.0
Catchment area (km^2)	1.3	12.4	19.0

Cycling is more efficient than walking for gaining access to stations and bus stops.

proportion of long urban car trips between 12 and 60 kilometres, which in turn reduces peak hour road congestion, air pollution and greenhouse gas emissions. In Melbourne, for example, only 12% of the population is within easy walking distance of a station but 80% is within easy cycling distance.

In the Dutch and Japanese equivalent to our suburbia, where commuters travel long distances to work, the rail lines are mostly beyond walking distance but are within easy cycling distance. It is these outer areas that are most similar to Australia, and between 30% and 50% of rail patrons access the station by cycling an average distance of 2.2 kilometres.

Most rail patrons will not walk more than a kilometre and many will not walk more than 600 metres, so in outer suburban locations there very few people within convenient walking distance to a station. Most people cycling to the station travel from between 800 metres and four kilometres, with very few cycling five kilometres or more.

Government (in) action

Encouraging bike/rail travel and cycling generally is recommended in the Australian National ESD and Greenhouse Gas Reduction Strategies, but has not been implemented. In the Netherlands they have a National Environment Plan which is supported by a Bicycle Master Plan. In Japan they have had a National Energy Security Policy designed to make them less reliant on overseas oil supplies. This has provided the rationale for their expansion of cycling and railways.

In NSW and Victoria the rail authorities continue to ignore the need for secure bicycle storage facilities. Most of the bicycle racks provided do not comply with the Australian Standard for secure long-term bicycle parking. In Melbourne and Sydney bike/rail patrons have a greater than 50% chance of having their bicycle stolen each year.

Subsidised driving

The latest urban transport studies in Melbourne, Sydney and Perth show that the hidden (external) costs of urban driving are in the order of $4000 per car, per year - a subsidy so large that the government would need to double the price of petrol to recover these costs.

Note that the cost of petrol in Japan and the Netherlands is more than double what it is in Australia and car parking is very restricted and very expensive. In the Netherlands they know that many of their current problems come from motoring subsidies in the past, and that the total cost of running the railways results in a social profit.

The Australian government has been giving the wrong economic price signals to consumers for years. They have been subsidising a company car fleet of over 2 million for years.

Rail can be profitable

The myth put about by economists is that all rail systems are subsidised and run at a loss. This is not true: in Japan motorists pay for the hidden costs of the pollution they cause and this indirectly results in rail systems making profits. The key to rail profits in Japan is that the government does not subsidise motoring. And while Australians have free company car parking, a parking space in central Tokyo costs as much as the average working-class suburban home in Australia. Japanese companies mostly provide workers with subsidised yearly rail tickets and only the very top executives get company cars.

According to *an Asia Week* survey (December 18, 1992) of the 1000 largest companies in Asia, three Japanese rail companies made a combined profit of A$1.6 billion in 1992. These companies are greatly expanding their rail services and developing three different high-speed rail systems and commuter express systems. In the same survey, Victoria's Public Transport Commission (PTC), which lost $150 million in 1992, was one of the most unprofitable companies in the region.

World-best practice

One needed change in economic thinking is to adopt 'world-best practice' as being the best way to turn losses into profits.

The urban population of Australia is very similar to the population of the Netherlands, which makes the following comparison easier to grasp. In the Netherlands the mass market for bike rail travel is well established and growing rapidly. The bicycle is used for more than 35% of all journeys to stations. The average size of a guarded bicycle parking facility is enough to contain about 1000 bicycles, although there are over 3000 bicycles at Gronigen central railway station. It

'Concrete' benefits of bicycle culture

Government in the Netherlands began building up the bicycle infrastructure in the 1970s, using up to ten per cent of the roads budget. Today 50% of commuters in the city of Gronigen cycle to work. Using bicycles enabled a giant parking lot to be turned into a town square. A traffic-jammed street was turned into a highly successful open-air market. High-quality apartments in traffic-free precincts have been built on former highways. Larger cities like Amsterdam are trying to follow Gronigen's example.

The notion that urban motorists pay for the costs they incur through taxes on petrol and other road-user charges is a myth. The hidden costs of driving in Australian cities are around $4000 per year per car, so the cost savings to society of substituting bicycle trips for short car trips are high (59c per km). The net benefit of substituting one billion single occupant car-km with one billion bicycle-km is around $600 million a year. So there is an economic case for the Federal Government to invest a billion dollars on bicycle infrastructure over ten years.

— Alan Parker

Too much of a good thing?

In Tokyo, traffic police are working overtime handing out tickets for illegally parked bicycles.
In 1991 police 'towed away' more than 800,000 illegally parked bikes. Only half of the confiscated bikes were reclaimed; the remainder was destroyed.

— Earth Island Journal, Fall

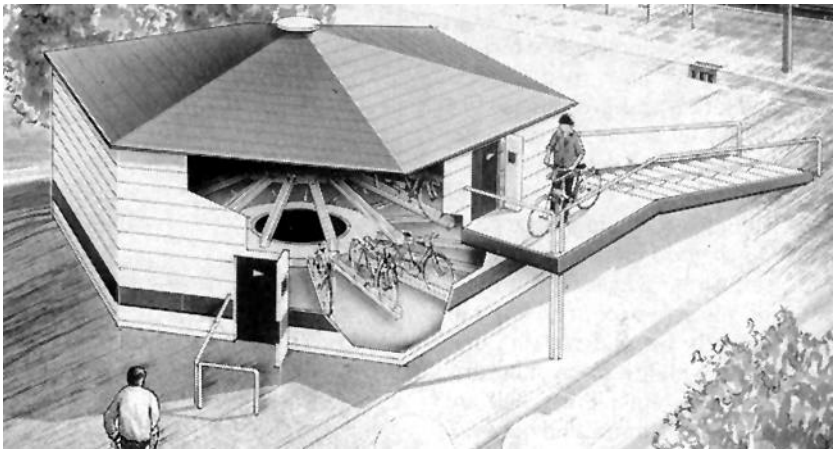
costs a cyclist about $100 a year, or $1 per day on a casual basis, to have a bicycle stored in a locker or in a garage with a security guard. Around one quarter of all bike/rail commuters have securely parked bicycles at both ends of their commuting trip.

If a city like Melbourne had the same proportion of bike/rail commuters as Dutch cities, there would be 35,000 bike/rail commuters - that is twice as many parked bikes as there are now parked cars:

We can learn from the Dutch how to make best use of railway station facilities and to enhance the station environment so that patrons feel secure, even when stations have no rail authority employees present. The staff at the guarded bicycle garages rent bicycles; repair, service and sell bicycles; and provide transport information services for cyclists.

The Dutch have also developed a unique bicycle storage system. The *Ficcaro* stores up to 88 bicycles, is completely automatic, requires no attendant and can be used 24 hours a day. The operating system is protected against electrical failure and acts of vandalism.

The Netherlands rail authorities have provided car parking spaces at stations but there are four guarded bicycle parking spaces for every car parking space, which gives us some idea of the priority they give to bicycles. In the future, car parking spaces will only be provided for the disabled.

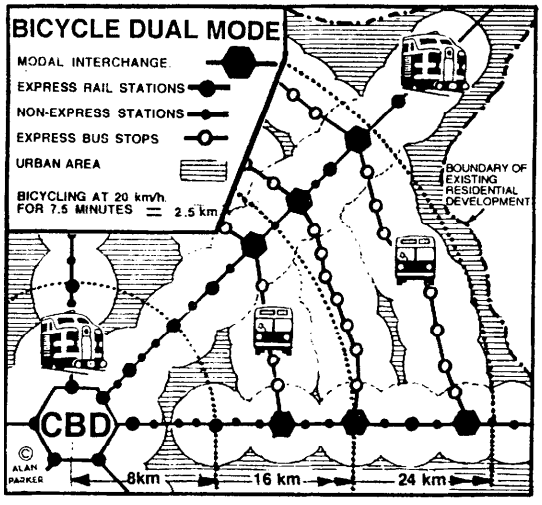


The Ficarro bicycle storage system.

Opening up the market

Transport planners in Australia need to convince themselves and their political masters the existence of a potential mass market for bike/rail travel. Interviewing people living within one and four kilometres of stations would reveal that potential, but that is not ever likely to happen given their 'petrol headed assumptions'. For the present we have to look overseas to see how it is possible to open up a mass market for bike/rail travel.

Taking bicycles on fully-loaded trains in the rush hour is not practical, so bicycle storage facilities are needed at both ends of the trip. Secure overnight storage is essential for around 20% to 30% of potential bike/rail users. With bicycle access at both ends of a rail trip, the rail system catchments are greatly expanded to include the entire inner suburbs and much cross-suburban travel – not just the CBD.



Quadrant of a large city and the catchment area of bicycle access to express bus and rail routes. Practice in the Netherlands shows that secure cycle storage makes bike/rail and bike/bus travel accessible.

Advertising campaigns to let people know that secure parking exists would be a starting point. More subtle marketing campaigns suggesting to families that bike/rail option may enable them to avoid the purchase of a second or third car are also likely to be effective.

Given Australia's lower population densities and lower land costs, perhaps our target should be to have two secure bicycle parking spaces for every car parking space - that is about 25,000 bicycle parking spaces on both the Sydney and Melbourne rail system.

The very low population density of many outer suburban areas means that there is an opportunity to think about integrating bicycles with new trunk bus routes.

If there were circumferential express bus services linked to the rail lines that radiate out from central business districts, bike/rail-express bus services could be used by nearly all able-bodied people in the major cities as is shown on the concept map.

To make these services work in Australia, the first step is to build up the patronage on the rail system and at modal interchanges. Measures designed to reduce the demand for car travel and restrict car parking would also be helpful.

We should be aiming to get hundreds of thousands of people back onto the rail system in our big cities. It is technically feasible but will never happen unless the Federal Government does something to ensure that there is a fundamental reform of our rail systems and that urban motorists pay for the hidden costs of congestion, air pollution, noise and the accidents they cause. ☼

DPIE DOES IT AGAIN – AT HOME

DPIE has done it again, this time at home. Well, not at its home in Canberra, but in a number of private homes around Australia. Sounds like mischief? Not at all. The Department of Primary Industries has been busy funding stand-alone power systems for people in isolated locations around across the country.

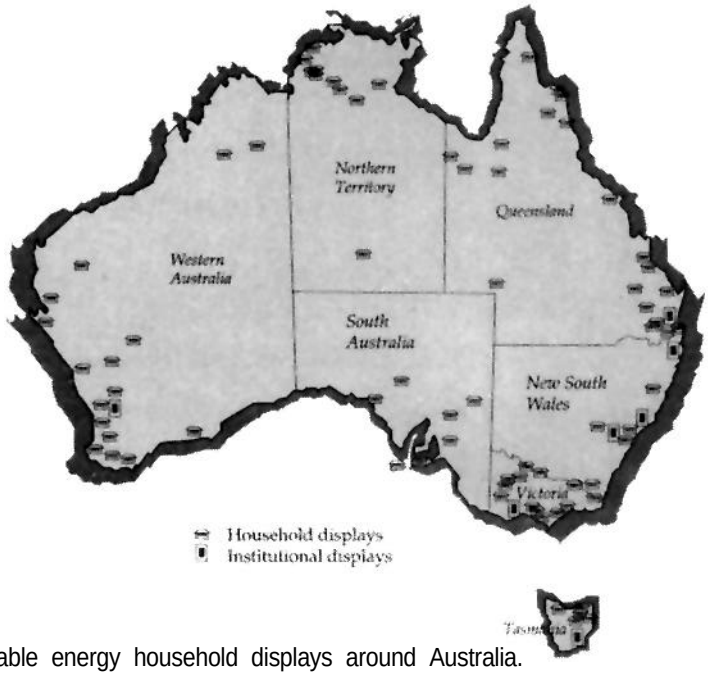
More than 70 home-owners applied to DPIE's Renewable Energy Promotion Program (REPP) for funding to develop hybrid renewable energy and diesel systems. Some of the houses have been set up as display homes under the Household Display program which was launched in Hobart by Senator Nick Sherry, Parliamentary Secretary to the Minister for Primary Industries and Energy, Mr Bob Collins.

Although the official Display program launch was on March 1, a number of the homes have already gone on display to show other residents of remote areas how to develop their own stand-alone systems. One of REPP's most important criteria required that applicants not be connected to the electricity grid. The Department's goal was to show that hybrid renewable systems *can* work well *and* save money.

REPP promotes the use of renewable energy, with the emphasis on stand-alone power supply systems. The focus of the program is on rural areas where grid electricity is not readily accessible.

The program aims to show people living in rural areas that Remote Area Power Supply (RAPS) systems can provide an efficient and reliable energy alternative to connection to grid power. RAPS can also help to reduce dependence on existing diesel generators through easily maintained and reliable systems. In environment and economic terms, such an option makes good sense.

RAPS systems have been designed and implemented for households of various sizes, ranging from large outback stations through to smaller low cost units for domestic use in typical family homes. These systems associated with the Renewable Energy Promotion Program may be found on display throughout the country.



Renewable energy household displays around Australia.

Specific technologies displayed include solar panels, wind turbines and hydro-electricity generation systems, together with a variety of battery storage systems with back-up power in the form of petrol and diesel generators.

The household displays offer interested people the opportunity to observe renewable energy systems by visiting functioning homes where the owners have been involved in the development of systems to meet their individual needs. Such displays indicate that users do not have to compromise their lifestyles and that renewable energy systems can be workable and financially viable.

The Alternative Technology Association's *Energymobile* has once again been commissioned by DPIE to tour rural areas and promote the use of renewable energy as part of the program. The focus of this year's tour will be to visit household displays in Eastern Australia and to attend launches and open days.

-John Molenaar & Suelette Dreyfus

For further information about the displays in your state, contact:

Victoria
Bruce McKenzie
Energy Victoria
5/115 Victoria Parade
East Melbourne 3002
ph:(03) 412 6886 or (03)412 5666

Queensland
Frank Barram
Alternative Energy Advisory Group
Department of Minerals & Energy
61 Mary St, Brisbane 4000
ph:(07)237 1486

South Australia
Marino Bolzon
Office of Energy
Lvl 19, Wakefield St,
Adelaide 5000
ph:(08)226 5500

New South Wales
Robert Brown
Office of Energy
Minerals and Energy House
PO Box 536, St. Leonards 2065
ph:(02)901 8764

Other states
Rusty Branford
DPIE
GPO Box 858, Canberra ACT 2601
ph:(06)272 5077

Caravanning with Solar Power

Many people have the dream of travelling around Australia in their caravan; going where they want when they want, and seeing as much of this marvellous country as possible in the process. Doing this in a caravan that is fitted with its own renewable power system can make the journey a little more comfortable.

Lance Turner

RON and Carol Lawrence live in a relocatable home park just out of Gawler in South Australia. Whenever they get the urge to go wandering, they hook up their eighteen-foot caravan to their *Hilux* four-wheel-drive and go. So what? Many people have caravan holidays.

The difference between the Lawrences' 'home away from home' and the usual caravan is the renewable energy system that was installed about three years ago.

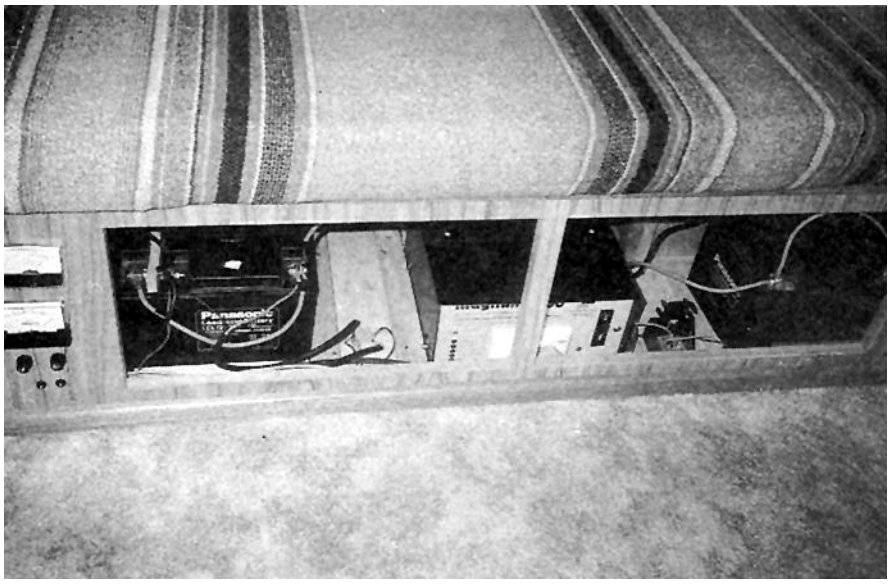
While some other caravans have been fitted with small renewable energy systems, there are few with the capabilities of this one. This system allows Ron and Carol to stop wherever they wish, and it can be their sole source of power for up to three days.

The system

The renewable energy system in this caravan consists of four solar panels - totalling around 120 watts - mounted on the pop-top roof of the van. This power is then fed via a purpose-built regulator into a sealed lead-acid battery bank. The batteries power virtually every electrical device in the van, from the TV antenna signal booster to the 190 litre upright 240 volt fridge/freezer. Of course the 240 volt appliances are powered via an inverter, which steps up the 12 volts DC from the batteries to 240 volts AC.

Solar power

Now let's look at this power system in a bit more detail. Originally the van had three 8 watt lightweight panels, purchased from *Rod Irving Electronics*, fitted to one side of the roof. Later, the power from these was boosted considerably by the addition of two more 24 watt units from the same supplier. While these panels were indeed lightweight, they proved to be less than du-



This photo shows how the system components all fit together and are stored under one of the two bunks in the caravan (bunk doors were removed for this photo). Note that the amp and volt meters, along with the two fuse holders and indicators, are mounted in the side of the bunk.

rable, as the eight watt units failed after only a year or so. This occurred due to the backing material of the panels warping from the high temperatures that they were subject to (as are all solar panels). While the 24 watt units have suffered from the same problem, they have as yet not died, although the output of one is a bit on the low side.

More recently, two 36 watt American-made panels, bought second-hand for $200 each, have been fitted in place of the eight watt units. These are very ruggedly built panels, with the solar cells sandwiched between two layers of ¼ inch thick toughened glass, all held in a heavy aluminium frame.

So what does all this add up to? On average, the solar panels give a total output power of over 700 watt hours per day. While this does not provide all of the power for Ron and Carol's needs, it does provide a good proportion of it and extends the time between battery recharging.

Batteries and bits

Unlike most renewable energy systems, any batteries used in a mobile installation must be able to withstand heavy shocks and vibration, as well as be as maintenance free as possible. Another problem to consider is that of gassing during recharging, which can be very dangerous in the confined spaces of a caravan.

For all of these reasons it was decided to use sealed lead-acid batteries. The batteries chosen were 38 amp hour *National Panasonic* units made in Japan. These were bought from *Jaycar Electronics* for around $100 each due to a special purchase. Ordinarily you would expect to pay a lot more for batteries of this quality.

The batteries are all wired in parallel and add up to give a total storage of 228 amp hours, or over 2700 watt hours, when discharged at the 20 hour rate. Being sealed, these batteries require virtually no maintenance, have no corrosion problems with terminals or cables and produce no dangerous gasses if charged correctly.

The batteries are mounted under one of the sleeping bunks, along with the rest of the system components, which keeps them all out of the way. The batteries are held in place with tight-fitting wooden blocks that are screwed to the floor of the van. You may think that they could jump out of this mounting system, but this has never happened, despite the van being taken on some very bad roads.

The charging status and battery condition are indicated by two meters, one for battery volts and one for charging current, as well as two LEDs which show whether the regulator is charging or in standby mode. There are also fuses for the 12 volt water pump as well as the solar regulator. The meters, fuses, and LEDs are mounted in the side panel of the bunk where they can be easily seen.

The regulator for the solar panels is a one-off unit that was built for this job, and uses a power MOSFET to do the switching. As I designed and installed the system, I also decided to design and built the regulator, as it was cheaper at the time to do this (total cost about $30) than to buy one, and I wanted to develop a design for a regulator anyway.

The regulator is capable of switching fifteen amps, although it only has to handle about seven amps or so in this system. It works by charging the batteries up to 13.8 volts, and then switching off until the voltage drops to below 13.2 volts.

The solar panels, although providing considerable extra power throughout the day, are not the only source of power for this caravan. When the van is hooked up to the towing vehicle, a separate heavy-duty charging lead is connected between the two. This lead runs directly to the vehicle's alternator via a 40 amp relay, 40 amp auto-resetting circuit breaker and a ±60 amp ammeter mounted inside the vehicle's cabin.

As the relay only activates with the ignition switch on, the caravan cannot flatten the car battery if left connected. The circuit breaker is for safety and also ensures that the flat batteries do not put too much strain on the alternator. The ammeter lets the Lawrences know how much current the batteries are drawing from the alternator.

240 volt power

As the caravan is wired for 240 volt as well as 12 volt power and has a 240 volt fridge, there was a need to fit an inverter large enough to cope with the demands that would be inflicted upon it. The unit chosen was a *Magnum 3000*, which has a continuous rating of 1250 watts and a surge rating of 3000 watts. This has proved adequate for the Lawrences' power requirements to date, including the large starting surge of the fridge, which draws 2000 watts on startup.

The 240 volts from the inverter and the conventional 240 volts from the mains needed to be able to share the

same circuits in the caravan without the possibility of one coming in contact with the other. Originally this was done using a suitably rated 240 volt DPDT relay that would switch to external mains whenever there was power available from the external input socket. All went well with this system until an unfortunate lightning strike or two.

As Carol put it, 'On our first trip through Victoria the system worked well. Even a lightning strike on the cables in the caravan park at Nelson only threw out the relay switch. It was a different story the next year in Cairns. The power went off and our inverter automatically cut in. In the next split second the power surged back on! The relay box flashed with a brilliant green light and the relay melted'.

The resulting high voltage had managed to jump across the relay and 'attack' the inverter, resulting in fifty dead power MOSFETs in the inverter and a very melted and burned relay (and the caravan's original circuit breaker didn't even trip!).

After I repaired the inverter, I replaced the relay with a large DPDT switch, which has much better isolation between the two sets of contacts. Also included across the mains line were three varistors, which are the devices found inside surge busters.

Appliances

As mentioned earlier, the caravan has the full complement of appliances, both 12 and 240 volt. These include a portable TV, fluoro and incandescent lights, a water pump, and of course, the 190 litre upright fridge.

As the fridge is the main power-consuming appliance in the van, it makes sense to reduce its power consumption as much as possible. This is being done by the replacement of the original inefficient two-pole fridge motor with a much more efficient four pole unit and the disconnection of the defrosting heater. Hopefully this will give a much longer running time from the batteries, possibly up to a week.

Other problems

Apart from the havoc and destruction dealt out by that unfortunately placed lightning strike and the warping solar panels, the only other problem has been with the Magnum inverter. As this unit has the main control circuit board mounted vertically with only one(!) mounting bracket, the board tends to vibrate and shake a lot while the van is in motion. This has caused several components to come adrift from the board due to 'dry joints' that resulted from the solder becoming fatigued. More support has been added to this board for future trips, but I must say that I can't recommend this inverter for mobile installations (of course, the manufacturers may have already addressed this problem).

Living with it

Now we know the technical details, how well has the system performed to date? Having been bitten by the wandering bug, Ron and Carol tend to take long holidays that see them travel all over the country. Their most recent holiday took them up to Darwin and then back along the west coast of Australia, the whole trip taking around five months.

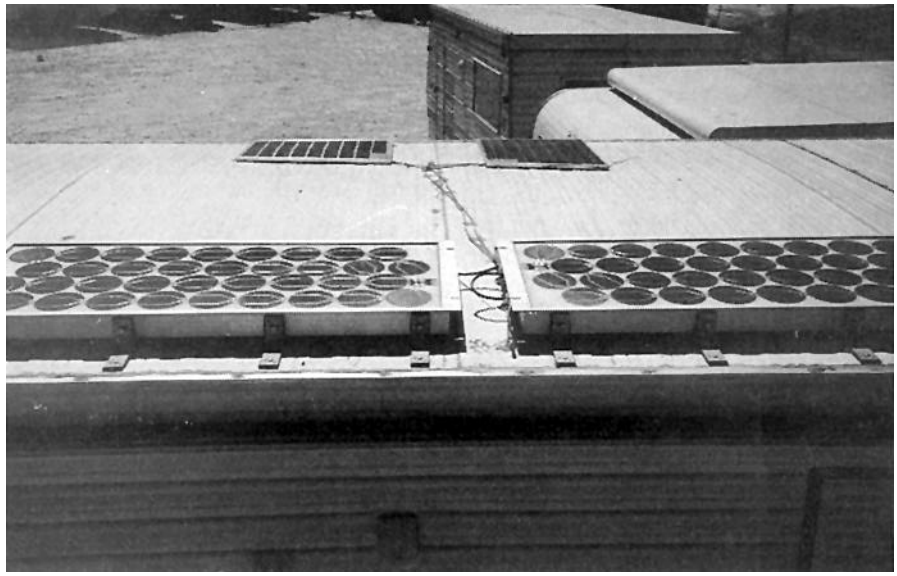
Like most people, the Lawrences like to keep the cost of their holidays down if they can, and their renewable power system has allowed them to do just that. By providing them with the power that they need, they have generally been able to avoid the need to pay for powered sites in caravan parks, giving them a bit more independence than your average caravanners.

Along the way, Ron and Carol met numerous people who were surprised by the capabilities of their power system. Most of them probably had no idea of what could be done with solar power. The very few people who did have solar power usually had the capability to run their lights on solar but little else, severely limiting their independence from the mains grid.

Carol said, 'We have found our solar power system marvellous. Having the large fridge means that we can plan our trips so that we can shop fortnightly in large towns, saving quite a bit on food costs, then off to the quiet bush stops.

'Now we can stop anywhere and have all our mod-cons. The power in the batteries lasts about three days. The sun recharging them extends that time'.

All in all, Ron and Carol are happy with the system, despite the problems that have cropped up. It would be of great advantage to many people (as well as the environment) if they were to follow this example and install renewable power in their caravans and similar vehicles. ☼



Here you can see the two American-made 36 watt solar panels in the foreground, with the two 24 watt RIE units at the back. The American panels are each mounted on eight brackets, with rubber between both the bracket and panel, as well as the bracket and the van roof. The difference in construction and quality is obvious, as is the heat-induced curve on the RIE units.

101 USES for a DEAD TYRE

Erika Charola

THE world has well over 500 million trucks and cars, resulting in an annual scrap tyre output of about 750 million, 11 million of which are from Australia.

So what happens the rejected rubber? Disposal into landfill sites has been the most common short-term resolution of the dilemma to date, but it is costly and creates a fire hazard.

In order to do away with this waste, most countries, including Australia, are developing industries which require rubber input. Used tyres are treated to undergo various degrees of decomposition or else are reused whole to make everything from compost bins to houses. But more about that later.

Above: The tyre 'graveyard' at the Modesto Power Plant, California.

Buying other people's problems

Whether rejected tyres are a problem in Australia remains a mystery enshrouded by the fact that we import them: bare, balding or retrodden. In 1992/93 Australia imported more than 630,000 used tyres at over A$9 million, for resale, retreading or disposal. These came mainly from Japan, the USA, Germany and Holland - countries where the sale of retreads is either illegal or implausible due to car maintenance regulations. Replacing and exporting half-worn tyres is more cost-effective for these countries than paying tip fees for tyres which have exhausted their life-expectancy.

It is the lamentable lack of discernment wielded by the Australian consumer which is largely to blame for this economic curiosity, one which sees our vehicles inadequately shod for Australian conditions, and our land and resources absorbing a disproportionate amount of waste.

Reviving the dead

Tyres are basically hydrocarbon polymer chains reinforced by steel. Gas, oil, carbon black and steel are recoverable through pyrolysis - a reversion process brought about by heating under high pressure. Variations on this process in high hydrogen or oxygen atmospheres have yielded higher-quality products at lower temperatures, but operational difficulties due to catalysts and inability to use steel-belted radials have prevented these becoming commercially viable. The fossil fuels derived from this process are used for small scale, energy intensive industries. In Japan, the *Kobe Steel Plant* recovers steel as does the Onahama tyre plant, which also sells carbon black to a copper smelter. Both operations sell oil to cement furnaces, a practice currently under consideration in Australia.

Further chemical processing techniques employed world-wide - all of which use heat and pressure - include treatment with NaOH, sulphuric acid,

The missing agenda

Not only does Australia import other people's unwanted tyres, but when it comes to legislation, Australia seems to want to ignore the problem altogether.

The 1991 National Waste Minimisation and Recycling Strategy set targets for reduction of paper, glass, plastic oil, steel can and organic wastes but not for tyres.

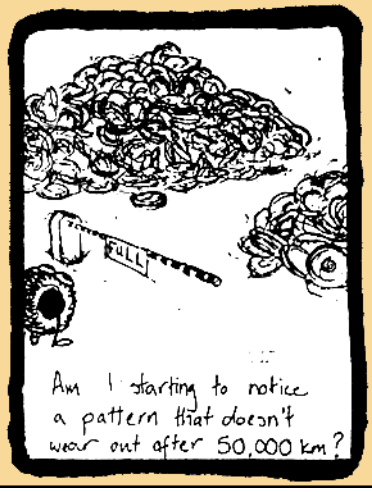
The Victorian 1992 Draft Industrial Waste Management Policy Discussion Paper emphasises 'waste minimisation at all stages of the industrial cycle' but the Victorian EPA's only comment on any possible conflict of interest presented by tyre importation is that it is a matter of Commonwealth concern.

In 1993 Federal Cabinet rejected a submission, presented by the Australian Tyre Manufacturers' Association with Department of Environment support, to ban imported tyres. The Association will make another attempt in 1995; this time with Department of Industry, Science and Technology sponsorship and the results of a current RACV study into the performance of imported part-worn tyres.

Only whole tyres are prohibited from landfill dumping by the Victorian State Enviromental Policy which came into effect in July 1993. Hence *shredded* tyres are stored in tips in case of future need.

We're not the only ones saving rubber for a rainy day. Regarded as an essential resource, rubber was once stockpiled by the US government for later use in the Korean war, but the enormous quantity of used tyres currently in reserve in the US – estimated at about 3 billion tyres, with an annual increase of 240 million – has now become a grave problem.

One can only hope that they're not falling behind in their war schedule.



'water-neutral' methods and plasticisation (the catalytic transformation employed in original production).

Throughout Europe and the United States, most operations involving industrial steam, such as hospital laundries or foundry furnaces, are partly driven by burnt rubber. Large-scale power production from tyre incineration, such as England's Wolverhampton plant and the Modesto works in California, have passed the experimental stage but reports reveal marginal profitability. These operations, like coal-driven power stations, are faced with the difficult task of controlling sulphur dioxide and particle emissions. Australia's rejected tyres could supply only 30MW annually - 0.1% of our power demand - and transportation costs have made this proposal unfeasible in the past.

In Australia, *South Pacific Tyres* and *Bridgestone Australia Ltd* operate in conjunction with *Tyrecycfe* and *Encore* reprocessing plants. A collection service is provided whereby tyre retailers can dispose of their dead. Tyres are shredded and may either be used for support and as drainage bases in road construction and landfill sites, or undergo further treatment to produce rubber crumb for use in paving and road surfacing. Goods produced include hoses, industrial matting and raw materials for other industrial processes. Australia's Encore reports thriving business with exports to many countries, especially Indonesia.

Marginal, but no less inspiring, uses for tyres include making coastal barriers to prevent erosion, noise buffers on freeway embankments, compost bins and vegetable or flower planters are further projects which employ entire tyres arranged in various configurations. Of course, no playground or army training circuit is complete without its quota of rubber rings. Alternatively, rubber strips make tram track liners which minimise noise output. A Kazakhstan practice is to slice the tyre longitudinally to create feeding trays for livestock.

Discarded tyres - 700,000 of them in fact - were used in the Port Hacking Project, NSW to build artificial reefs for fish.

The earthship alternative

Fish are not the only recipients of hydrocarbon homes. Residents of New Mexico in the US have developed a housing construction method in which whole tyres and sand filler are arranged brickwork fashion into walls. The resulting surface is covered with a plaster finish.

These *Earthships,* as they are dubbed by their creators, are designed as environment friendly, energy-efficient dwellings which also have provisions for solar-powered toilets and power generators. Houses are constructed as a string of U-shape rooms with the open glass wall facing south for maximum heat retention. Inner partition walls are made of tin cans held by cement mortar.

'Housing from rubbish' ideas were popular in the early seventies as homelessness, especially in the third world, became more evident to enterprising architects. Other proposed solutions included shelters of aluminium cans and beer bottles.

The variety of uses for rejected tyres reflects the availability of the resource and, as a corollary, the extent of the waste problem. If enthusiasm for our recycling nous doesn't warrant accepting life within a rubbish tip, then any of the solutions under discussion are still secondary to a reduction of the cause of the problem. ☼

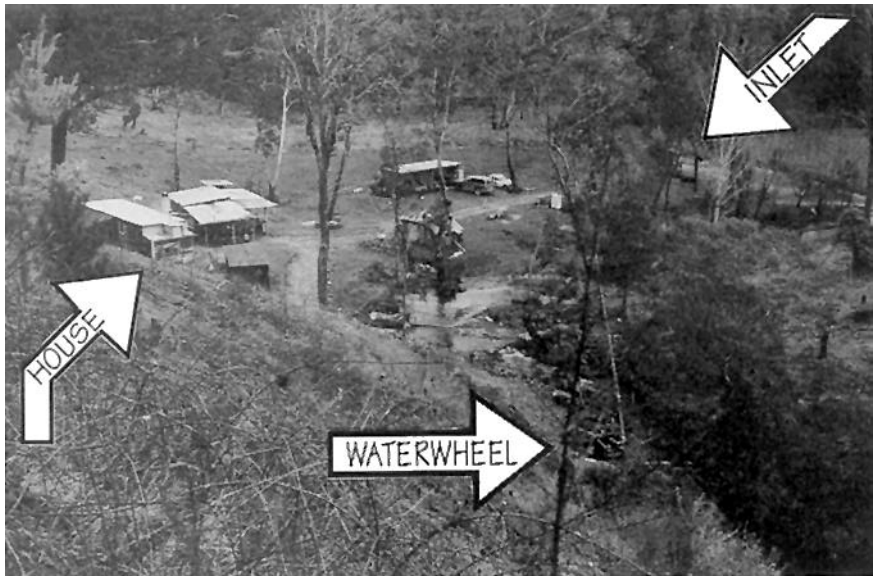
Earthships on the way!

More about Earthships coming soon in a future issue of Soft Tech.

Thanks to the staff at South Pacific Tyres *and Greg Mackey of the* Australian Tyre Manufacturers Association.

WATERWHEEL powered HOUSE

Mick Harris &
Suelette Dreyfus



A simple waterwheel power system runs six compact fluorescent lights in this isolated home. This photo shows the location of the various system components.

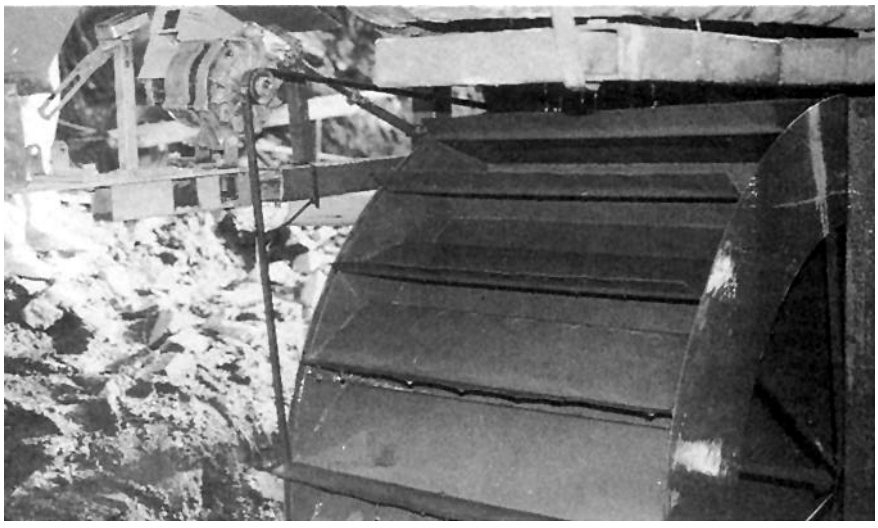
FRANK Thompson likes living the life of a hermit in the Australian Alps. The 84-year-old former Army cook used to spend evenings reading by gas lantern in his high country cabin between Corryong and Khancoban. Gas lanterns are very romantic on a snowy night, but they can be tough on older eyes struggling to read the newspaper. Now, thanks to the in-' genuity of his niece's husband, Frank enjoys reading by the light of a compact fluorescent light globe.

The cabin was more than ten kilometres away from the nearest connection to the electricity grid, according to Frank's nephew-in-law David Bennett. David wanted to bring electricity to the cabin, but a grid connection was out of the question due to the high cost. The challenge was to find an affordable renewable energy source appropriate for the cabin's environment. Solar power was one option but Frank's cabin was in a deep gully, so direct sunshine would only have been available for less than half the day. A solar-based solution was less than optimal. Frank also wanted to keep costs down, which made the equipment for a solar set-up virtually out of reach anyway.

But what Australia's highest mountains lacked in sunshine, they made up for in water. The property had a year-round-stream, a small tributary of the Murray River. Barely a metre wide and just as deep, it was hardly the Amazon, though during floods it could feel that way. The creek did not have enough fall to run a high pressure turbine such as a Pelton wheel. Initially, the site looked impossible. However, David believed a modest fall of perhaps 1.3 metres could be engineered. He decided that one of the world's oldest and most simple technologies - the traditional water wheel -would be perfect for the job.

The project would only support a small electricity supply - enough for a handful of high-efficiency light globes - but that was all Frank really needed. The homestead already had a gas-fired stove and fridge, a woodchip-based hot water heater and a wonderful open fire place for space heating.

David based his water wheel on designs displayed at the Brunswick Energy Park. His all-steel, welded water wheel included very basic components: mild steel sheet, square steel tube, two bearings for the wheel to pivot on, angle iron for a pulley and a V belt. He used the sheet metal, which came in a width of 1200mm, for the 2mm-thick sides of the wheel and the buckets. The square section steel provided the wheel's frame and spokes. The wheel cost about $1500 to make - a price which did not include David's labour. Most of the materials were salvaged from rubbish dumped by a large industrial company in Melbourne.



The modified alternator with direct gearing.

This was the first water wheel that David had made and it was definitely a learning process. It took him more than 2 months part time to build the wheel and an additional week to install it at the mountain site. He said with a laugh, 'I was an electrician, not a welder'.

Despite his lack of experience, he was absolutely determined to make the project work. 'I wanted to prove I could do it. When people said, "Oh, you can't do that. You're an idiot." I wanted to be able to shut them up'; David explained. Now he is able to make similar water wheels in about one day.

The water wheel concept became somewhat of a passion for the Victorian, who had suffered a stroke a few years before and been warned by his doctors to quit his job and slow down. He may have changed his profession but he his still very busy; now he runs DC Alternative Power Systems, a Yarrambat company making water wheels and slow revving alternators.

As the project developed, the mountain site began to look more promising. A representative from Australian Wind Power advised David that the system needed only the equivalent of about one-tenth of one horse power consistently from the stream in order to turn the water wheel.

David also wanted to set up an alternator in the system -an ambition which caused a few headaches. 'When we first got the wheel up and running, we were getting 37 revs per minute. But when we put the car alternator on it, the thing came to a dead stop. It was a real disappointment', David said.

It was time to go back to the drawing board. After David modified the alternator, the wheel began turning again, this time at seven revs per minute. The alternator, however, was whizzing at 130 revs per minute and the system was producing 2.5 amps at 12 volts. David was pleased. He added a bank of six 2 volt batteries to the system.

One of the best things about the water wheel system was that it did not damage the stream ecosystem, which was as important to Frank, a keen fisherman, as it is to the local wildlife. Frank drew all his water for drinking and washing from the stream, so David was careful to design something that would not upset the natural clarity of the water or upset the flow downstream.

All the water removed from the stream for the 100 metre run through the pipe to the water wheel is returned untainted back into the river system.

Frank is 'wrapt' in the water wheel system, according to David. There have

Making your own waterwheel

Cut two circles from 2mm thick sheet steel with an outer diameter of 1200mm and an inner diameter of 800mm. These circles will act as the sides of your water wheel. If you don't have oxyacetylene cutting equipment to cut the circles, you could get a sheet metal shop to cut it for you.

Now you should also cut the sheet metal rectangles which form the buckets. Figure 1 shows how they are bent and fitted to the wheel. Using this shape results in one bucket forming the back of the next bucket and making construction easier.

The hub and spokes are put together as follows. Cut the square steel tube to form spokes. The correct length will give you a 50mm overlap over the steel circles. Cut a total of sixteen lengths and weld one end of each onto the flanges. Weld them at regular intervals so you end up with eight spokes on each flange. Now weld the sheet metal circles onto the spokes making certain they are exactly in the centre and the two sides match. This forms the two sides of the wheel.

Next you have to add the buckets. To do this set the two wheels up on a temporary shaft. Put the sheet metal buckets into the correct position and clamp in place. Weld the buckets to the circles using good sized spot welds. Any gaps can be filled by Silicone or if you hot dip galvanise it small gaps will be sealed in the process. Slide the piece of round pipe through the holes in the flanges and weld into position.

To fix the wheel into its final position, simply slide it onto the drive shaft and bolt into place. To protect the wheel from rust you can paint it with cold gal metal paint or get it hot dip galvanised. Alternatively don't treat it at all. Steel rusts very slowly when it is kept wet.

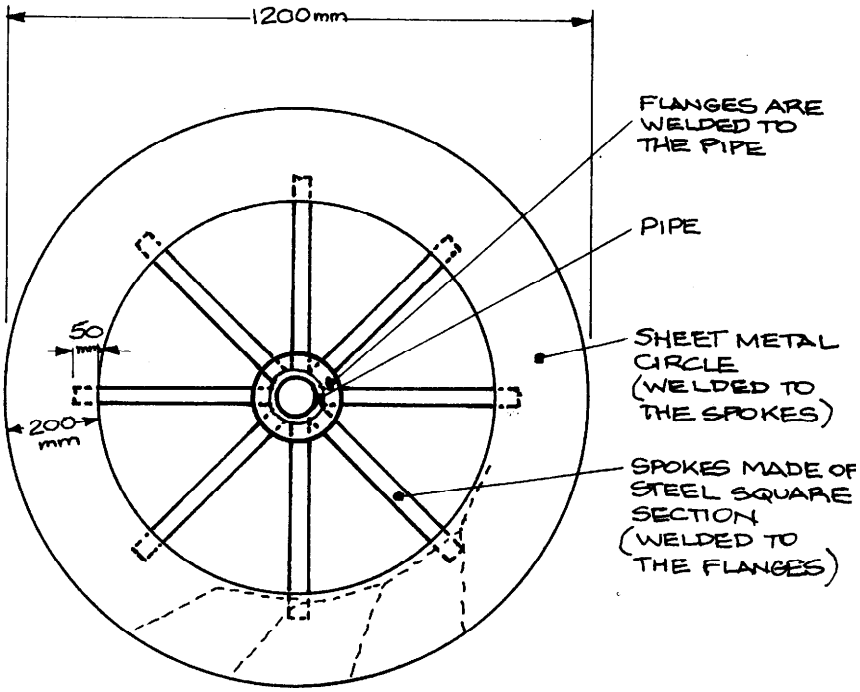


Figure 1. The water wheel

Connecting up the system

The water supply

The water to run the water wheel comes through a six inch steel pipe from 100 metres upstream. To keep rubbish out of the pipe water enters it through a slotted section, while a valve in the pipe controls the water flow. To help protect the wheel from flooding David cut a back water in the bank of the creek. This diverts flood water (as well as rocks and tree trunks) away from the wheel during high water levels.

The water wheel was connected to both a generator and a water pump. It took **a** bit of trial and error to get gearing and load on the water wheel just right. The slower a water wheel goes the more power it develops. However if it turns too slowly it will stall. In the end the speed was set at seven **RPM.**

The generator

The generator was connected to the water wheel with **a** 154 inch (390cm) belt which runs around the outside of the wheel and then directly to a pulley on the generator.

Originally a conventional car alternator was tried out, however this was unsuccessful. When power was supplied to the field the alternator became much harder to turn and the wheel would stall.

The generator used was a modified car alternator with permanent magnets fitted and the stator windings rewound. It is capable of generating five amps but generally produces around two amps continuously.

The power from the water wheel runs fifty metres to the house where it charges batteries to power the house.

Water pumping with water

David made up the pump himself using bits of scrap. It consists of a copper tube with a rod and plunger which are attached to an eccentric gear on the water wheels central shaft. As the rod and plunger move up and down, water is drawn in and out of the pump. The stop valve sitting below the water level and the non-return valve on the other side of the pump convert this oscillating water into a one-way flow.

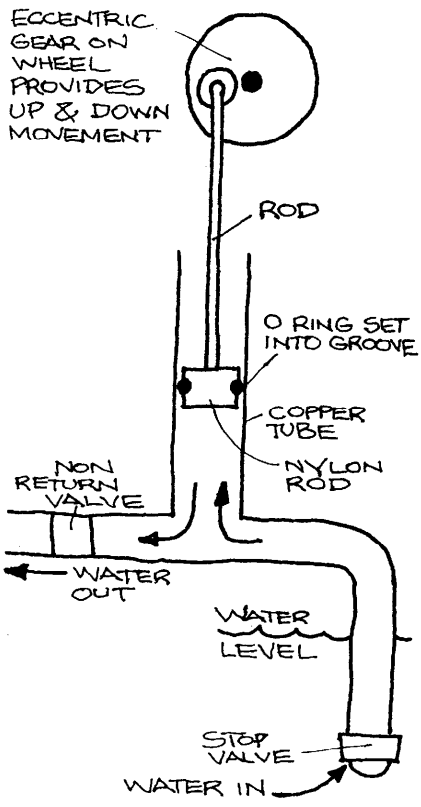


Figure 2. The pump

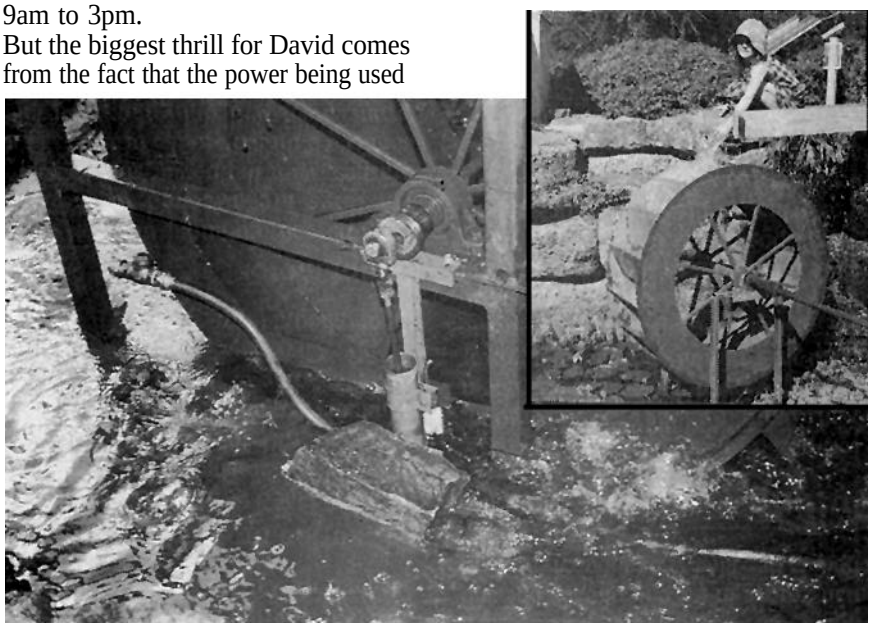
been occasional small hiccups, such as when autumn floods dragged logs down the stream and inflicted minor damage on the system. The logs pinched the water wheel's belt resulting in the belt 'getting a kink and breaking', David said. But he maintains the system has worked very well and remains a big fan of small-scale water-based energy systems.

'With a wind generator, you only get power when the wind is blowing. Solar is the same - you only get power when the sun shines. With hydro, you have it all the time consistently', he said.

David is planning to expand the property's renewable energy system. He has bought an inverter, so his uncle-in-law will be able to use his power tools. David joked, 'Once Frank has a taste of 240 volts, he'll probably want all sorts of appliances'.

David is also saving money to set up a solar system. He has already made a solar tracker from an old *Holden* windscreen wiper motor and bought one 53 watt solar panel. The solar tracker will be essential since the bottom of the gully only gets sunshine from about 9am to 3pm.

But the biggest thrill for David comes from the fact that the power being used by his wife's uncle is free. David said, 'He's getting something for nothing. It's not a lot, but it is enough'. ☼



The water wheel and pump – shown here in flood conditions.
The inset photo shows the original waterwheel on which David's design was based.

CLEANING UP SEWAGE with PLANTS

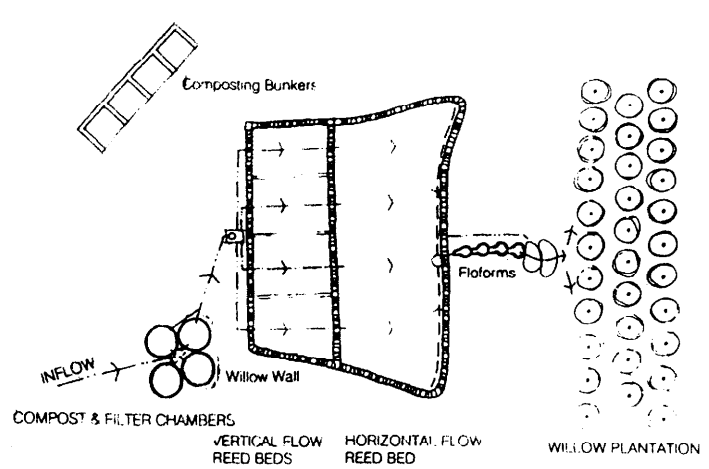
The Centre for Alternative Technology in Machynlleth, Wales, is a display village for all kinds of appropriate technologies and environmentally sustainable systems. One of the things that most impressed Fiona Tito on her recent visit to the Centre was the toilets!

Fiona Tito

FROM the moment you visit the loo at the Centre for Alternative Technology in Machynlleth, you are reminded that you are now an active participant in a wondrous biological nutrient cycle. In the Ladies, what happens to both your liquid and solid deposits is spelled out on the back of the dunny door, with colourful pictures. My husband Ron tells me that in the Men's, you are asked to make a deposit into the 'Urine Bank'. It certainly was the most intellectually stimulating of any similar visit in the month we were away!

Instead of becoming a remote pollution problem, all sewage produced there is dealt with on site. The composted waste is used directly as a liquid fertiliser, watered down five to one. Solids are used as a fertiliser and conditioner for the infertile soil of the old slate quarry where the Centre is located. In both cases, the fertiliser is used on the flower gardens and the forest areas, but not on vegetables used for human consumption. The water leaving the various processes is high enough quality to go directly into the local river, the Afon Dulas.

There are two main elements of the nutrient recycling process - the reed bed systems and the composting toilets. This article concentrates on the main reed bed system, which serves the visitors to the Centre (estimated to be about 150 people per day), as well as those who live there. A second smaller reed bed system serves the education cabins and it is used to show the school students who stay there how their own wastes are treated. There are also two twin-vault composting toilets - one for the public and one for the cabins.

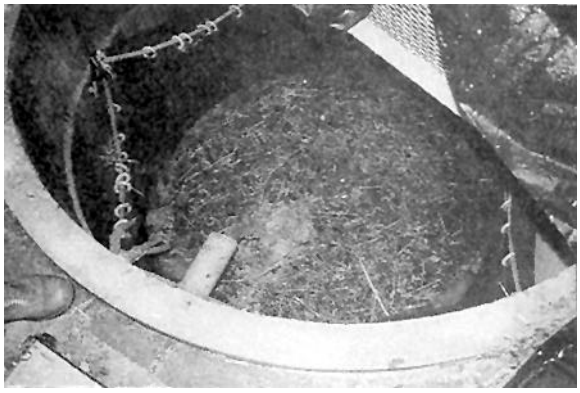


The reed bed sewage disposal system.

How does it work?

In the men's toilet, some deposits are made direct into the urine bank for use without further processing. The other sewage leaves the low-flush toilets and waste water system and travels down into the four solids collection chambers. At any one time, there are two active chambers and two resting ones. The chambers are two-metre circular concrete holding tanks that are three metres deep. A heavy netting bag containing straw or reeds hangs in the chamber, and the entry pipe directs the sewage onto the carbon material in one of the active chambers.

One active chamber receives the material for two days, and then the sewage is directed to the other active chamber. When the changeover occurs, a new layer of straw or reeds is added to the chamber that is to start receiving sewage. This two-day pattern continues until the two active chambers are full. They are then left to dry out, and the other two chambers become active. When convenient, a back hoe is used to lift the full bags of solids and carbon material from the previously active chambers out to the composting bunkers.



One of the active solids collection chambers.

Doesn't it smell?

The high amount of carbon material mixed with the solids is intended to promote aerobic cornposting, which does not smell bad.

Sometimes the carbon material breaks down faster than the solids, and becomes anaerobic and smelly. This had occurred in the middle of one of the piles we saw. The heat of the decomposing mass was making the carbon materials break down very quickly. However, because it was in the middle of the pile, the smell was not so noticeable, except when it was disturbed.

While the theory was that the pile should be 'turned' to ensure even composting, in reality the compost was just left to sit for longer and breakdown in its own time. In these circumstances the smell was not a problem.

The reed beds

The liquid from the solids chambers drains through the net and down a pipe onto quite a large cistern. The purpose of the cistern is to 'flush' the water into the first stage of the reed beds - the vertical flow section. This flushing works better than a slow steady trickle and prevents a build up of nutrients directly at the outlet pipe. The force of the flush distributes the water and nutrients across the whole of the bed.

The vertical flow section contains the Common Reed *(Phragmites australis).* The plants grow in one-metre-deep fine gravel and sand. The vertical bed is divided into four parts, each separately watered every two days (at the same time as the solids tanks are changed) so that the effluent flows into the next bed along. This gives the reeds two days of intense nutrients and some resting time to use the nutrients, which leads to better overall growth in the vertical bed. It takes about five minutes for the 'dose' to make its way from the surface of the vertical bed through to the drain at the bottom and into the beginning of the horizontal bed. The horizontal flow bed has a channel along the back, into which the effluent from the vertical bed drains. The horizontal bed is a single unit consisting of coarse gravel, with a number of reed and water plant species growing in it. The plants include Common reed *(Phragmites australis),* bulrushes *(Typha* species), club rushes *(Schoenoplectus* species), sedges *(Carex* species), a number of grasses *(Glyceria* and *Phalaris* species), reeds *(Juncus* species), Irises such as yellow flag *(Iris pseudocorus)* and perpetual spinach.

This bed is larger than the vertical flow bed. Experience has indicated that the distance from the channel to the drainage line at the front of the horizontal flow bed could be even longer. The front drainage line from the horizontal flow bed drains the now reasonably clear effluent into another cistern.

Once the horizontal bed cistern fills, the effluent then empties in one dose and enters a set of six concrete *flowforms,* which are designed to oxygenate and 'revitalise' the water. The flowforms cause the 'dose' to make a figure-eight movement in each concrete bowl. These shapes are said to be artificial replicas of rocks carved by turbulent streams. In turn, water in these flowforms is said to mimic the natural turbulence pattern of rivers.

Whether they do anything more than more effectively oxygenate the water is impossible to judge on one visit. Our guide at the Centre thought that the plants onto which the water flowed were growing more vigorously than expected because of oxygenation from water going down a stepped cascade.

From the flowforms the water enters a dirt channel, which weaves among a grove of willows of various kinds. The willows are pleached together at the bases so that it is more difficult for any single tree to die. They are currently trimmed on an annual basis by a local craftsperson. They can also supply pea and bean poles for the Centre's gardens. The water at the end goes directly into the river, and is of sufficiently high quality to meet all environmental standards.

Maintenance

The system was very impressive - it was relatively uncomplicated in its operation and did not require large amounts of monitoring, considering how much nutrient was being recycled

More importantly, it gave a picture of what is possible. It gave me a vision of a technology that could be used at a local level and that could help us create a nutrient cycle, instead of a nutrient sink.

I have always believed that the true sophistication of a society should be judged on its wise use of its own excrement - on this basis, the Centre for Alternative Technology at Machynlleth has lessons for us all. ☼

The intersection between the horizontal and vertical reed beds.

INSTANT SOLAR-HYBRID SYSTEM

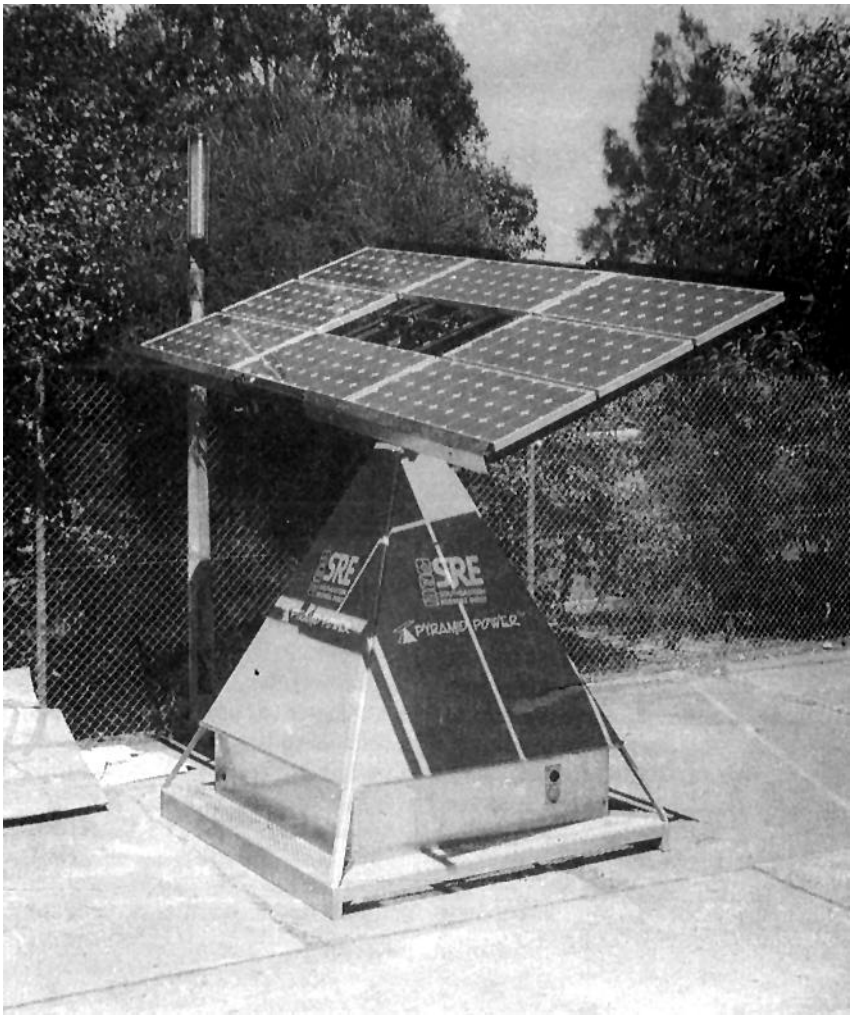
Robert Grimmett

JUST imagine ordering a solar-powered system (complete with diesel backup generator) from your electricity utility., A few days after you order it, the entire system arrives and is installed ready to supply your household power in under an hour.

South Eastern Renewable Energy (SRE) the business unit of New South Wales electricity distributor, *Illawarra Electricity*, has been aware since its inception of the disadvantages of contemporary remote area power systems - even the packaged variety.

Safe transportation of the various components, particularly to remote areas, has often proved difficult and expensive. Some conventional systems require considerable effort to prepare a site with adequate storage for batteries and inverters.

Delays in delivery of essential components can cause inconvenience to customers and installers, with considerable time required on-site to construct and commission the systems.



All components of the Pyramid Power 'instant' solar/diesel hybrid system are integrated within the unit, making for ease of transportation and installation.

Complete power system on a truck

Pyramid Power™ is a compact new system that aims to solve all of these problems. The units are built and thoroughly tested in the factory prior to despatch. All of the components are totally integrated within the unit, which measures only two metres square. The solar panels fold up for ease of transportation and the entire unit can be delivered on the back of a small truck. It can then be unloaded easily onto any flat, unshaded piece of ground or onto a concrete slab or similar surface.

Within minutes, the Pyramid Power unit can be connected to the house and the whole system becomes operational.

A *Platypus Power* micro-hydro unit can also be connected to the system as an integral power input. Provision also exists for connecting a windgenerator or additional solar panels.

System components

Pyramid Power is a self-contained solar/diesel hybrid system with an integrated solar panel tracker. A standard unit will deliver up to 4800 watt-hours of solar-generated electricity daily.

A state-of-the-art sine-wave inverter with microprocessor control is included along with the sealed lead-acid storage batteries and a back-up diesel generator.

Each part of the system is separated from the others by internal partitions.

The standard 4kVA diesel unit is automatically operated by the microprocessor twice each day if top-up battery charging is required. Alternatively, the generator can be activated manually to cater for large loads.

Coconut-oil fuel a possibility

SRE is currently investigating the feasibility of running the diesel generator economically using fuel derived from

vegetable sources, with early trials providing encouraging results.

Illawarra Electricity has been running a diesel vehicle successfully on coconut oil in a joint research project with Wollongong University.

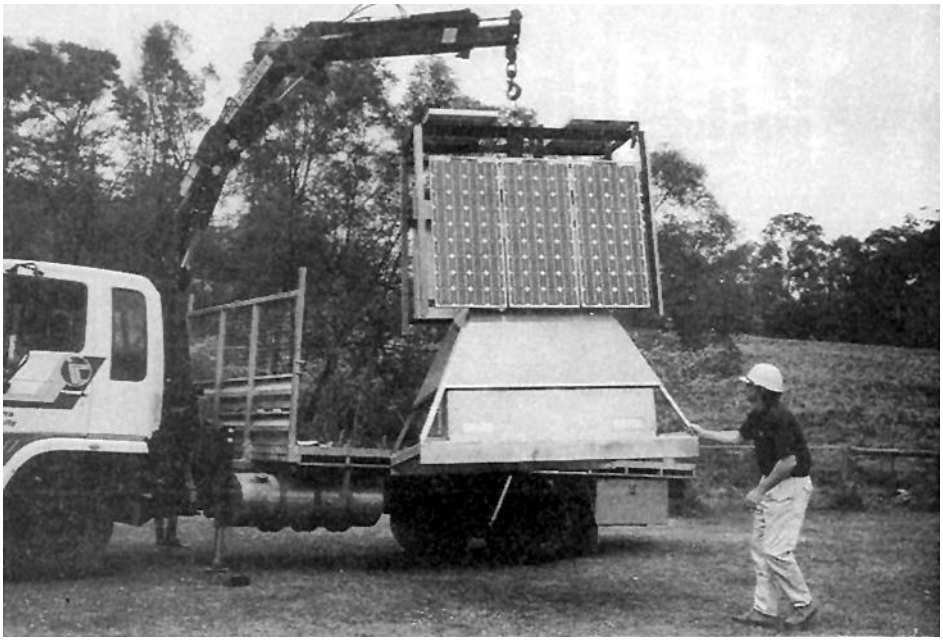
Avoiding grid installations

Other electricity utilities have expressed keen interest in Pyramid Power as a means of providing temporary power to customers awaiting grid extensions.

There is also interest amongst some utilities in using Pyramid Power to avoid constructing expensive and unaesthetic rural grid extensions, to avoid tree clearing for easements and even to decommission existing lines in remote areas. ☼

Pyramid Power is being marketed by Southeastern Renewable Energy.

Steve Garrett and Stephen Mundy of DCFX Solar in Pambula, NSW were primarily responsible for designing and constructing the units.



The entire system - including batteries, solar panels and inverter - sits neatly on the back of a truck.

For further information on Pyramid Power™ systems contact Southeastern Renewable Energy on ph:1800 644 550

SAFETY & INSURANCE issues

Ray Prowse

IN terms of its ability to deliver an electric shock, what is the difference between an AC electric current of 10 amps at 240 volts coming from the electricity grid and that coming from an inverter? There is none - electricity can kill.
Electricians are well trained in safety aspects and are licensed because of their training to take responsibility for the safety of wiring installations. There is no opportunity for electricians to just say that they are well trained and have sufficient skills and knowledge to carry out wiring installations - they have to prove it by completing the requirements to become licensed electricians.
In the RAPS industry there is no requirement for extra-low voltage standalone systems to be wired by licensed electricians. In the absence of such a requirement, it is up to industry to make sure that systems are installed to relevant Australian Standards and to acceptable industry best-practice standards.
Many people in the RAPS industry are electricians and can complete the wiring installation of the RAPS system components in addition to the AC house wiring. Some people who install RAPS systems are not electricians and work on the installation of the RAPS system only - including the connection of the inverter to the batteries - but do not do any wiring on the AC side of the inverter. Australian Standards for extra-low voltage wiring provide sound guidelines for this wiring.
While a licence is not required in order to carry out this work, acceptable standards and safety practices must be observed. For example, in many installations the cable from the photovoltaic array to the charge regulator runs from the roof to the battery room at floor level. Almost certainly the cable will have to be run through the roof space at some point. If the cable is too small there is the possibility of overheating, which, if excessive, may cause a fire. Overheating will not occur if the current through the cable is less than the current carrying capacity of that cable. Such a capacity varies depending on the environment of the cable, ie whether the cable is unenclosed, enclosed in conduit or enclosed by insulation. This must be considered when selecting the size of the cable to be used for the job. Good practice indicates that enclosing the cable in conduit protects the cable from vermin and from deterioration due to movement of the cable. If this method is used, allowance must be made for a lower current carrying capacity than that which is derived from cables in an unenclosed environment.
While safety of people using the system is important, it is also important to make sure the house is safe from the possibility of fires caused by the overheating of cables.

Will the insurance company pay up?

It has often been argued that insurance companies will not honour an insurance contract if the house and the RAPS system have not been wired by a licensed electrician.
The insurance companies I consulted all maintained that such a claim would be honoured and that they would then take action to recover the costs from the person who caused the fire or other occurrence. Action cannot be taken, however, against the person who holds the policy. That is, if a person wires their own system and a claim on insurance is subsequently made, the insurance company will, in most cases, pay the claim and not seek costs from the policy holder. It should be noted, however, that the policy holder will find it extremely difficult to renew an insurance policy after such a claim if it is proven that they are at fault. The message is quite simple. *If the installation is done to relevant Australian Standards, there will be no opportunity for a costs claim against the installer.* If not, then the installer may face legal action to recover the costs for the claim.
It is clearly easier for licenced electricians to convince any insurance company investigating the cause of a fire that the wiring was done to relevant standards, than it is for someone who is not an electrician.
A non-electrician will have to make sure that the system wiring agrees with standards down to every minute detail - as it should anyway. All system wiring details should be recorded. For example, notes should be made of all cables: their type, length, current carrying capacity, expected maximum current, whether the cable is enclosed or not - and in what - and how the cable is terminated - lugs, crimped or soldered. Photographs of the system wir-

Australian Standards

The following Australian Standards should be adhered to in any installation of a RAPS system:

1. AS 1768 - 1991	Lightning Protection
2. AS 2401.1 - 1994	Battery Chargers for Lead Acid Batteries
3. AS 2676.1 - 1992	Guide to the Installation, Maintenance, Testing and Replacement of Secondary batteries in Buildings, Part 1: Vented Cells and/or Part 2: Sealed Cells
4. AS 3000 - 1991	SAA Wiring Rules. All Relevant Sections
5. AS 43010.1 - 1987	Electrical Installations – Supply by Generating Set. Part 1: Internal Combustion Engine Driven Set.
6. AS 3011.1 - 1992	Electrical Installations – Secondary batteries installed in Buildings. Part 1:Vented Cells and/or Part 2: Sealed Cells.

Currently being formulated is:

7. AS 4086.2	Secondary Batteries for use with Stand Alone Power Systems. Part 2: Installation and Maintenance.

for RAPS systems

ing would help. Installers may even want to provide the owners with a statutory declaration stating that the system has been wired to all relevant standards - and list the standards. Remember though that the owners could, at some stage after the installation is completed, change the wiring themselves.

This is starting to sound like a lot of work, but if it is done, it shouldn't be too difficult to convince any inspector that the system was installed to all relevant standards.

Effect of poor installations on the industry

The RAPS industry lives on the reputation gained from the installation and performance of good quality systems. The industry cannot afford systems that do not work up to the expectations of the owners, do not abide by Australian Standards, or are simply dangerous.

Some time ago there was a death associated with a RAPS system in Queensland. The facts - which came out in an enquiry - indicate grave doubt about whether the installer knew enough about the installation of electrical systems.

- ☼ The installer had reversed the active and neutral connection at the entry to the inverter.
- ☼ There was no earth wire between the inverter and the installation.
- ☼ The environmental conditions at the time of the fatality contributed to the death.
- ☼ The site for the battery and inverter installation was poorly selected.

Sure, there are more deaths associated with mains grid systems than RAPS systems every year, but the bad press surrounding this one fatality has cast doubt on the safety of all RAPS systems. Because the RAPS industry is so small, it cannot absorb even a small amount of bad publicity and steps must be taken to make sure that such fatalities do not occur again.

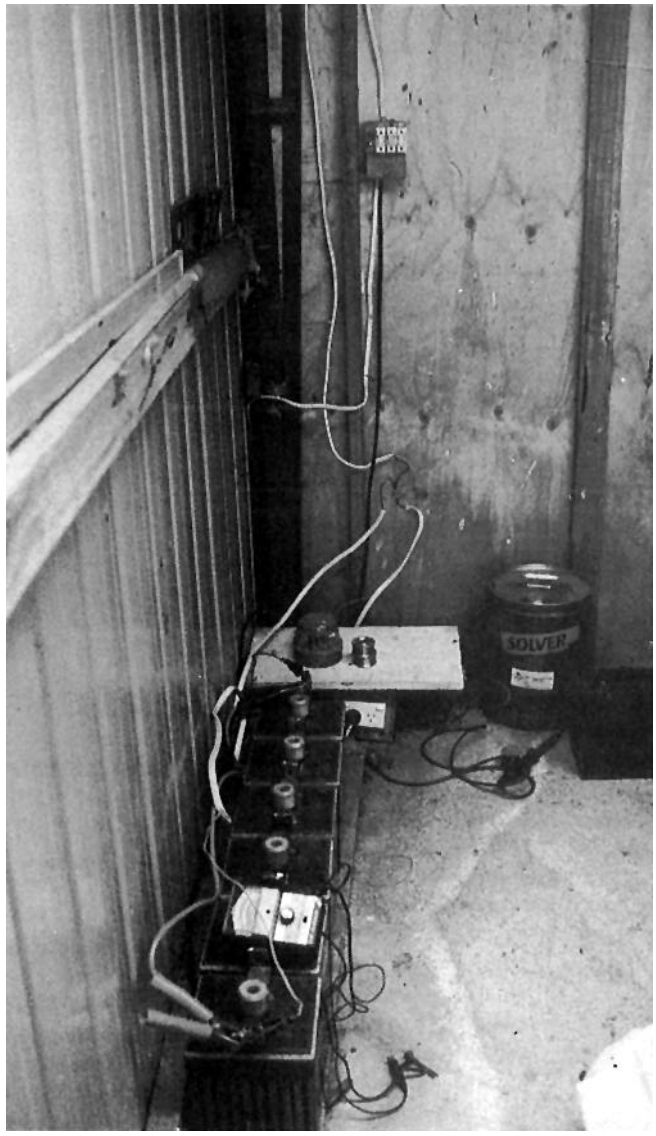
I have come across some dreadful RAPS systems. In each case, including the system pictured here, there was nothing wrong with the system's components, it was just how they were put together that was the problem. The same components in a well-designed and installed system will perform well.

These systems are bad advertisements for the industry - yet they were probably installed by someone who ***be***lieved that they knew how to install a system to acceptable standards. Systems such as these must be eradicated from the industry, lest the industry be pushed back into the dark ages.

Directions

The renewable energy industry has evolved over many years without any real emphasis on system design and installation procedures. There have been some groundbreaking businesses which have brought a professional approach to the industry, but the time has come for all workers in the industry to display the same professionalism in order to enhance the reputation of renewable technologies as the way towards a sustainable future.

Any reader who is in doubt about the accuracy of a system design or the appropriateness of system components should contact the Solar Energy Industry Association of Australia (SEIAA) for advice before going ahead with an installation.



The installer of this 'disaster waiting to happen' knew nothing about the relevant installation standards.

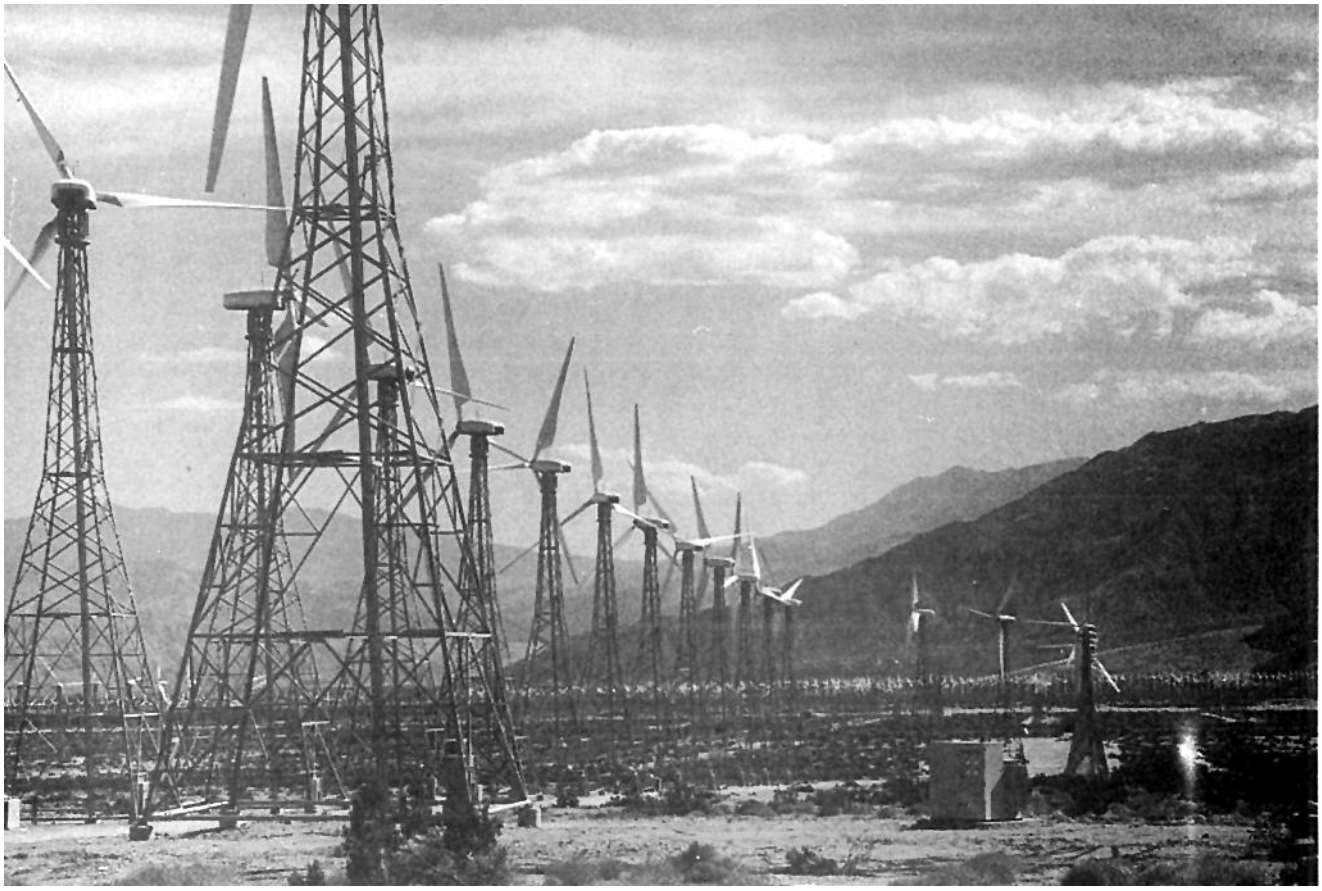
Note: unshrouded battery terminals; cables clamped (rather than bolted) to the terminals; the inverter top used as a shelf; close proximity to a container of flammable liquid.

We could go on...

Both SEIAA and ATA offer short training courses for people wanting to raise their level of knowledge and skills in system design and installation. Some TAFE colleges offer more detailed, certificate courses in renewable energy. ☼

Any readers with photos of systems, good or bad, are invited to send them to Ray Prowse at the SEIAA national office. SEIAA is attempting to establish a data bank of useful photos to be used to promote good practices - or what not to do - within the industry.

WINDFARM on a GRAND SCALE



Amid all the excitement about ATA's purchase of the windgenerator at Breamley, we thought it might be an inspiration to hear a bit about a fully developed wind farm. Ron and Fiona Tito from the ATA Canberra group recently visited one of California's three wind farms.

Fiona Tito

YOU can hear it in the air. From a distance, it seems like a whisper, perhaps a mumble, but as you get closer it becomes the unmistakable harmonic sound of blades cutting through the wind and making power. And at the San Gorgonio Pass Wind Farm, there are 4300 windgenerators humming away!

These quiet whirring giants, standing in row upon row above the hot desert country about 150 kilometres west of Los Angeles, produce 600 million kilowatt hours of electricity per year. This is then sold to the local electricity utility, the *Southern California Edison Company,* for distribution.

However, the end users of this 'green' power still have some way to go in the energy conservation game. The power generated is only enough to supply the power demands of nearby Palm Springs and its 40,000 or so energy-hungry residents. Palm Springs is a desert playground for the rich and famous: full of golf courses and floodlit palms. These figures mean that, on average, each resident uses more than 15,000 kilowatts of electricity per year - almost twice the average US household consumption. In comparison, our energy-frugal house in Michelago uses only around 1000 kilowatts per year, and we have a good standard of modem living.

The wind farm lies in the San Gorgonio Pass, just beside the San Bernadino Freeway (Interstate Highway 10). The pass is between two mountain ranges, both of which are over 3000 metres high: the Little San Bernadino Mountains and San Jacinta Mountains. The pass connects the hot desert, east of the mountains, to the cooler valleys and coastal areas in the west. Its geography is crucial to the operation of the wind farm.

Known previously as *Agua Caliente,* a name derived from the hot springs located nearby, the desert is heated by the sun. When the air above it rises, a low-pressure pocket is produced. This then acts as a vacuum, pulling in the cooler coastal air. The narrowness of the passage through which the cool air passes accelerates it even more, providing annual average wind speeds between six to ten metres per second (14 to 20 miles per hour).

There are many types of wind turbines at the farm: each have either two or three blades, and tower size and struc-

ture varies. The majority of them come from Denmark but some are manufactured in the US, Canada, West Germany, Great Britain, Japan and the Netherlands.

About 1000 of the older units are being removed and replaced by 150 new state-of-the-art turbines, which produce more power together than all those they replace.

Each wind turbine has its own electronic sensors, which allow it to turn on when conditions are right, and off when winds are too strong or when a problem is sensed. The larger, newer windpower plants are also connected to a central computer, which enables an operator to turn them on and off in order to check their efficiency and to fault find when a machine is not working.

The windgenerators were paid for by institutional and private investors. Until the mid 1980s the US Government provided tax incentives to help finance the industry's growth. Although the subsidy has ceased, many wind turbines have been added since then, essentially because it is economic to install them. The *Desert Wind Energy Association* (DWEA) says that about 50% of California's wind generating capacity has been installed without tax assistance.

'So how economical is it?', I hear all you sceptics ask. The DWEA claims the installation costs are marginally greater than these of a natural-gas-fired power station (5 cents per kilowatt, compared to 4 cents per kilowatt) but cheaper than many other options. It is on the side of maintenance and running costs that the real difference occurs. A modern wind plant costs about one cent per kilowatt to operate and maintain. By comparison, a nuclear or coal-fired station costs twice as much to run, and a gas- or oil-fired one three times as much. If environmental benefits, such as air quality, are taken into account then it has been estimated that the environmental benefits exceed the total cost of the wind turbine.

Apparently there are sufficient wind resources in the US to supply ten per cent of their current needs. If usage was reduced through energy conservation measures, wind energy could have an even greater role.

It is a little surprising with the American capacity to turn almost anything into a Disney World extravaganza that there was little tourist exploitation of the wind turbines. Perhaps a Wind Theme Park could be a useful consciousness-raising addition.

Meanwhile, it was a wonderful, refreshing sight to see horses and cattle wandering among these giant, singing, metal trees. ☼

Breamlea UPDATE

Over a test period of two months, the Breamlea windgenerator produced more than 15kWh of power, which puts it right on target for projected annual production.

There has been much interest in the proposed share scheme, but it has proved far more complicated to set up than first anticipated. We will keep you posted.

Donations to the *Renewable Energy Development Trust* (which go toward Breamlea and other ATA projects) are tax deductible. Send your cheque to 247 Flinders Lane, Melbourne 3000 Australia, or call (03)650 7883 for more info.

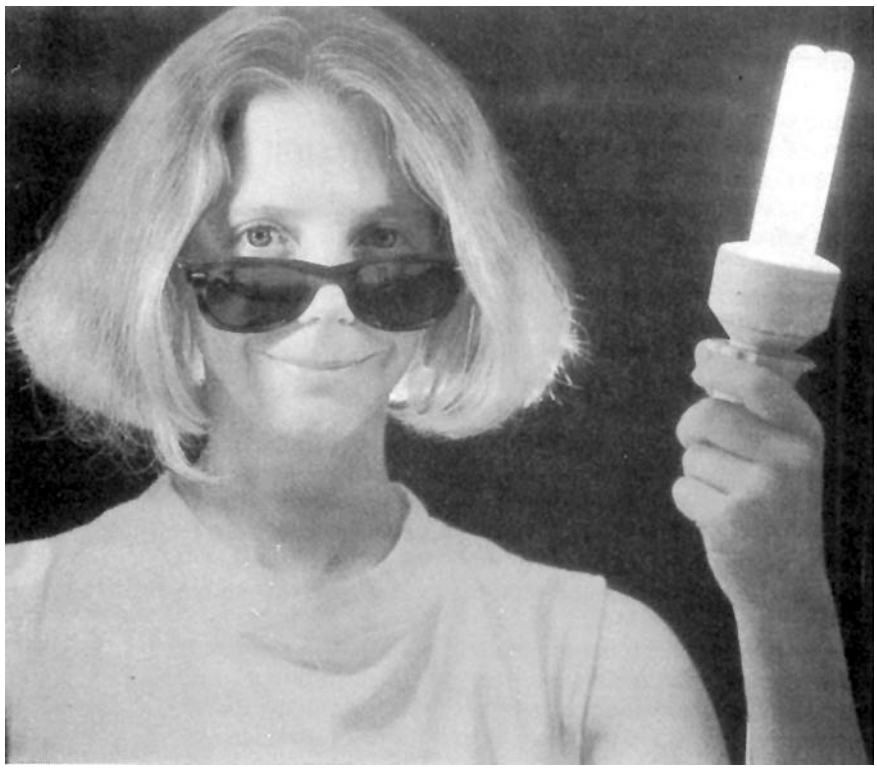
Repairing your compact fluoros

Lance Turner

MANY people are still not sure about the reliability of compact fluoro lamps. They do have good light output for very low energy consumption, but how well do they last? After all, they cost around $20 to $30 each, and fitting out a house with these lamps can be an expensive exercise.

Unfortunately, from both my experiences and those of other ATA members, there are some very unreliable lamps out there that could well be giving compact fluoros a bad name.

What's even worse is that most of those faulty lamps are Australian made. The units in question are sold under at least three different brand names - GE Energy *Choice*, *Performer* and *The Smart Lamp* -but are all identical. These lamp bases (the electronic ballast) are usually packaged with imported tubes. From what I have seen, 'many of these lamps last less than a year, and one I saw recently being in service for only three weeks.



Compact fluorescent lamps - some of them are not reliable.

What goes wrong?

The most common fault that I have seen with these lamps involves the electronic circuitry. Like all equipment made in Australia, there must be provision in the circuit for overload protection should a component fail and draw too much current. In these lamps, the protection is provided by a device known as a fusible resistor.

Like a normal resistor, these things have a standard nominal resistance which is written on the outside of the device using the standard four-band resistor colour coding system. What distinguishes these devices from a normal one watt resistor is that they are matt grey in colour instead of brown or blue like most resistors.

What does this device do? The idea is that the lamp ballast will have a known current consumption that is proportional to its light output. A fusible resistor is connected so that all of the current entering the ballast from the mains socket flows through this resistor. The resistor is of a suitable value so that it is dissipating only a small amount of power. If a component elsewhere in the circuit fails, causing too much power to be drawn, the power dissipation in the fusible resistor will increase to the point where it too will fail, thus shutting off power to the lamp.

This is all well and good in theory, but in practice the fusible resistors are prone to failure for no apparent reason. The result is a component worth a few cents stopping a $25 lamp from working.

Fixing the faults

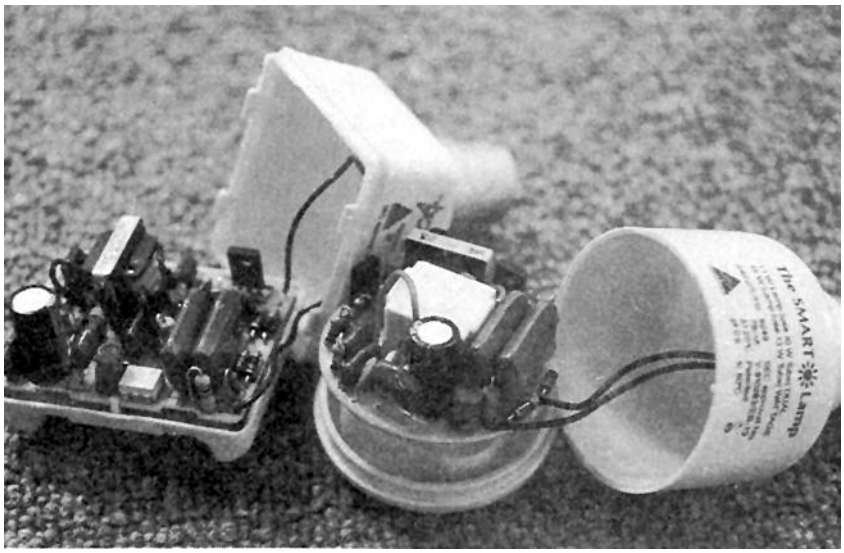
So how do you fix it? Start by removing the tube from the base, and then with a very sharp, thin-bladed knife (such as a Stanley knife or similar) break the seal between the two halves of the ballast case, On a 2D type lamp you will have to fight it out with the glue used to seal the unit. The more common long type should come apart easily.

You will now have to ease the circuit board from the main body. There will be enough lead length to enable you to gain reasonable access to the components. With the 2D type you will need to carefully feed the four tube socket wires through the holes in the circuit board.

Now that you have the lamp apart, look for the two wires that come from the mains power fitting in the body of the lamp (not the tube socket). Where one of these enters the circuit board, you will find the fusible resistor - marked FR1 on the board. It is now just a matter of removing this resistor and fitting a replacement of the same ratings.

With the units I have fixed, I have been using standard ¼ watt carbon film resistors of the same value as replacements. These resistors, while not really designed to act as a protection device, do an excellent job all the same (I have tested them and they interrupt 240 volts easily and rapidly, with little arcing).

By the way, it is a must that you use a low-power soldering iron of no more than 25 watts, or else you will damage the circuit board. A solder sucker



Here you can see both types of compact fluoro bases after disassembly. The unreliable component, **FR1,** can be seen just above the lower black lead where it attaches to the circuit board. Note that in the ballast on the left, the resistor has already been replaced.

or a roll of desolder braid can be an enormous help here.

Once you have replaced the resistor, reassemble the unit, making sure that none of the wires have become dislodged from the tube socket contacts (the 2D tube contacts are not the most well-designed units - they hold the wire by friction alone). Your compact fluoro should now work again. Of course, if the original resistor died due to the failure of another component, your new resistor will also go the way of the dodo. Of the numerous ballasts that I have repaired, only one or two have had other dead components. The rest have worked fine, and are still going unless another fault has occured.

More problems

The second problem that has shown up with these lamps is also within the circuitry, and involves the 100 ohm ½ watt resistor that limits current in the MOC3021 triac optocoupler. While I am not completely sure of its role in the circuit, it appears that the MOC3021 provides starting pulses to the circuit when the lamp is first turned on.

The problem with the resistor is that it overheats and can actually split in half, stopping the lamp from running. The solution is simple, just replace it and all should be well.

Next!

This brings us to the next problem with these lamps, which is more a mechanical one. The bayonette cap style ballasts have a tendency to lose the pins that hold the lamp into the fitting. This can be easily fixed by soldering the pin back into place. If you have lost the original, a new one can be made from a short piece of copper wire about 2mm in diameter.

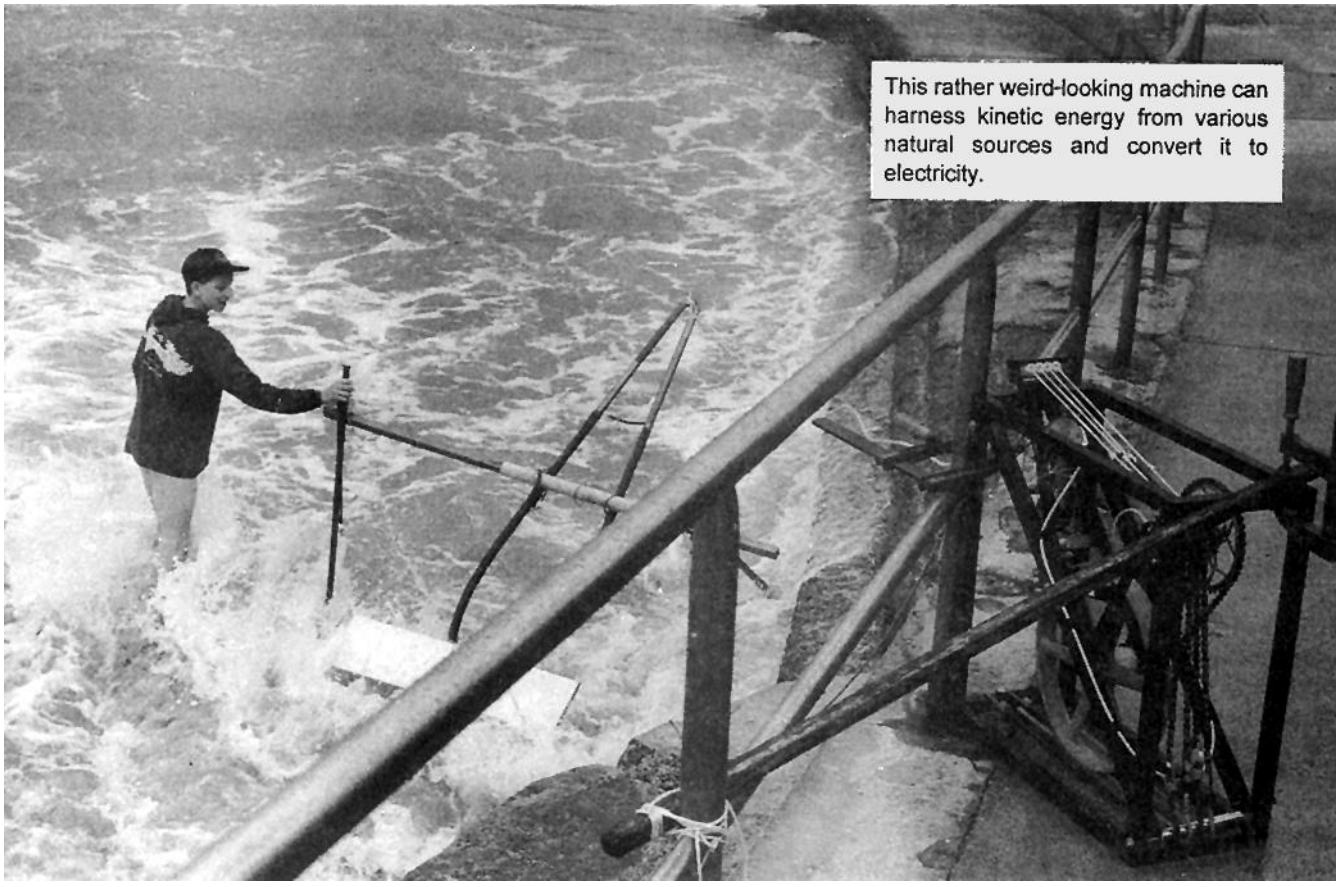
Last but not least

The fourth problem that we have encountered only occurs in the conventional long style of lamp, not the 2D type. The two contacts in the tube socket can come adrift and push back into the ballast body so that the tube pins do not make proper contact. This is easily solved by pulling the lamp apart as described earlier and gluing the contacts into place with some epoxy resin glue.

We hope that some of those many dead compact fluoros that are lying around in kitchen drawers all around the country will now be resurrected and go on to a long and glorious life, or at least a useful one.

If you have had bad experiences with these beasties, please let us know of your problems and if and how you fixed them. ☼

Harnessing KINETIC Energy



This rather weird-looking machine can harness kinetic energy from various natural sources and convert it to electricity.

This article is based on a Junior Science Research Project which won the Author the Young Scientist Award for 1993.

George Cant

PEOPLE use lots of different kinds of natural energy, such as wind, solar and fossil fuels. Lots of nature's energy is transferred into movement of trees or the wind producing waves, but most of this energy is not harnessed.

We do use energy from the movement of animals and people: horses move carts, people pedal bicycles and so on. The energy from fossil fuels and nuclear reactions, for example, are harder to collect than little movements from waves or from branches moving about in the wind, but the technology is well known and they produce a lot more power.

This article aims to show that small movements can be harnessed by a simple machine using technology that doesn't pollute and which & available all over the world.

This model could be improved and could do practical things like generating power to charge batteries or to power beacons at sea.

Collecting energy

The method of collecting energy involves the use of a flywheel device. The energy comes from the back-and-forth movements of things such as waves going up and down the beach or the branches of trees moving in the wind.

The moving objects, be they branches or paddles in the waves, are connected to the machine by ropes. Small movements pull on the ropes which turn a drive shaft by means of ratchets made from bicycle parts. This shaft pulls a chain which turns the flywheel, which in turn stores the energy between movements. The stored energy in the flywheel can then be transferred to the generator to produce electricity.

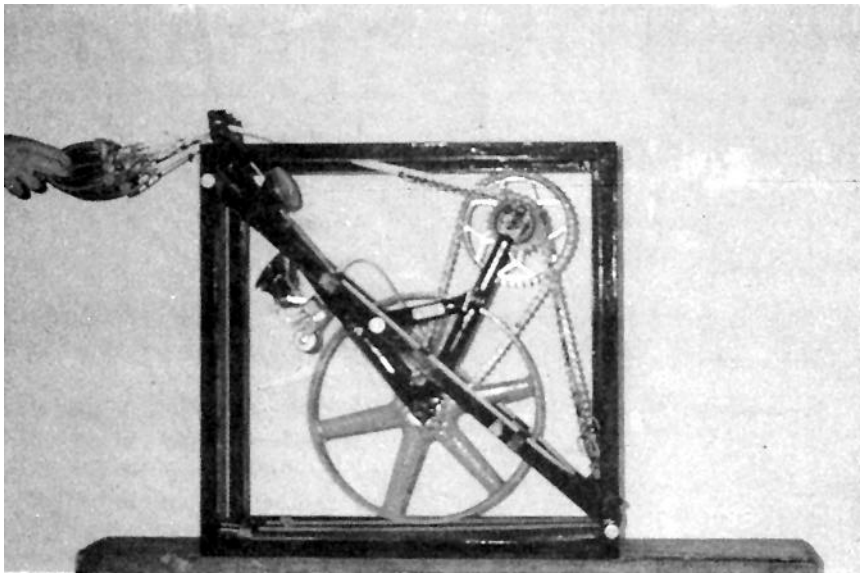
Making the machine

The machine described here can use different energy sources at the same time.

The model is made mainly from old bike parts, including the inner frame, chain, gears, drive mechanism and the electrical generator.

The outer frame came from a discarded shopfitting display unit which was made of square steel tube with comer insert joints. The flywheel was an old cast-iron wheel. I wrapped rubber tape around the flywheel, so that when the generator was rolling against it, there would be less noise and it would run more smoothly.

The model went together very easily, as most of the parts were designed for each other.



The machine is made from readily available bike parts.

After the model was complete, it was painted with rust converter which prepared it for painting. It was then given two coats of paint to improve its appearance and to stop it going rusty when it is situated near salt water.

The generator

The electrical generator is a normal bike generator (a *Sanyo Dynapower*, 6 volt DC) and is joined to the machine by a little metal bracket. The generator needs to be earthed and this is done by the bracket.

The drive mechanism

The drive system consists of a set of four sprockets with ratchets and one fixed sprocket, all on the same shaft. The fixed sprocket is connected to the drive sprocket on the flywheel hub by a standard bike chain. The set of sprockets with ratchets are turned by chains that run across them. These chains have a bungee cord at one end, connecting them to the frame. At the other end they have ropes connecting them to whatever is supplying the power via four more bungee cords. These act as shock absorbers and remove the jolt when the wave hits the paddle.

There are several gears to select from, and these are used to overcome the initial inertia of the flywheel. Once the flywheel is rotating, a higher gear can be selected so that the flywheel will gain more speed.

Results

The first time I tried the machine, I had it joined up to the waves in a special spot where the waves came in and were channelled up the beach along a wall. When the water came rushing up the beach it had a lot of force so it was not hard to get the paddle to move. When the first big wave came in, it pushed the paddle and got the flywheel spinning. After a few waves, the timber frame holding the paddle fell apart because it could not stand up to the force of the waves.

Later that day I set it up in a different place, attaching it to the walkway of the pool. This structure was much stronger than the first and the machine ran very well and was able to produce electricity.

Conclusion

This machine proves that the energy from waves and other natural movements can be harnessed. The machine could run much better if it had four paddles all set up in different places so that all the paddles would be moving at different times, thus producing a lot more electricity. The paddles would have been a lot more effective if they were a different shape - for example, concave instead of flat.

This is a working model of a possibly larger and more efficient motor which could be scientifically designed to harness kinetic energy from the surf or other natural energy sources, possibly all at the same time. ☼

BUILDING WITH STRAW

Leo Newport

I FIRST encountered a strawbale house two or three years ago. Within a few moments of experiencing the ambience of that elegant home, upon noting the utter simplicity of the concept and upon realising the implications of using this sustainable, environmentally friendly material from which the house had been built, I was hooked.

It was an attractive, complete home constructed of simple bales of string-tied strawbales that were neatly stacked, pinned together with short rods, then covered in chicken wire and adobe. It had an internal area of around twenty squares - about 1800 square metres - and had been constructed inside the huge pavilion of a Californian home show in only a few days by *The EOS Institute for the Study, of Sustainable Living* and friends, using almost exclusively unskilled volunteer labour.

Economic and social benefits

In community terms there are distinct social benefits where people band together to assist each other in times of difficulty. The Amish religious communities in America commonly band together to help each other in areas such as home-building and barn-raising.

In order to gain the economical benefits of building with strawbale it is common now in America for people to gather the help of family, friends and neighbours in erecting their strawbale homes. People are drawn into this community of friends centred around the new home. Everyone involved soon feels a powerful sense of protectiveness towards this house. They built it with their own hands, and they are now a part of it and it is a part of them.

Individuals today do not seem to have enough control over personal space. There is a profound feeling of self-satisfaction and joy which comes from building one's own home and from using natural products.

Women, although nominally equal, are still largely dependent on men to provide or at least build women's shelter. Few women will tackle hand building without a lot of involvement from men. Women in America, ranging from nuns to high school girls, have taken to strawbale building in amazing numbers. Strawbale building provides the opportunity for single women, or any inexperienced individuals - particularly those on very low incomes - to escape the crippling costs of home-building, as strawbale structures can be built for as low as 30% to 40% of the cost of a conventionally-built home.

Environmental benefits

Most people are completely unaware that the greatest cause of world methane emissions - which contributes to the greenhouse effect - is not bovine flatulence, but is caused by the decaying straw of the world's ricefields.

In New South Wales last year approximately 600,000 tonnes of rice straw were burned. This absolute waste of a valuable, natural, renewable, sustainable resource resulted in about 30,000 tonnes of carbon dioxide entering the air and over 2000 tonnes of solid particlates entering our atmosphere.

Consider the very different scenario of that rice straw being baled instead of burned. That straw could have provided enough material to build the walls of 15,000 twenty-square homes. It could have saved around two to three million cubic metres of native forest and provided a market for the rice farmers' waste material. Consider the economic, environmental and ecological benefits of using this material. Then add to that all the *other* straws such as wheat, barley, oats, etc which are all wasted but *could* be used!

In the United States alone it is estimated that enough straw is wasted every year to build over five million homes. And by harvesting the world's rice straw instead of burning it or allowing it to decay, a major contributor to the greenhouse effect might be abolished.

Imagine the reductions in logging which would be made possible by the use of strawbale building techniques!

How it is done

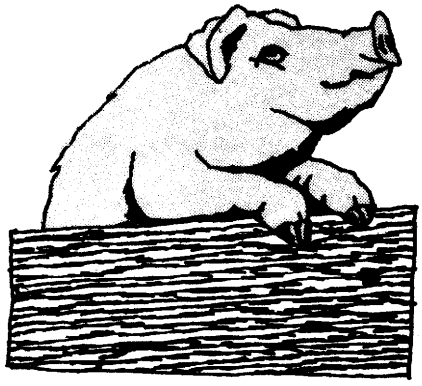
There is ample opportunity to use recycled materials and energy-efficient features. There is very little hard physical labour such as in rammed earth structures or with handling heavy mud bricks.

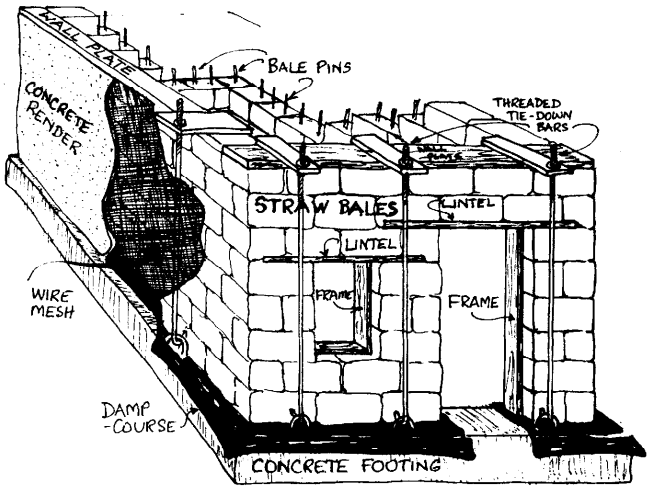
The straw is not used *with* anything - as in earth bricks or rammed wall structures. Individual string-tied bales of straw are simply stacked into walls.

The basic technique consists of laying down a good concrete foundation and stacking rows of strawbales in a *running bond* - rather like building with bricks or blocks but on a larger scale. In order to prevent lateral movement of strawbale walls, they are spiked with short pieces of reinforcing bar.

The walls are topped with wall plates which are then tensioned down and brought to *true* level with connections directed into the footings by means of threaded bar or perhaps high tensile fencing wire or turnbuckles, The wall is then covered with wire mesh and rendered with cement stucco.

Carefully sized, framed openings are left for doors and windows. These frames are spiked laterally into the bales with 300mm wood pegs and further protected from distortion by wide lintels above the openings.





If the three little pigs had constructed their straw house like this, the Big Bad Wolf would have had big problems!

Strawbale walls are compressed under tension before being plastered. There are strawbale houses in South Dakota and Nebraska in the United States which have been occupied since the late 1800s and early 1900s.

These homes have withstood searing summer temperatures as well as tornadoes, earthquakes and the freezing winter blizzards blown down from Canada. Many of the walls of these strawbale homes are fully load bearing and the houses have been built without posts or beams, in the manner we describe as *Merrigalah Style.*

Fire, insects, damp ...and cows

When people think of a straw house their first thoughts (after all the Three Little Pigs jokes are out of the way) are that the building might catch fire, be damp, attract insects, or even be eaten by passing livestock!

There is actually no danger of fire, as the straw is sealed completely within the airless chamber of the finished wall. Government tests in Canada showed that strawbale walls perform better than conventional building materials with regard to resistance of fire. It is easier to light a wet telephone book than it is to light a strawbale wall.

A strawbale house doesn't provide any greater dampness risk than in other forms of building, but it is necessary to understand how dampness occurs. Dampness comes from three main areas: the first through rainwater striking the walls; the second by water entering the top of the wall; and thirdly, dampness caused by wicking, or capillary action, through the base of the walls.

In virtually all new strawbale wall constructions it is advisable to add a commercial water barrier compound to the cement render mixture. In areas of very high rainfall one should ensure that the overhang provided by eaves is at least 600mm and all guttering is kept clean. If the top of the walls is sealed properly and an effective dampcourse material is installed between the footing and the first row of bales, then dampness from these areas is easily avoided.

Be sure that you buy only dry straw. When you are storing it before building commences, make sure it is stacked well off the ground and is covered with plastic sheeting or tarpaulins.

There is no oxygen to sustain the life of any creature caught in the walls, so it dies very quickly and painlessly. The same applies to mould. Mould cannot reproduce in the absence of oxygen, and so this is another reason to have confidence in straw.

As for farm animals eating the house, this is not a problem either as the straw is *not* hay or other feed crop. Straw is the cereal grain stalk which remains after the food has been stripped.

Building permits

At this stage, Australian councils are only likely to approve applications for strawbale homes to be constructed using the load-bearing *post and beam* method of construction. In these cases the strawbale wall is not load bearing and is, technically, nothing more than infill within that structure,

It is unlikely that approval would be granted for a residence built in the Merrigalah Style, in which the walls themselves are load bearing and carry the full weight of the roof

Test programs

The only effective and controlled test programs have been conducted in Canada and the US, and to a lesser extent in Wales. These tests all show highly satisfactory loading performances as well as the superior fire-resistance and insulation properties of Merrigalah Style load-bearing strawbale walls.

Unfortunately, these test results are not much good to Australians in seeking council approvals, as bale sizes and weights in America are quite different to those in this country. The whole concept is virtually unknown and untried in Australia and the authorities remain unaware of its benefits.

In order for the wide spectrum of superior qualities of strawbale buildings to be accredited under the *National Accreditation Scheme,* which includes recognition by the *Australian Standards Association* and by the *Australian Uniform Building Regulation Co-ordinating Council,* it is necessary to undertake a highly detailed series of scientific performance tests.

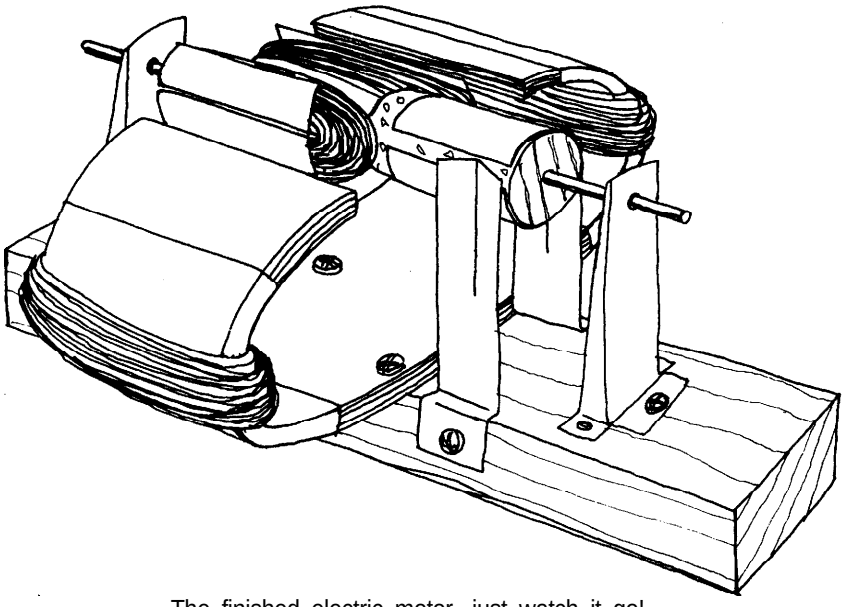
Testing costs by the *CSIRO Division of Building Construction and Engineering* will be in the vicinity of $60,000, so we are trying to establish a non-profit research and education organisation - to be known as *The Merrigalah Project* - to attract tax deductible donations and grants to pay for testing.

We are confident that the tests will show that strawbale is a quick, economical and very user-friendly material that will enable virtually anyone to build beautiful, well-insulated, comfortable, safe housing at a really low cost. ☼

For further information, send a large stamped self-addressed envelope - with $9 to cover postage and other costs - to Leo Newport, PO Box 602, Ryde NSW 2112.

NOEL'S TREASURES FROM TRASH
Low Cost Home Science Project #11

This electric motor can be wired in several different ways to suit a number of purposes.



The finished electric motor -just watch it go!

How electric motors work

An electric motor consists of two main pieces, the ***rotor*** (or armature) and ***the stator.*** In the motor we are about to make, the rotor runs inside the stator and is turned by the magnetic fields produced when the current flowing through it reacts against the stator field. The power is supplied to the moving rotor via brushes which rub on two semi-circular metal sections on the rotor shaft called the ***commutator.*** This commutator switches the direction of current in the coils twice a revolution so that the force on the rotor is always in the same direction.

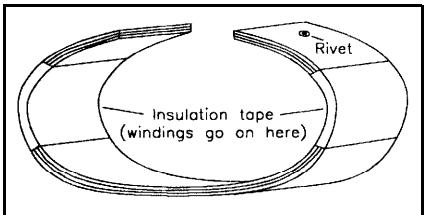
The stator can consist of either permanent magnets to provide the field, or coils of wire like those in the armature.

If this all sounds too complex, then perhaps we should learn by building it.

The stator

Start by cutting the ends out of the jam tins and mark a line around the circumference of the tins, halfway between the top and bottom on seven of them. Now cut them down one side and along the line you have just marked. You should end up with pieces of tin about 50mm x 270mm. You may cut off the rolled edges if you like, as this will make the tin easier to work, but less rigid.

Take eight pieces and put them together with the rolled edges on alternating sides. Now drill a hole 132mm from one end and 25mm from one side. Hold the tin in a piece of thick cloth to reduce the risk of cutting yourself when drilling. You may like to use a centre punch (or a big nail) to make a dent so that the drill doesn't wander. You can then bolt or pop-rivet the pieces together. You now have the stator laminations.



The stator is shaped like this.

Trim the ends so that they are level and then wrap them in insulating tape where the windings will go. Drill two holes about 30mm apart either side of the centre of your stator (four holes in all).

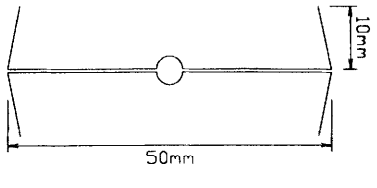
Now you need to wind at least 50 turns of wire around the stator, about 50mm in from both ends (two coils), making sure that they are both wound in the same direction. Leave this as one continuous piece of wire with enough at each end for connecting up later, and remove about 10mm of insulation from each end. You now have your electromagnetic stator.

The rotor

Take two pieces of tin about 70mm x 45mm. Make a small groove across the middle of each one so that it will clamp easily onto the bike spoke. Now bend each end up to just over 90°, about 10mm from each end, as in the diagram. Take the cork, find and mark the centre at each end and put a 5mm deep cut across the centre of one end. You must then force the bike spoke down through the centre of the cork, making sure that it is centred (if you sharpen one end of the spoke it will be much easier). The cork should sit 25mm from one end of the spoke, with the cut end toward the centre of the spoke.

Take the two rotor pieces, clamp them to the spoke, and slide them down into the cut you made in the cork. Cover the metal with insulating tape. This will protect the windings as well as hold the metal pieces together. Now wind at least 50 turns of wire onto each side of the rotor, making sure that the windings are in the same direction, and strip some insulation from each end. This should also be one long piece of wire, not two separate windings.

Take two small pieces of tin about 35mm x 30mm, and bend them so that they fit neatly around either side of the cork. Secure them onto the cork with a strong rubber band, making sure that they don't touch each other. Now you



This is how you fold the rotor pieces.

can solder one wire of the windings to each of the small tin pieces. This gives you your rotor, the small tin pieces being the commutator. Note here that the gap between the commutator pieces should line up with the slot in the cork that holds the armature pieces. The rubber band allows you to adjust the commutator *timing* in both directions to find the best output of the motor.

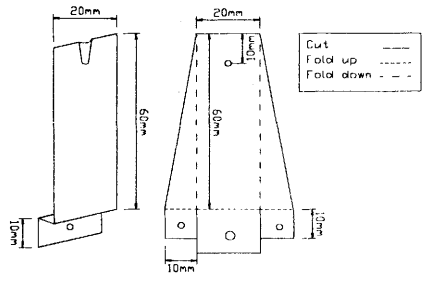
Bits and pieces

Other parts required to complete the motor are the rotor supports and the brushes. These are cut from tin cans and the patterns can be seen in the diagram. Start by making the rotor supports. After cutting out, you must drill the holes and fold as shown in the diagram. Next you should cut out two pieces for the brushes, about 20mm x 80mm, and also fold as per the diagram. You will then need to put a small groove in the end of each one and a hole in the other end, about 5mm in.

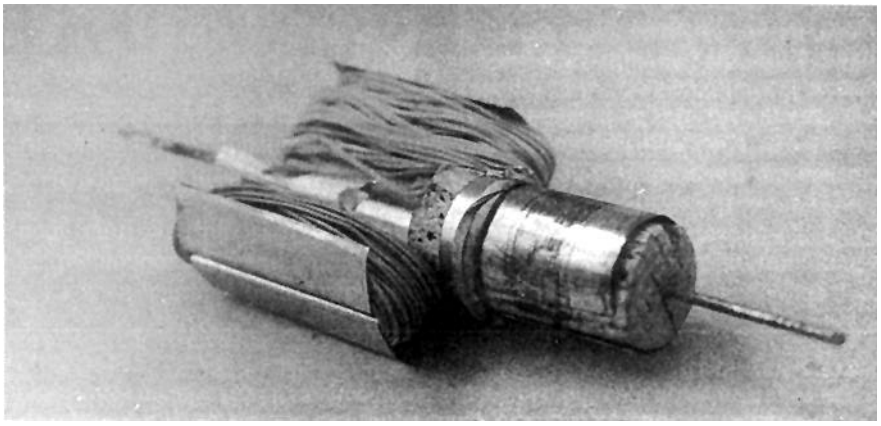
Putting it all together

Fix one rotor support onto the base, about 30mm from the end. Now mount the stator next to this support, about 45mm in from the end. Slide the rotor into position through the hole in the support. Use pieces of drinking straw on the rotor shaft as spacers so that the rotor is positioned between the stator poles. Then fit the other rotor support into place and make sure that the rotor turns easily.

Bend the stator pieces down so that they are level with the rotor, but far enough apart to allow the rotor to rotate freely. Now attach the two brushes to either side of the base, level with the commutator, and bend them so that they apply light pressure to the commutator.



These are the patterns for the brushes and rotor mounts.



This is the completed rotor. Note the rubber band holding the commutator pieces.

Ready to roll

Now that your motor is complete you only need to hook up the wires and apply power. There are a number of different configurations that you can use, and we will try several of them.

DC series motor

Connect the +ve of the 12 volt supply to one of the brushes and then connect the other brush to one end of the stator windings. Connect the other end of the stator winding to the -ve of the power supply. Give it a little flick and the motor should turn.

Shunt motor

In this configuration, the two stator windings are attached to the two brushes, with the power supply being connected directly to the brushes. This arrangement will draw more current, but the motor will have more power.

Permanent magnet motor

You can also make the motor up as permanent magnet motor. If you have a horseshoe magnet with a gap between the poles that is wide enough for the rotor to run in, you can remove the stator and put the magnet in its place. Then simply connect the power supply across the brushes and away you go.

If you only have a bar magnet, you can make up another stator as before, but with no windings on it. Bend the stator to the right shape as before, and then cut about 15mm out of the centre of it so that you have two separate pole pieces. Once you have mounted these on the base you just put your bar magnet across the gap.

If you have used an electromagnet for the stator as well as the rotor, you can run this motor in either of the above configurations on AC as well as DC. Your motor will not run on AC if you have used a permanent magnet stator.

There are a number of ways that you can improve your motor. You can put some graphite (from a soft pencil) on the commutator and brushes, some oil on the shaft where it goes through the supports, or use more turns on the windings. Good luck. ☼

You will need:

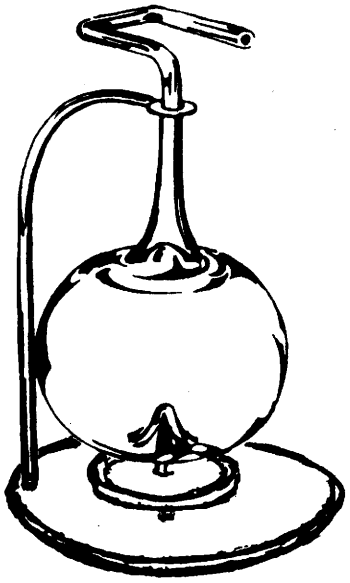
- *a 12 volt power supply, AC or DC*
- *eight steel jam tins (670g size)*
- *piece of wood 200 x 50 x 19mm*
- *at least 25 metres thin enamelled or other insulated wire.*
- *four self-tapping screws 15 x 3mm*
- *eight self-tapping screws 10 x 3mm*
- *a drinking straw*
- *three small bolts and nuts or pop-rivets*
- *a straight-sided cork*
- *a bike spoke*
- *a strong rubber band*
- *some insulation tape*
- *large horseshoe or bar magnets (optional)*

Tools needed:

- *tin snips*
- *hacksaw blade*
- *pliers*
- *drill and 3mm drill-bit*
- *pencil and ruler*

TOYS FOR THE GROWN-UPS

In recent catalogues we have advertised several different models of the Stirling Cycle engines for sale. Due to a problem with the manufacturer of these machines, they have become unavailable. To take their place we now have several different and unusual devices available, including a model of Hero's original steam engine. We apologise for any problems that may have been caused by our supply problems, but can guarantee that these models are just as interesting and as much fun.



Hero's Steam Turbine

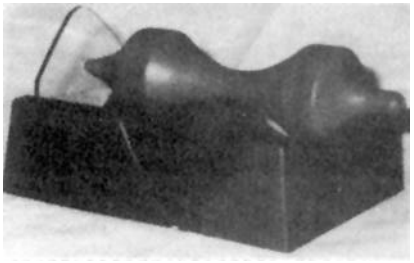
This is a working model of the world's simplest steam engine, first proposed in 50BC by Hero of Alexandria. Made from Pyrex glass with a brass stand, this model is simple in both design and concept. Model is 170mm high with a 100mm base diameter.

Water/ice Stirling engine

This is a low-temperature differential Stirling engine that runs on hot water or ice for hours at a time. This quality engine does not require any flame or other intense heat source, making it safe for kids of all ages. This unusual model is 220mm high and is mounted on a 180mm round base. An 80 page book titled *An introduction to Stirling engines* is included with each engine.

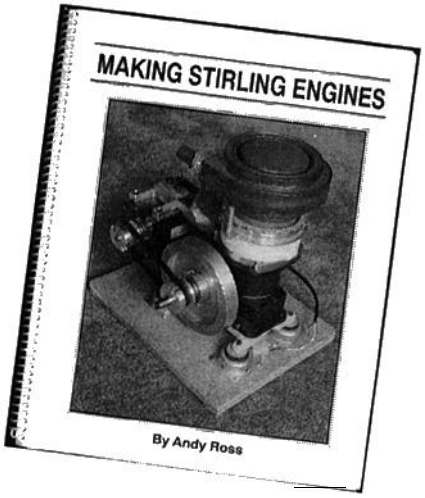
Making Stirling Engines

This book gives detailed instructions on constructing a number of different versions of Stirling engines. It also gives a brief history of these machines. Many black-and-white photos throughout.



Frictionless Super Rotor

This precision-made scientific demonstrator is easy to operate and shows the principles of magnetism, rotational inertia and friction as it spins quietly and near-continuously. The base is 120mm x 80mm and the rotor is 130mm long.



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PRICES? WHAT PRICES?

At the time of going to press we were still negotiating prices for these Stirling engines and books. But by the time you get this magazine we should have everything organised. If you would like more information about Stirling engines – or books on making them – please call, fax or write and we'll let you know the latest.

Alternative Technology Association, 247 Flinders Lane, Melbourne 3000
ph:(03)650 7883 fax:(03)650 4175

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INSULATION BUYING GUIDE

Andrew Blair

JACK was 78. He been living alone since his wife Shirley had died and the kids had grown up and left home. He still lived in the family home but only really lived in the den. In winter he would read, doze or watch television there with the doors to the rest of the house closed.

Some time ago, an insulation salesman sold him insulation for the ceiling of the house. Actually, the neighbours had put the salesman onto Jack when they had their house done. The salesman had told Jack that one inch of insulation would be like one blanket on the bed; two inches would be like two blankets, and so on. Jack always slept with the bedroom window open, so decided that four inches of insulation would be about right.

After it had been installed, Jack noticed that the den required the heater to be on a much lower setting and he observed that his gas bill was less. He also noticed, however, that the rest of the house was colder. Before the insulation was put in, the house had warmed up on sunny winter days. Now the insulation stopped the sun's heat from coming through the roof and the house was always cold - except of course for the den. In summer the house stayed much cooler than it had before. Overall, Jack felt that the insulation was worthwhile, despite the fact that most of the house was like an icebox in winter.

His neighbours' house was the similar, but had central heating. After the insulation was installed, their house was much warmer than Jack's and their heating bill dropped considerably although it was still larger than Jack's.

Insulation theory

This story outlines some of the basic ideas involved in house insulation. Insulation does not make a house warm. It slows down the movement of heat into or out of the house. In the case of Jack's house, the insulation kept the heat in the den, but because the rest of the house was not being heated it was cold. The insulation kept the warmth in the ceiling space out of the rest of the house, making it freezing in winter and comfortably cool in summer.

Photo from BBS Blanket Building Supplies (Tontine Polyester Insulation).

Polyester insulation is available as a roll-out blanket. It is pleasant material to handle and the suppliers claim that no special protective gear is required to install it.

Heat transfer

Heat moves from place to place by conduction, convection and radiation. It is radiant heat from the sun that heats our houses. Reflective foil acts as an insulator by bouncing the heat back in the direction it has come. Bulk fill insulation - fibreglass or rockwool batts, wool, foam insulation, cellulose fibre, etc - is a poor conductor of heat so it takes heat a long time to actually travel through an insulating material. Bulk fill insulation also has the effect of preventing convection currents carrying heat from one place to another.

For the insulation of houses to be effective the doors and windows must be kept closed and any ventilators sealed off. In winter it is common to open the windows if the day is warm and to keep them closed for the rest of the time. In summer it is common to keep the house closed during the heat of the day and then open it at night to let it cool off.

Wall insulation

In days gone by it was common to put aluminium foil onto the outside of the timber studs of a house when it was being built but not to place bulk fill insulation in the walls. This had very little insulating effect because it was not possible to seal it completely. Currents of air passed over the top and under the bottom of the sheets of foil as well as through the joins in the middle. Air also passed through holes where brick ties had been put in place, and where electricians and plumbers made holes for pipes and wires. By itself the foil was fairly useless.

With bulk insulation - usually batts - behind the foil between the studs, the insulation of the house was improved enormously.

For double brick cavity walls, bulk insulation is still very much worthwhile. Most people like to leave an air gap between the two courses of bricks in a cavity wall in order to prevent dampness from the outside getting inside.

Batts are not popular in cavity walls as they reduce air circulation. Bricklayers are loathe to install batts while the wall is being built and so, unfortunately, few brick houses have insulated walls.

Table 1 shows that insulating double brick walls is well worthwhile and that sheet foam insulation is extremely effective. (U values are explained in the box on page 69.) If you use batts in the ceiling, then the strong protests of the bricklayers must be ignored and you should insist that batts be included as the walls are built. Those who have persevered in the past have been delighted.

Most of us do not live in houses that have insulated walls. What can be done about it? The answer is: not much. For cavity brick walls, it is possible to inject foam insulation into the walls as a liquid. It expands and then sets solid. There is considerable resistance to this for fear of fumes being given off by the foam and coming through the wall, affecting the people inside the house. There is a market just waiting for the right invention: a product to insulate the walls of existing houses.

Roof or ceiling insulation

Many houses have space between the roof and the ceiling. This means that insulation can be added later if it was not there when the house was built. For houses with the ceiling and the roof so close together that there is no space for a person to get into, the insulation must be put in place when the house is built or by taking off the roof.

Because the ceiling is usually flat, or close to it, a much wider range of insulation types can be used. Anything that is a good insulator can be used; be it loose fill rockwool, fibreglass or rockwool batts, seaweed, treated paper pulp (cellulose) or wool. Other good insulator -such as cardboard, sheets of newspaper, old carpet, underfelt, wood chips, or straw - would all work, but because these materials would bum they are not recommended and would not be permitted.

Types of insulation

There is an enormous variety of insulation materials available. All have advantages and disadvantages"

Table 1. **External house walls**

		'U' value	Lag (hours)
UNINSULATED external walls	**brick cavity** 110 brick 50 airspace 110 brick	1.67	6.2
	brick veneer 110 brick 140 airspace (studs) 12 plasterboard	1.85	3.1
	weatherboard 20 weatherboard 100 airspace 12 plasterboard	1.82	0.8
INSULATED external walls*	**brick cavity** 110 brick 70 foam (urea formaldehyde) 110 brick	0.38	7.5
	brick veneer 110 brick 50 airspace 50 bulk insulation 40 airspace reflective foil 12 plasterboard	0.38	3.8
	weatherboard 20 weatherboard 50 airspace 50 bulk insulation 40 airspace reflective foil 12 plasterboard	0.38	1.2

* For purposes of comparison, the insulated walls were constructed so they would all have the same 'U' value. In order to do this in the brick-veneer house, normal building practice was improved to give a still air space in the cavity between the timber frame and the brick skin. It is therefore a better insulated wall than normal.

Information in this table from the Brick Development Research Institute

Aluminium foil is shiny, and so radiates radiant (but not conducted or convected) heat back in the direction it has come from. It also has the ability to act as a moisture barrier and is frequently included in a house for its moisture resisting, rather than insulating, properties.

Foil built into a wall will only be effective as an insulator if there is an air space next to it into which it can re-radiate heat. Often foil is placed on the

outside of wall studs. If weatherboards are nailed over the outside, then it will have little insulating effect against heat travelling through from the outside. It cannot reflect that heat into air between it and the weatherboards because there is none. A brick veneer wall will have an air cavity between the foil and the bricks. If this cavity is well ventilated, the heat from the outside will be reflected back into the cavity, heating the air, which will rise up through the cavity and escape.

Foil in ceilings can radiate heat from the roof back into the roof space and so will act as an insulator as long as it is bright and shiny. Once it gets dust on it, it no longer radiates heat as effectively. Placed on top of the ceiling battens, or under iron or tile roofs, where the lower surface will not get dust on it, it will radiate heat back down into the building in the winter time.

If foil has holes in it and hot air can pass through it, it has little use as an insulator. Foil is available in rolls and comes reinforced with other materials to make it strong enough to be nailed to walls.

It is available in a concertina form and can be fastened under floors, in ceilings or between wall studs. To be effective, care must be taken to make it well sealed. A product called *Foil Board* nailed across the outside of studs will achieve this if carefully fitted.

Foil has also been made into batts, with two flat layers separated from each other by little walls at right angles. The air gap in between acts as an insulator; air is a poor conductor. This, and the radiant effect of the foil, provides the insulation effect.

Fibrous bulk-fill materials

Bulk-fill materials are the best known and most widely used materials. Because of their thickness they reduce the conduction of heat; the thicker the better. Their fibrous nature prevents the convection of heat through air currents. Their bulk blocks radiant heat but does not reflect heat as well as foil does. On the other hand, it does not matter if it gets dusty.

Loose fill insulation is usually blown into place by the supplier. It can only be put on flat or near-flat surfaces. It is often cheaper than batts and consequently there is not a great deal of difference in the cost by the time it is installed. If it has to be removed it can be a problem, though removal is not impossible. It has the benefit of sitting' snugly on the ceiling and sealing it well, blocking off gaps which may allow air currents to get in. In contrast, if batts or foil are not carefully fitted these gaps can remain.

Although there are various types of bulk materials, fibreglass or rockwool batts are the most popular and have the biggest share of the market.

Batts are popular because they don't require special equipment for their installation. They also remain rigid and are therefore well suited to be placed in wall cavities or ceilings. They are easily installed or moved if a light or fan needs to be installed in the ceiling, or if an extension to the house is undertaken.

Millions of **glass fibres** go to make up fibreglass which is used as batts. The batts are available in various sizes and thicknesses. The thicker the batt, the higher the R value. If you want a higher R value it is possible to put two batts together. Batts are made to fit snugly between a standard wall stud spacing of 450mm or 600mm.

Fibreglass sheds small fibres whenever it is being handled. When the sun streams into a house in which fibreglass batts are being installed, the sun shows that the air is full of these tiny fibres. As a safety precaution, it is advised that installers of fibreglass batts wear long sleeves, a dust mask, gloves and goggles. If you don't, you will find yourself very itchy and coughing afterwards. Claims have been made that fibreglass is carcinogenic.

Rockwool is also made up of small fibres. It is available in batts or as loose lumps. Rockwool **is** made from molten rock (basalt) or furnace slag - sometimes called *slagwool*. Its properties are similar to fibreglass although it is perhaps a little more dense.

R values, condensation, measurements & other technical stuff

Insulation reduces the movement of heat. Heat travels from a region of high temperature to a region with a lower temperature. In this article we talk about the movement of heat, not the movement of cold. cold is just lack of heat. In winter, a house may be cold because heat moves out. Insulation is used to reduce heat moving out in winter, or moving in during summer.

When attempting to find out what sort of insulation is best, scientists want something that they can measure. The figures in Table 1 show very clearly that the *U* value for uninsulated brick is about the same as for uninsulated weatherboard. This explains why Jack's house was like a refrigerator in winter; the heat got out easily through the walls. The U value is the measure of the heat movement. It has a similar use to the more commonly used R value; a measure of the resistance to the movement of heat. High U values mean a lot of heat is moving through, while high R values mean that there is high resistance to such movement.

A chart has been prepared by Bradford that represents the R value recommendations for walls and roof in the different regions of Australia. Tasmania, Northern Australia, inland areas and mountainous areas all have the recommendation of R3.5 for ceilings and R2.0 for walls. For Sydney, Perth and Brisbane the recommendation is R2.5 in ceilings and R1.5 in walls. More information is available in their *Building insulation design guide*.

Lag time is the time it takes for heat to travel through a wall. Here the uninsulated brick and the weatherboard are very different. On a hot summer's day a double brick wall house will take about six hours before the heat gets through the wall. The weatherboard house will start to heat up almost straight away. At night, as the two houses start to cool down, the brick house will take much longer.

Houses with concrete floors and brick walls – especially internal walls – tend to be much more temperature stable than houses with less mass. This is referred to as *thermal mass* and in general terms; the higher the thermal mass, the longer it takes for a building to heat up and cool down. If the thermal mass is on the inside of the insulation it makes for a building with a very stable temperature.

It is easy to confuse the effects of insulation and thermal mass, which is why the examples of the uninsulated and the insulated brick walls have been compared with each other and with the weatherboard walls.

The **polyester** material used in insulation is like the polyester used in some sleeping bags, heating ducting, etc. It is available as a roll-out blanket with or without foil attached to it. It is pleasant material to handle and the suppliers claim that no special gloves, mask or goggles are required to install it.

Wool appeals to a lot of people because it is a natural material. The insulation is made from low-quality wool and offcuts. It is washed and then treated with a non-toxic pesticide so that moths, other insects and bacteria do not eat it. It is produced as a batt but each batt has to be stapled in position to the wall studs in the wall cavity. It is also available as loose material for insulating ceilings.

Cellulose wood fibres are obtained from newspapers and treated to make them tire resistant. The resultant material is blown into the ceiling of houses and, like rock wool, settles into place providing excellent insulation. The idea of using a recycled material appeals to many people.

Seaweed is used for ceiling insulation and is sold under the name of *Alpinite*. The material, Eel grass *(Zosteru marina),* is the seaweed that washes up on beaches in southern Australia.

Asbestos is a naturally occurring fibre that was used for insulation until it became associated with lung disease.

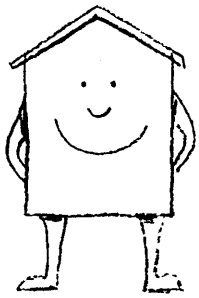
Vermiculite is a rock material (mica) that has been expanded through heating. It is lightweight, an excellent insulator is fire resistant. The small granules of vermiculite can be poured onto ceilings, cavity walls or other places where they can be contained.

Polystyrene, urea-formaldehyde and other foam materials have been used for insulation in the past.

styrofoam is an insulation board produced by *Dow Chemicals.* It is used under floors, as well as in walls and ceilings for insulation. It is available in 25mm thickness, making it suitable for cavity brick walls, as well as 35mm and 50mm widths. It acts as a vapour barrier and contains a fire retardant to inhibit accidental ignition. However, the boards are combustible - like so many other building materials. lt is a tongue and groove jointed, high-density polystyrene foam.

Other considerations

Manufacturers' advertising materials raise questions about opposition products. Some of the questions raised are not particularly relevant.



According to the Asthma Foundation of Victoria, fibreglass insulation is acceptable as long as it is sealed so that fibres will not become airborne.

Allergies - It is well known that houses have the ability to produce airborne vapours - from paints, plastics, carpets, wall boards, glues, etc - that will affect some people, particularly asthmatics. One of the ways around this problem is to have a better-ventilated house, which is totally opposed to the idea of keeping the house well sealed to prevent heat loss in winter or heat gain in summer.

Some manufacturers of insulation claim that fibreglass is a health hazard. If a house is well constructed, the fibreglass insulation should be sealed out of the living areas. Whilst it is being installed however, it can be a problem.

Moisture can have an effect in a number of ways. A vapour barrier which prevents moisture - in air, for example - travelling through it should always be installed on the warm side of the insulation. It can have condensation forming on it and pools of water may develop. Often foil is used as a vapour barrier rather than as an insulating material.

The insulation material may absorb moisture. It may carry water by capillarity - like a wick or a towel. Some insulation, if it gets wet, may go rotten.

Fire safety - It is important that insulation does not bum. It is also good if it acts as a barrier to fire should a fire occur. This, however, is not essential unless it is installed for that purpose. Some materials may char a little but not flame. Others under intense heat may melt.

Sound insulation - In general, the more solid a wall the better sound proofed it will be. The same applies with insulation. Extremely light, low-density insulating materials are less likely to provide good soundproofing.

Windows - Even if a house is well insulated and has a high thermal mass inside the insulation, the temperature of the house will be significantly affected by the area of the windows. Although glass is regarded as an insulator, the thickness of glass in windows is only a few millimetres and so windows in most houses let lots of heat through. In modem houses with big windows the heat passing through the windows is enormous. If you want your house to be well insulated, you cannot afford to have huge areas of glass windows.

Double glazing will reduce heat transfer through the glass, but for most Australian situations double glazing is not regarded as economical.

Cost - The only way to compare the cost of one product with another is to compare the R value of each product for a set area. The usual way would be to work out the cost per square metre. Fibreglass, rockwool and Styrofoam batts can be manufactured with a high degree of precision and the R value can be accurately stated. This cannot be done with loose fill materials. But this does not really matter, as a good installer will add a little bit extra to allow for settling and still have an even cover to at least the depth required to give the R value being paid for. Prices vary a lot. For this reason do not accept the prices published here as the price you will have to pay. ☼

Further information

Energy Victoria
Insulation Guide: a guide to insulating new and existing homes

Australian Standard – AS 2627

Bradford Insulation
Building insulation design guide
Insulation performance guide

ACI Insulation
How to install ACI insulation products
The inside story of insulation

Environment Protection Authority
Indoor air quality in domestic premises (Publication 327)

Asthma Foundation of Victoria
Specifications for an asthma-friendly house ph:(03)853 5666

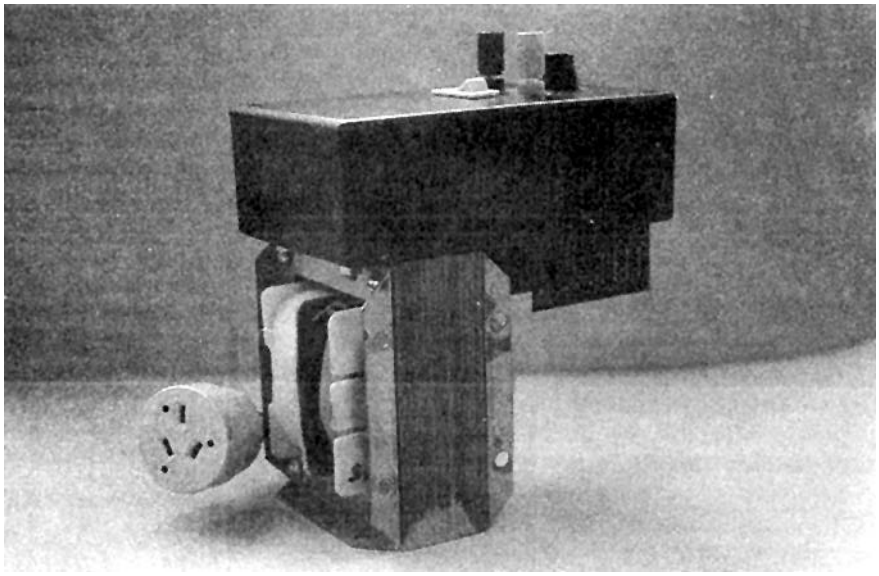
Table 2

Product	Material	Location	Presentation	Comments	Price/m^2	Contact
FOIL						
ACI *Sisalation* *Permastop*	laminate Sisalation/fibreglass	walls, ceiling, roof ceiling, roof	rolls rolls	contact supplier	varies, p.o.a.	ACI (02)792 1188
Auswool *Blanket*	foil/wool	ceiling, roof	rolls	50mm 75mm	$7.20 $8.90	Auswool (08)347 4556
Bradford *Thermofoil*	laminate – building grade	walls, roof	plastic-wrapped	R1.3 (walls), 1.25m^2	varies, p.o.a.	Bradford (02)844 7944
Building Blanket Supplies *Building Blanket* *Reflector Blanket* *Duroid*	 foil/fibreglass foil/fibreglass foil	 roof walls, ceiling, roof	 rolls rolls rolls	contact supplier	varies, p.o.a.	BBS (07)881 2300
Gang-Nail *Tecofoil*	reflective foil laminate	walls, ceiling, roof	rolls	contact supplier	varies, p.o.a.	Gang-Nail (03)763 4444
Insulco *Foil Insulation* *Building Blanket*	laminate foil/fibreglass	walls, ceiling, roof ceiling, roof	rolls rolls	contact supplier	varies, p.o.a.	Insulco (02)625 4444
Wren Industries *Foil batts*	concertina foil	walls, floor, ceiling	packs	R1.7 b.v. walls R2.2 timb. fl.	$3.95	Wren (03)532 5855
BULK INSULATION						
ACI *Pink Batts*	fibreglass	walls,ceiling	plastic packs	contact supplier	varies, p.o.a.	ACI (03)764 8868
Auswool	100% wool	ceiling walls	bulk delivery bag handypacks	R2.5 R3.0 R1.5 R2.0 R2.0, 7.4m	$9.70 $11.30 $6.50 $8.10 $55.95	Auswool (08)347 4556
Bradford *Gold Batts* Rockwool Rockwool	glasswool basalt rock granulated	walls,(ceiling) walls, ceiling ceiling	plastic packs plastic bags plastic bags	R1.5 – 3.5 R1.5 – 3.0	$3.85 – $7.90 $5.70 – $10.05 $4.00, installed	Bradford (03)265 4055
Building Blanket Supplies Reflecta Batts Reflecta Blanket Poly Batts	 polyester, foil polyester, foil polyester	 walls, ceiling, roof walls, ceiling, roof walls, ceiling, floor	 packs rolls packs	 R2.0 – R3.5 R2.0 – R3.5 R1.5 – R2.5	 varies, p.o.a.	BBS (07)881 2300
Dow Chemical *Wallmate* *Wallmate B V*	high density polystyrene foam	walls, floor, ceiling walls, floor, ceiling	packs packs	25mm thick R1.5 - R1.7 30mm thick R1.6 - R1.8	varies, p.o.a.	DCA (03)368 4411
Exfoliators	vermiculite	ceiling, walls.	bags	contact supplier	varies, p.o.a.	Exfoliators (03)528 4044
Fibre Fluf Home Insulation *Fibre Fluf* *Foil Board*	 cellulose foil/polystyrene	 ceiling walls	 bags	 R2.5 R2.0 in cavity walls	 varies, p.o.a.	FFHI (03)555 4717 (03)555 4299
Insulation Concepts *Insul Fluf*	cellulose	ceiling	bags or pumped in	R2.5 – R5.0	$2.95 – $5.90	IC (03)792 2524 (03)794 7172

Build Your Own 12 VOLT INVERTER

This simple design allows you to build a square wave inverter at very low cost. A future article will show you how to modify this design into a sine-wave inverter.

G. William Slade



This is the prototype inverter. It was built 'open construction' for ease of testing. Make sure that yours is completely encased in a suitable enclosure for safety.

WOULDN'T it be great to operate your mains-powered electric drill or stereo on the energy from the sun or wind?

Most household appliances and electronic devices require 240 volts at 50 hertz to operate correctly (and safely). In order to convert the direct current (DC) from the batteries and solar panels to standard mains alternating current (AC), an inverter is needed. Of course you could buy one of the excellent devices on the market to fulfil the task, but that would take all the fun out of doing it yourself.

Using relatively inexpensive and some 'junk' components, a simple square-wave 240 volt, 50 hertz inverter can be constructed which will power devices up to around 200 watts.

Voltage regulation

The inverter discussed here will not regulate the voltage or frequency, the latter being set by a resistor/capacitor network. However, if it is connected to a standard 12 volt lead-acid battery, the voltage will not vary more than 8% to 10% over the safe operating range of the battery. Also, the frequency will be stable to within a few per cent if high-quality components are used in the frequency generator part of the circuit.

This inverter will run lamps, stereos and small power tools well. Be careful about using this device for computers and other sensitive electronic equipment since there is no voltage regulation.

The ability of the inverter to handle reactive loads (such as motors and transformers) depends on the choice of components and the type of inverter circuit. This has implications on circuit safety if you're considering modifying this design.

Circuit description

Figure 1 is the schematic for the basic inverter circuit. The circuit is fairly straightforward. Notice the clamping diodes on the transformer primary. A NE555 timer chip acts as the oscillator and a CD4027 dual JK flip-flop generates the symmetric square waves that provide the drive to two high-current power MOSFETs. Since the power MOSFETs are

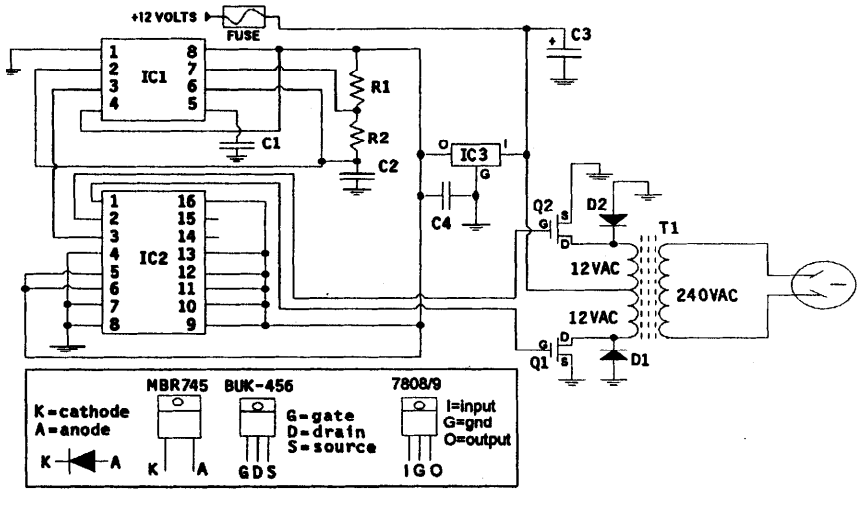


Figure 1. The circuit diagram for the inverter. Note the pin-outs for the power devices in the inset box.

WARNING!

This device can produce voltages and currents that can kill! Be *absolutely certain* that you have properly insulated all high voltage leads before connecting the inverter to the battery. Don't electrocute yourself! Always use the 'one hand behind your back' rule when trouble-shooting a live circuit. We want all those renewable energy people out there to stay alive!

either fully on or off, the circuit can be made very efficient.

While the transformer is connected directly to the battery via the fuse, the rest of the circuit has power supplied via a three-terminal regulator, IC3. This provides IC1 and IC2 with regulated voltage so that the circuit will run correctly. The output of the regulator is filtered by C4.

Starting with the 555 timer circuit, resistors R1, R2 and capacitor C2 set the frequency of oscillation to around 100 hertz (twice the line frequency). Depending on the quality of the components, the frequency may vary noticeably with temperature by up to a few percent. Generally, if you are not running digital clocks or induction motors from the inverter, absolute frequency stability is not critical.

Now look at the parts list below. The BUK456 MOSFET can be found at *Dick Smith Electronics. The* MBR745 is from *Rockby Electronics* in Huntingdale, Victoria. *Stewart Electronics* (also in Huntingdale) supply 1.2mm enamelled wire, but scrounging larger diameter wire would be a better way to go. Just make sure that the enamel is not damaged in any way! The output of the 555 timer is connected to the clock input (pin 3) of the 4027 flip-flop circuit. The flip-flop is configured so that its state will swap back and forth once every two clock cycles, hence the need for a 100Hz signal from the 555 timer.

The *outputs* (pins 2 and 3) from the 4027 are connected directly to the gate connections of the switching transistors. This causes one transistor to turn on while the other turns off and vice-versa. This alternately energises one of the two primary transformer windings, thereby generating the alternating current output. The two clamping diodes D1 and D2 are important for allowing energy to flow backwards from the load into the battery. This prevents the output transistors from being damaged or destroyed by reverse currents and high reverse voltages which appear when inductive loads (like motors, fluorescent lights and transformers) are connected to the output.

The clamping diodes in the prototype circuit are MBR745 Schottky barrier diodes with a forward voltage of about 0.5 volts and a maximum average current rating of seven amps. Typically, any large rectifier diode will work here, but lower efficiency will result if regular silicon rectifier diodes are used.

The transformer

The trickiest and largest part of this project is finding or making the proper transformer. This is where scrounging comes in handy. In order to buy a new transformer capable of running at 100 to 200 watts you could pay up to $100. It doesn't make any sense to pay so much when there are many dead stereos, TVs and other large electronic devices willing to give up their parts to a new life. The big rectangular-shaped transformers from large audio power amplifiers make good inverter transformers. Be sure to get a transformer with core laminations that are not welded together.

Parts required to build the inverter

IC1	NE555 timer
IC2	CD4027 dual JK flip-flop
IC3	LM7809 three terminal regulator
Q1, Q2	BUK456 power MOSFET
D1, D2	MBR745 Schottky diodes
C1	0.1µF 50 volt polyester capacitor
C2	0.22µF 50 volt polyester capacitor
C3	4700µF 35 volt electrolytic capacitor
C4	0.1µf 50 volt polyester capacitor
R1	5.6kΩ ¼ watt resistor
R2	27kΩ ¼ watt resistor
T1	Transformer (see text)
Misc	Suitable enclosure, heatsinks for Q1 & Q2, power point socket, 15 amp fuse and holder, high and low current hook-up wire, insulation tape, power switch, enamelled winding wire, IC sockets (if desired).

Rewinding

If you cannibalise an old piece of equipment for a transformer, it is highly likely that you will have to rewind it to get the proper turns ratio for your inverter. If you have managed to get a transformer with a 24 volt centre tapped winding, or two equal capacity 12 volt windings, you will not have to do any modifications to your transformer, just use it as is, and ignore the next few paragraphs.

After the transformer is removed from the old equipment, you must determine the number of turns on the secondary side so that you can rewind it properly.

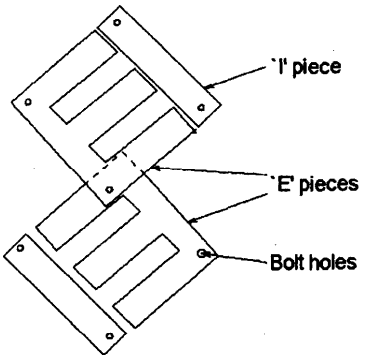


Figure 2. The transformer laminations, and how they are assembled.

Connect the 240 volt side carefully (make sure that you know what you are doing!) to the mains and measure the output voltage on all the secondary windings with a voltmeter. Write down what these voltages are, noting the colours of the leads and their positions. You need to do this because you will have to take the transformer apart and carefully count the old secondary windings as they are removed. Disconnect the mains and set aside your voltmeter.

Get out a hammer, thin-bladed knife, chisel and a pair of pliers. Break apart the core laminations and remove them so the windings are easily accessible. The first core lamination is the most difficult to remove. After removing all screws or bolts which hold the core together, carefully tap the chisel behind the first 'E' lamination to break the shellac. Using pliers, remove the lamination. This could involve a bit of a struggle, but don't worry if the first one is bent up badly. It wouldn't have gone back in easily anyway. Once the first one is out, use the knife to carefully separate the other laminations without scratching up the shellac coating too badly. For ease of reassembly, it is a good idea to arrange the individual laminations in a pile patterned after the way they go in the actual core.

Figure 2 shows the proper opposing orientation of the laminations. Once all the laminations have been removed, carefully peel off the tape covering the winding layers. If the transformer is the split-bobbin type, with the primary and secondaries wound on separate bobbins, the job will be easy. Just remove the tape on the low voltage winding. If the transformer is the single bobbin type, be careful not to damage the high-voltage (mains) winding leads. Re-

move the low-voltage windings, keeping careful count of the number of turns as they come off. Save the old wire; it can be used later on in this project (if it's at least 1.5mm in diameter) or saved for another project. Copper is valuable, don't throw it out! When removing the low-voltage winding, take care not to damage the mains winding.

Using enamelled magnet wire of 1.5 to 2.0mm diameter, neatly wind the proper number of turns onto the bobbin. This will be around 30 to 40 turns from one side to the centre tap. Two windings will be needed on the bobbin with a centre tap - a total of 60 to 80 turns. The exact number of turns can be found using the following easy formula:

$$\text{\# of turns needed from centre tap} = \frac{12 \times \text{\# of turns taken off original winding}}{\text{voltage of orignal winding.}}$$

It is crucial that exactly the same number of windings are put on either side of the centre tap to prevent core saturation and destruction of the switching transistors. The particular transformer used in the prototype inverter had a 15 volt secondary with 48 turns. Using the preceding formula, it can be seen that a 12 volt winding must have 38 turns. Since two 12 volt windings are needed, a total of 76 turns were necessary. The winding direction for both of the 12 volt windings must be the same.

After the low-voltage windings are wound onto the transformer bobbin, solder some heavy gauge ($2mm^2$) stranded insulated hook-up wire to the ends of the windings, as well as the centre tap. Tape up the connections well with some good plastic electrical tape or heatshrink tubing. Wrap the newly placed transformer windings with tape to hold them in place and to protect the enamel coating from damage.

Now it is time to replace the core laminations. I found that if the transformer bobbin is lying on its side and all the 'E' shaped pieces are installed first and the 'I' shaped pieces second, the assembly goes fairly quickly. You may need to gently tap the last couple of 'E' laminations into place with a plastic mallet. The 'I' pieces can be tapped in this way too. A little shellac can be applied to the 'I' pieces to hold them in place and to prevent buzzing when the transformer is in operation. No shellac was used in the prototype, but the transformer seems to work fine when clamped together by its mounting bolts.

The circuit

Construction of the circuit is fairly straightforward. The main thing to keep in mind is that this circuit switches currents of the order of 10 to 20 amps. The wiring in the high current areas of the circuit must be large enough to safely handle the current. Additionally, a fuse between the battery and the inverter is highly recommended to prevent fires from short circuits and overloads.

The prototype was built on a universal project board, bought at Dick Smith for a couple of dollars. Start by soldering the sockets for IC1 and IC2 in place, then install the resistors, capacitors, IC3 etc. The power MOSFETs are mounted on small external heat sinks. Use heavy ($1.5\text{-}2.0mm^2$) wire for all high-current connections for minimal loss and maximum safety. For the low current electronic connections, light duty hook-up wire can be used. As always with switching circuits, keep all connections as short as possible for efficient operation and minimum radio interference.

The smoke test

Before installing the ICs in their sockets, apply power to the 12 volt input. If the the does not blow and there is no smoke, then using a voltmeter, check the voltage on each pin of both IC sockets. Pins 2, 4, 6, 7 and 8 of ICI should be at 9 volts and pin 1, 3 and 5 should be at 0 volts. Pins 5, 6, 9 to 13 and 16 of IC2 should be at 9 volts and pins 1 to 4 and 7, 8, 15 and 16 should be at 0 volts.

Remove power and, after discharging all capacitors, install the 555 and 4027 ICs in their sockets. Apply power again and carefully check for overheating parts. You should hear a slight buzz in the transformer at this point. If any part gets too hot to touch or if there is total silence from the transformer, remove power and check the circuit for faults.

If all seems well, carefully measure the voltage on the 240 volt side of the transformer (you should have a power point type receptacle installed safely here). The voltmeter should read around 240 to 250 volts if things are right, although this may vary a bit. Plug in a lamp of less than 150 watts capacity and see what happens. If the 12 volt source is a large battery, you should be able to run non-reactive devices of up to 160 watts with a 15 amp fuse. The circuit is very energy efficient. The efficiency of the prototype was measured to be 92% with a 100 watt resistive load.

If you put loads like TVs, stereos or universal motors (power tools, etc) onto the inverter, efficiency is somewhat less, because of the inductive loading of the transformers and motor windings. These devices have all been tried out using the prototype and have worked well for hours at a time with no overheating or failures. Induction motors (refrigerators, fans, etc) do not run particularly well on square wave inverters, and can overheat, so be careful plugging these devices in.

Conclusion

This inverter can be scaled up to higher powers quite easily by using more or larger output transistors and a bigger transformer. It can be modified to produce voltage and frequency regulated power. It is relatively simple to build an efficient 12 volt DC to 240 volt **AC** conversion device for small renewable power systems. Just be sure to play it safe by properly respecting high voltage and using large enough wiring in the low-voltage, high-current situations. Have fun! ☼

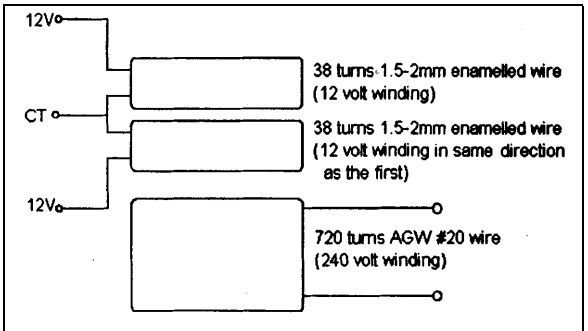


Figure 3 - Schematic view of the transformer windings to illustrate the orientation of the windings and the centre tap.

QUESTIONS & ANSWERS

Green solar power

I am getting ready to install a solar power system for my home.

I have heard of a new type of solar cell that has been developed by Dr. Martin Green from the University of NSW. From what I have read in the media, there seem to be several different types of these cells. The price of panels made with these cells was also supposed to drop enormously, but I have seen no cheap panels as yet.

Is the development still going on, and if so, when are we likely to see these panels become available to the public?

Margaret Gilbert, Geraldton WA

Professor Martin Green's group at the University of New South Wales ***Centre for Photovoltaic Devices and Systems*** have recently announced a breakthrough for reducing photovoltaic costs, identifying and partially demonstrating a processing route to cheap, efficient solar cells.

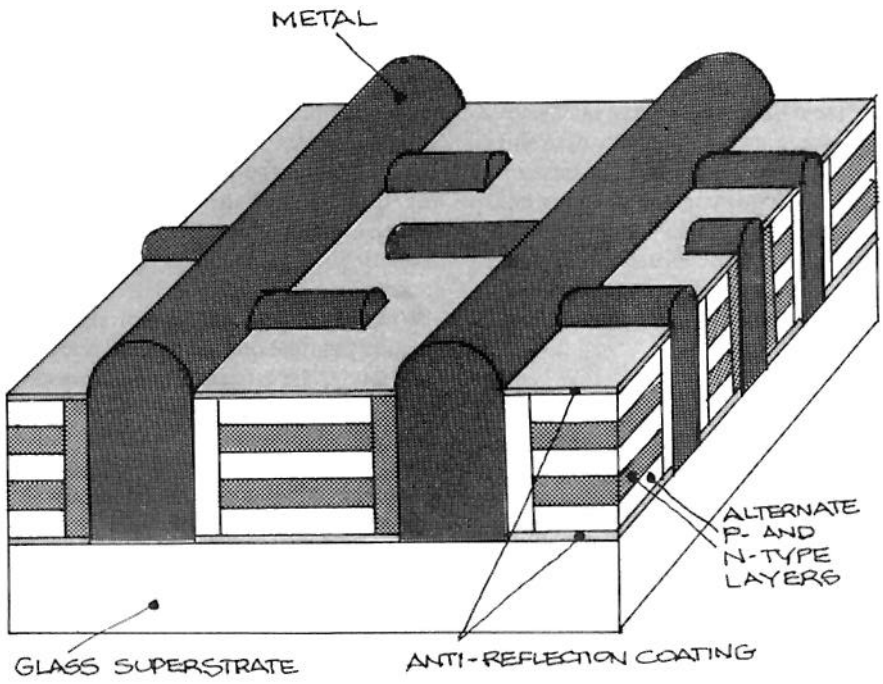
This technique utilises multiple, very thin layers of recrystallised low-quality silicon, doped to mimic bulk crystalline solar cells, but which are stacked one on top of the other and connected electrically in parallel. This structure has the potential for efficient, stable solar cells at lower cost.

The advantages are very low usage of low quality material, reliance on proven manufacturing techniques and respectable conversion efficiencies.

The technology will be developed over the next five years, via a recently announced joint project between the University and *Pacific Power*. An additional two years has been allocated to bringing the technology into production.

Meanwhile, take advantage of the currently available high quality and very competitively priced Australian made product and enjoy the benefits of solar power while you wait.

David Jordan, Technical Manager
BP Solar



Here is the structure of the new multi-layer cells developed by Dr. Martin Green and his team at the University of NSW.

BP SOLAR, manufacturer of solar cells, modules and systems for nine years in Australia, have added their skills and experience to ours to help answer your questions about solar power systems.

Andrew Blair and Lance Turner are here to answer your general technical questions.

We do our best to answer all questions sent in, but space is limited, so try to keep your questions short.

Please keep in mind that every situation is different, so the answers given here may not necessarily be perfect for you. If you are in any doubt, we advise that you seek the services of a qualified person who can come to you.

Send your questions to:
Soft Technology
247 Flinders Lane, Melbourne VIC 3000

Pettier power

Can anyone provide me with the performance characteristics of *Peltier effect* devices used as DC current sources? If one side of a Peltier effect device is heated and the other side is cooled then a voltage is generated across the terminals -this is called the ***Seebeck*** effect.

Frankie Thornbee

Peltier effect devices are more commonly known for their use in cheap imported car fridges, available for around $100 (see Soft Tech #50). They do indeed produce power when one side is heated and the other is cooled. They can produce useful power, as can be seen when one of these fridges is in heat mode and is then disconnected from the 12 volt supply. The fan, being connected directly across the Peltier device, will continue to run for some time.

As yet, I don't have any specific data on these devices. I hope to do some more tests on them in the near future, with the results to be published in a later issue.

If you need extensive information, your local library may have books covering some of the aspects of Peltier devices. Failing that, the data-base of a tertiary college or university may contain some information on the subject.

Aside from these two possibilities, I suggest that you keep looking in this column in future issues for more information.

Lance Turner

Converting a computer to 12 volt

I read with interest your article about the *Green small office* in Soft Technology #48. I live in a solar-powered house with mostly 12 volt appliances, but I do have one electrical outlet from a 200 watt inverter from which I run an IBM 386 computer.

I understand that the operating system of these computers runs off twelve and five volts DC, and it has always struck me as unhelpful that I have to put my original house twelve volt supply through the inverter to step it up to 240 volts AC, only to then have the computer step it back down again to the lower DC voltages - a very inefficient and inelegant process.

Would you or someone associated with your magazine know if it would be possible to by-pass the inverter and install a widget that enables the computer to access the house 12 volt DC supply direct? If it is possible to do this, any ideas on who to approach to do it, and how much it might cost?

Bill Bottomley, Kulnura NSW

It is possible to convert your IBM compatible to run directly from 12 volts without an inverter. There was in fact an article detailing how to do just that in Soft Technology #44.

This article described how to construct a power supply that could provide all of the voltages required for your computer, with enough current for most newer computers. It uses second-hand bits and pieces from the computers original power supply and an old TV, as well as a few components from an electronics store. The efficiency of the circuitry was around 80%, not bad really.

I should mention here that if you have a very efficient inverter and computer power supply, the process of converting the low voltage DC to provide power to the computer as-is could be around 70% efficient, or even a bit more.

While there are other much simpler circuits than the one mentioned above, they tend to be less efficient and waste a lot of power.

I know of no-one who sells 12 volt computer power supplies off-the-shelf. If you don't feel confident about making one yourself, perhaps you could approach a supplier of low voltage inverters/power supplies, such as *Statronics,* to see what they could come up with. As for cost, it is hard to say, but a commercially built one-off unit could run to several hundred dollars.

Lance Turner

Winter's on the way

I wish to ask for your advice on the matter of home heating. The house I am in now has an oil heater that I wish to change to a more friendly form. I live in an inner city suburb of Adelaide, so the types of alternative heating are limited. At present I have been looking closely at the *Geothermal Heating and Cooling System.* I am leaning towards this unit at present despite the high initial cost. Do you have any information on this system or know of anyone who has this system that I can contact to get some more information?

P. Bennett, Brooklyn Park SA

The system that you mention in your letter is in fact similar in operation to conventional heat pump technology. The major difference being that instead of the heating/cooling system having a coil exposed to the outside air to either dump or extract heat, this coil is part of a heat exchanger system. Water flows around this coil to either remove or provide heat to the coils.

This water is then pumped down pipes that have been sunk into fifty metre deep bores in the ground in the vacinity of the building. There are usually around five of these bores for a standard domestic installation. The ground will then either absorb or provide heat to the water, depending on whether the system is supposed to be heating or cooling.

By using this system of heat exchange, the unit can provide heating in areas that suffer from low outside ambient temperatures without the problems of freezing up that conventional heat pumps suffer from.

As far as power consumption is concerned, from what I could find out about these systems, they generally consume about 25% less power than the equivalent heat pump system. Although this will help to offset the initial higher installation cost of the system (about 30% to 50% higher), it is really a borderline case as to whether the system is worth installing. This system is really more suited to use in commercial situations, or where heating or cooling is required for extended period throughout the year.

So, what would I suggest? Personally, I prefer gas heating because of the high efficiency overall and the lower levels of pollutants created. If you don't have mains gas connected and are looking for fast, efficient heating with minimal fuss, reverse-cycle airconditioning would be the way to go. Other options include slow combustion stoves and even open fire places, although the latter can be somewhat polluting and grotty.

Lance Turner

BOOK REVIEWS

How to build a chemical-free house

Janet Forster
Kangaroo Press, 1994 $14.95

There is a growing concern in our society over the reckless use of toxic chemicals, and this new book represents one level of this concern in relation to house building. The author's preference for seeking an appropriate house plan from the existing stock of project house builders is a good one, because this matches the preferred approach of 95% of Australians who purchase a new home.

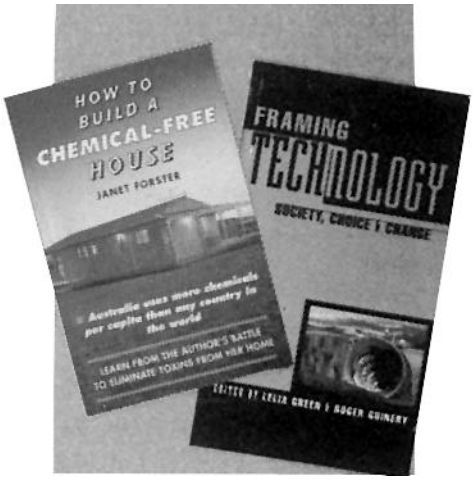
The book begins at the beginning and ends at the end of the house-building process, and while this may seem a terribly obvious structure for this type of book, it is at odds with the stated aim, 'to produce a "how to" handbook, small enough to take with you when you go house shopping'. The indexing system assists only to a small degree.

The text is in the form of a story - or perhaps an epic anecdote - relaying the author's experience with the building process. Special emphasis is given to chemical exclusion, but it is by no means an overview of chemicals in building materials and fittings. This is very important to keep in mind as many common building materials have not been mentioned and there are also several errors. This would be of greatest concern to a reader new to the topic and unequipped to discern.

However, from her investigations into the possibility of building a chemical free house, the author has recorded some information of note which would be useful to many comfortable with this anecdotal writing style. The more often such information is given to the public, the sooner we will see our society less casual about chemical use.

While we certainly need easily readable texts alongside those of a more academic nature, idiosyncratic turns of phrase and poor grammar are surely not a positive contribution to the conveyance of information. It is a great pity that a better editor was not provided for this book, for that would have improved it ten-fold.

- James Banfield



Framing technology - society, choice & change

Edited by Lelia Green & Roger Guinery
Allen & Unwin, 1994 $22.95

One of the biggest problems with collections of essays by different authors is that they sometimes seem disjointed. This book doesn't have quite enough 'glue' -however some of the fourteen essays are quite interesting on their own.

Framing technology is primarily about higher technologies, such as computers and communications networks. The book defines technology in the widest possible sense of the word (although don't expect much on renewable energy technologies in here.) It examines policy, resource efficiency and social equity issues for everything from cyberspace, to medical technology, to TV. The chapter which examines technology and health is particularly interesting. What is the cause of all those 'spiralling health care costs' the newspaper always write about? The authors conclude that the desire of medical professionals to always have 'cutting edge' technology when, for example, less-expensive older technologies may be just as appropriate, is one key cause of cost blow outs. They also note the disproportionate costs of curing rather than preventing diseases. This chapter, like many in the book, provides a good supply of facts and figures from the US and Europe in order to benchmark Australia's performance.

The issues around women and technology are addressed well in several chapters. One author aptly notes, 'the average household is packed with technology that women use, and men repair and design'. The interdisciplinary approach of this book combines economic, gender, environmental and sociological analysis of changing higher technologies to good effect. The same author wrote, 'There are economic considerations -women's domestic labour is unpaid. As an industrial designer I interviewed said, "Why invest heavily in the design of domestic technology when there is no measure of productivity for housework as there is industrial work?"'

This book is one of the few I have seen which provides an Australian perspective on many of these issues. At least five of the chapters examine how changing technology impacts specifically on Australia and New Zealand.

Some of the chapters are a bit hard going, in part because this book attempts to straddle two worlds - the academic and the popular. However, if you are seriously interested in the implications of changing high technology in Australia, then this book provides enough good material to justify another purchase at the book store.

- Suelette Dreyfus

Solar racing cars

J. Storey, A. Schinckel & C. Kyle
Aust. Govt. Publishing Service 1994
$29.95 (inc. world-wide surface postage)

Australia ph:008 020 049
USA ph:800 944 6190
Elsewhere overseas ph:616 295 4861

So you're interested in solar cars. If you want to know what makes these things tick then this book is certainly an excellent starting point. It is full of information about these high-tech (and some decidedly not so) marvels.

The book is centred around the 1993 World Solar Challenge (and the two previous races) and the vehicles that took part.

The first chapter gives a background on previous Australian-held events, as well as other events held around the world. It also touches on the rapid advances that have been made in this field over the last few years.

The following chapters deal in detail with race rules, required car specifications, construction methods and materials, motors, solar panels, control gear, and virtually every facet of solar car racing, There are detailed explanations of the advancements in solar panel technology, high-efficiency motors and transmissions, electronic controllers, batteries, aerodynamics, suspension systems, wheels and tyres, safety requirements, and even race strategies employed in the 1993 race.

A data sheet is also given for every vehicle in the 1993 race and the top six in the two previous races.

This book is well laid out and is written in a clear and concise way. Almost anyone will, after reading this book, have a much better understanding of solar cars. For anyone thinking about entering in the next big race, it is a fantastic way to get a grounding in the knowledge required.

The only thing that detracts from this publication is the absence of colour photos, although there are adequate black and white photos, diagrams and graphs to explain the more technical aspects of the text.

I thoroughly enjoyed reading this book and can recommend it to anyone with an interest in solar or electric vehicles.

This book is sponsored by the Department of Primary Industries and Energy, the Department of the Environment, Sports and Territories, New Energy Development Organisation and the US Department of Energy and Energy Promotion. It is good to see the various government departments, and even countries, cooperating to promote what is surely our most likely energy source of the future.

- Lance Turner

Getting started in Permaculture

Ross and Jenny Mars
Candlelight Trust, $16.95

This is a quick and easy book to read. At only 60 pages, with large print and plenty of illustrations, it provides readers with all manner of ideas to use on their own plot of land.

Every suggestion is accompanied by a description of how to do it, and it is put in easy- to-understand terminology.

Several ideas for organic pest control are of particular interest as is the section on sheet mulching -all the components for a good sheet mulch are listed as well as the building techniques.

There are also suggestions for recycling bottles and tyres, as well as making shade houses, hot houses, earthworm farms and compost.

If you don't know what a haybox cooker is, you will by the time you've finished. And just in case, like I did, you think an 'animal tractor' is a pig pulling a set of harrows, then you'll soon be set straight.

Everything in this book is laid out simply and is easy to follow. There is an index and glossary of terms in the rear of the book and references for further reading.

Finally, let's talk *Environmentally Responsible Living.* This section has tips on making soap, handmade paper, cleaning with household products, hygiene and toiletries.

It's a good book with plenty of great ideas to get you going - buy it!

-Leigh Firman

Tomorrow's world -the Australian initiative

Associated Publishing Corporation distributed by McGraw Hill, $39.95

This book is all about showcasing Australia in the world of invention and innovation. It starts with an historical perspective which outlines the more notable 'world firsts' from pre-white settlement through to 1984. Some of these are generally known, such as the rotary hoe, the boomerang, the surf life-saving reel, the shearing machine, the flying doctor service, the 'black box' flight recorder, the bionic ear, the frozen embryo baby and the wine cask.

The book starts to prick your interest - or incredulity - when it tells you that we quiet-achieving geniuses are also responsible for: pre-paid postage; the refrigeration plant; the electric drill; the feature film; ***Aspro;*** the car radio; bathing beauty contests; round-the-world airline service; the milk bar; race cam; the atomic absorption spectrometer and trousers with permanent creases.

The body of the book deals with quite an impressive array of more recent innovations and inventions. Of special interest to readers of Soft Tech would be the inclusion of the grid-interactive sine wave inverter, the ***Sunsine Green Grid.*** The ***Survivor*** wind turbine scores a spot with its innovative speed regulation system, and of course Martin Green and his team at the University of NSW are there with their laser-grooved buried-contact solar cells. There are many other items applicable to renewable and environmental technology including various pollution controls and more notably Rick Mayne's split cycle internal combustion engine which runs on a range of low-grade fuels and is redefining the word efficiency.

Each entry is accompanied by half to one page of general but informative text and the production and layout are of a high standard. With a rousing foreword by the Prime Minister, it is clearly a 'let's feel good about ourselves' book and you global villagers out there may find it just a tad jingoistic. Nevertheless it is probably equally at home as a novelty book on the coffee table as it is a serious resource for educators.

-Adrian Braun

BEHIND THE SCENES

More new faces

Mick Harris, long time ATA National Group Commitee member and Executive Officer has decided to call it a day and go off to explore other avenues of life. After a stint on the up coming Energymobile tour, he will be taking a trip to South-east Asia, followed by an extended break, after which he will be looking for something new to tackle.

With the loss of both Mick Harris and Imelda Evans, there has been room for a new face or two about the office. We are pleased to welcome the new manager, Lyndsay Last, to the team here at the ATA.

Mick Harris waves farewell to everyone at the ATA. (Please excuse the poor quality of the photo. We had to use a copy as the original mysteriously disappeared!).

Brisbane ATA group

ATA Brisbane has been going now for approximately six months, with an average of twelve people attending each meeting.

They have had a number of guest speakers at their meetings, who have discussed such topics as solar cookers, solar panels and fluidyne pumps.

There have also been special interest groups which meet regularly. One of these groups is designing and building an electric bike while another is building the fluidyne pump.

So, if you are interested, why not go along to a meeting and have a look. The Brisbane ATA meets on the fourth Tuesday of every month.

For further information contact
Paul Edwards on ph: (07)849 4565

Canberra group

The Canberra ATA group holds its meetings at 7.30pm on the last Wednesday of every odd month (January, March, May, etc) at the Environment Centre in Kingsley St. On January 25, the group was given an interesting talk on solar home design by Paul Hanley.

On March 26 there will be a solar open day at Ron Tito's home, followed by a barbecue.

At the monthly meeting on March 29 there will be a talk on geothermal energy, given by Doone Wyborn. This will be followed by a *What's New* question and answer session. There will be tea and coffee served on the night.

On May 31, at the monthly meeting, there will be discussions on the subjects of both the basics of electricity and do-it-yourself energy audits.

For more information contact
Ron Tito on ph:(06)235 9172

Melbourne branch

The newly formed Melbourne branch has planned a great variety of events for this year. Meetings will be held on the third Thursday of each month at *Going Solar* on Victoria St, starting with a meeting on Water Alternatives on March 16. The group will be looking at ways to save, recycle and reuse water.

In addition, there will be field trips; the first of which is a tour of a house at Briagolong that is using a remote area power supply (RAPS). This tour will take place on March 26.

For more information on the house tour, contact Bruce McKenzie on ph:(03)651 7775
For general group enquiries contact Chris Moss on ph:(03)885 2108.

Sydney group

Sydney ATA held its AGM on January 21. The retiring convener, Geoff Tory, declared 1994 a successful and eventful year, with four major seminars given.

The new office bearers are: Godfrey Davies as Convenor; Nick Little as Secretary; Peter Moore as Treasurer; with Peter Vail as Publications Officer. Robert Upitis has been confirmed as the Sydney delegate to the National group.

The Sydney group will be hosting the next National Meeting on April 22 and 23. They are organising field visits to the Little Bay Solar Research Facility to inspect the grid-connected solar installation and also to the nearby Malabar wind tower.

For details of these and other up coming events, contact
Godfrey Davies ph:(02)436 0173.

Energymobile tour

DPIE tour

The Energymobile will be on tour for most of the first six months of this year. *The Department of Primary Industries and Energy (DPIE)* have again provided sponsorship for a two-month tour of south-eastern Australia. The tour will focus on the display homes sponsored by the DPIE as part of the Federal Governments *Renewable Energy Promotion Program* (REPP), as well as agricultural shows and community events in rural areas. For further information about the REPP program see, the article on page 40.

The tour will be conducted in two parts. The first leg left Melbourne on February 23 and will cover northern Victoria, southern New South Wales and the ACT, returning to Melbourne at the end of March.

The second leg will leave Melbourne in early June and cover the east coast up to Gladstone and will return through central New South Wales and north-western Victoria, arriving back in Melbourne at the end of July.

Visions of Australia tour

Visions of Australia has provided funding for the Energymobile to tour Tasmania for a three week period. With the assistance of rural communities, we hope to extend the tour to six weeks so that we can visit a diverse range of rural communities. The Energymobile will leave Melbourne in mid April and tour

the north-eastern part of the state. We will also attend *Agfest* in Launceston in early May and continue to the north-western part of the state.

Visions of Australia aims to make exhibitions of cultural material accessible to more Australians.

For information on the tour, or to make a booking, contact John Molenaar at the ATA on ph: (03) 650 7883.

Energymobile Tour 1995

Date	Destination	Event
Feb 22	EM departs Melbourne	Drive to Wangaratta
Feb 23	Wodonga	Melrose Primary School
Feb 24,25	Wangaratta	Rural Expo
Feb 27	Albury	The Scotts School
Mar 1,2	Tuggeranong	Calwell Primary School
Mar 4	Deniliquin	Alternative Farm Display
Mar5	Deniliquin	Deniliquin Show
Mar 9	Drive to Cooma	
Mar 10,11	Cooma Show	Agricultural Show
Mar 12	Cambewarra (Nowra)	Household Display
Mar 15	Milton	Household Display
Mar 17,18,19	Mossvale	Agricultural Show
Mar 23	Bombala	Household display
Mar 26	Sale	Household display
Mar 27	Return to Melbourne	

Tasmanian tour dates are yet to be set – call the ATA for details.

Unconfirmed dates and destinations

June	Sydney	**July**	Nambour
	Newcastle		Gladstone
	Tamworth		Bourke
	Armidale		Broken Hill
	Coolangatta		Mildura
	Toowoomba		Horsham
	Brisbane		Hamilton
			St Arnaud

Solar model cars

The sun might have hidden behind a formidable wall of November clouds, but the racing teams in the 1994 Australian Model Solar Car Challenge radiate more than enough enthusiam to ensure a successful competition.

The figure 8 track, built by the staff of the *Museum of Victoria and scienceworks,* presented the cars with new challenges as they had to pass through shadow created by a 1½ metre wide bridge and also negotiate a 350mm highincline.

The model cars were based on the standard photovoltaic solar module used for schools. Each vehicle was required to have wheels, a model driver, steering device, suspension, gearing and an aerodynamic shape.

While Western Australia fielded three of the four finalists, with South Australia making up the fourth, it was the all-girl team from Perth College that took the title. Their entry, *Priscilla - Queen of the Solar Cars,* achieved speeds of over 20km/h.

These cars might not yet reach the speeds of their Formula One counterparts, but there is no denying that this is a less controversial and more environment-friendly form of racing.

And boats as well

For several years, interest had been shown in having primary schools involved in the solar car project. The organising committee decided that solar boats would be more appropriate, since they are much simpler to design and construct than the cars; and have fewer technical problems to solve.

In the inaugural Solar boat challenge, for primary schools, fifteen boats were built by approximately 80 students at twelve primary schools. Some of the entries came from schools that had prior experience in the car race, but the majority were completely new to the solar racing concept.

The objectives of the boat challenge were to not only build the fastest boat but to also try to use recycled materials, to pay attention to design and aesthetics and to make it as relevant as possible to a full-scale people transporter.

The boats were of limited size and had to be powered by three 0.45 volt 3 amp solar cells powering a 1.5 to 3 volt motor. The cells were provided to schools, along with construction ideas and a resource list, for the relatively low cost of $60.

The race was held in a five metre shallow pool of water with a nylon guide line to keep the boats running straight. After a preliminary round robin competition, the field was narrowed to *SS LEW,* (North Fitzroy Primary School) and *Sunseeker,* (Korowa Anglican Girls' School). SS LEW won with the impressive time of 10.18 seconds, beating *Sunseeker* by just over a boat length.

A number of discretionary prizes were awarded including those to Fitzroy Community for team spirit, Melbourne Grammar for aerodynamic design and Beaconsfield Primary for pure persistence.

The inaugural event was a great success and the competition has enormous potential in future years due both to the comparatively low cost and simplicity of developing a device that will operate on solar power and to the large number of as yet uninvolved primary schools throughout Victoria.

These events were covered by Paul Wellington

LETTERS

Inverter safety

I would like to contribute to the debate on the relative safety of earthed versus floating AC inverter systems in Remote Area Power Supplies (RAPS).

I work in *cardiac protected areas* in hospital operating theatres where the aim is to minimise any risk of shock injury to patients from faulty electrical equipment. Despite all **patient-connected** equipment undergoing regular checking for intact double insulation and electrical safety, faults can occur.

At 50Hz, currents of 50 to 100mA at skin, or 50 to 100uA via an intracardiac conducter (micro shock), can cause cardiac arrest. To eliminate the possibility of injurious current leakage from faulty equipment through patient (or staff) to earth, an isolation transformer separates the theatre power supply from mains. The earthing system is electrically separate from the live wires, and of very low resistance (equipotential) to minimise any current build-up in the event of an induction fault.

Earth Leakage Core Balance (ELCB) devices monitor current flowing in the active and neutral lines (normally equal), and will cut power if an actual hazard (ie short circuit) occurs. However the cut-off current and and duration is above the micro shock cardiac arrest threshold.

Therefore, Line Isolation Monitors (LIMs) are employed on each isolated circuit. These provide visual and auditory warning of potential earth leakages by monitoring the potential difference between the active and neutral wires and earth. If a piece of patient equipment with an earth fault is plugged in, the LIM will detect this and alarm (and trip) before the appliance is even turned on.

The operating theatre isolated electrical supply can thus be likened to the home inverter with floating output in which the neutral is isolated from earth. The use of a LIM would give early warning of potential hazard; the ELCB providing second line protection against actual hazard.

I believe such a system is inherently safer than the Multiple Earthed Neutral (MEN) system specified in domestic household wiring standards, and is suitable for owner-installation in stand-alone RAPS systems.

(Dr) Geoff Kilminster,
Brunswick VIC

As an electrician and a reader of Soft Technology I feel that I must respond to Andrew Durran and Alan Hutchinson.

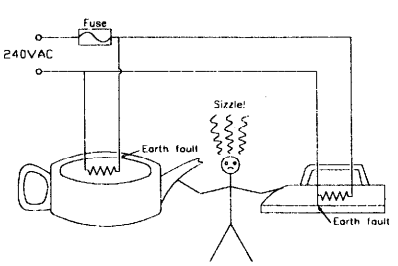
Although a storage battery can produce a large current well in excess of that needed to kill, the voltage is usually too low to force enough current into the body to feel. One may be burnt by items heated by electricity but at voltages below about forty volts DC the chances of being electrocuted are practically nil.

General Electric in the US removed earth connections in their labs to prevent damage caused to circuits by static discharges. The removal of the earth does make it safer for the electronics that are being worked on, but makes it more dangerous for the person using the equipment (usually soldering irons).

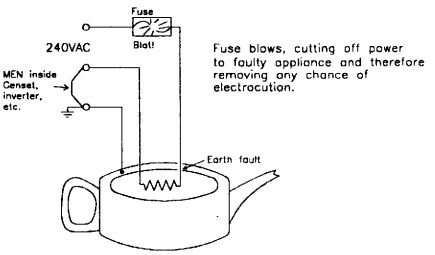
It is impossible to make an earth fault detector for use on a floating 240 volt AC system. The safest systems in order of safety are:

1. Use isolation transformers on every appliance.
2. Earth everything and use a residual current device (also known as an earth leakage circuit breaker).
3. Earth everything and use overcurrent fuses as close as possible to the supply.

Systems 1 and 2 are used in operating theatres and systems 2 and 3 are required by SECWA. The occurrence of death by electrocution in Australia is the lowest in the world and in America is the highest, I certainly wouldn't want to follow their example.



Using floating output – unsafe



Earthed output (MEN) – safe

I would have hoped that two obviously highly qualified men would know the above and know some regulations that keep Australians safe. Read the SAA wiring rules (AS 3000).

Frankie Thornbee

I have just read Soft Tech #50 magazine and feel I must respond to the article and letters regarding inverter safety and in particular the MEN earthing practice insisted upon by the relevant power authorities in Australia.

I am a qualified electronics and communications service technician having some 33 years in this field. During my earlier years as an apprentice in a large service company, the first requirement insisted upon by our manager was to use an isolation transformer to protect my safety when servicing live equipment such as TV, video, hifi, transmitters etc. This was to reduce the possibility of a shock between mains active and earth. Everything in the early days had earthed metal chassis, which meant if you worked on this without an isolating transformer your risk of a lethal shock was greatly increased.

Personally, I consider the earth mains MEN system to be inherently dangerous, because by being earthed, every person is already connected to one side of the mains 240 volts. This means that 50 per cent, or half the circuit, is already completed. Most people would not be aware of this.

Records show that most accidental electrocutions in Australia were a direct result of coming into contact with a live active while being already earthed.

If you would like to contact any of the people writing in to our letters page, let us know and we will do our best to put you in touch with them.

In a floating, unearthed system the above scenario is much less likely to happen. First of all, a floating system does not automatically connect all persons to earth or one side of the circuit. It requires a connection to both sides of the power before a shock can result - a much less likely occurance than with the earthed MEN system.

Almost all of today's appliances are double insulated and do not have any earth lead at all. Why? Because the manufacturers realise this is much safer in an earthed system. Many of our safety rules should be carefully re-examined. Perhaps many past fatalities could have been avoided. One day we may see someone take legal action against a power authority for death or injury because of the MEN system.

Noel Stutterd (Solar Tasmania), Burnie TAS

Disability and alternative technology

In the (necessary) rush to find a dominant sustainable technology, it appears that an important area has been overlooked. That is, the interaction of such technology with people who for whatever reason are unable to perform tasks commonly performed by the majority. More simply, how does alternative technology relate to disabled people?

My first venture into this realm saw me at the showrooms of Electrodrive (Brunswick, Melbourne), makers of electric wheelchairs. I enquired about solar powered wheelchairs, to be told that such technology does not exist. While electric wheelchairs are the best 'alternative' transport for the disabled, it seems solar panels are just too large for this use.

Does anyone know of anyone using solar power in this way?

Lester Vat, West Brusnwick VIC

Education group

I am a member of a group called Eco house Education Inc. which comprises a number of enthusiastic Uni students from across Sydney. We are working on a project to renovate an existing house in Sydney to make it more environmentally friendly. Using this house as a demonstration model, we will open it to the public and school groups to educate them on appropriate technologies which they can apply to their own homes and lives.

I would be very interested to get information from other readers who have attempted similar projects, or who are knowledgeable on areas such as solar hot water systems, composting toilets, organic gardening etc, and from Uni students in the Sydney region who would like to get involved.

I can be contacted on ph:(02)517 2089 or at 194 Ellesmere Rd, Gymea Bay NSW 2227.

And by the way, keep up the good work with the magazine! I have recently become a member of the ATA and hope to learn a lot more on alternative technology.

David Huang, Gymea Bay NSW

Oops!

I'm writing with reference to an item in your Spring 94 issue of Soft Technology. It was in the Products section and referred to Solco Solar Water Heaters. You gave no information on how to get in touch with the manufacturers. Do you have an address or phone number for them?

Andy Colvin, Elands NSW

We apologise for this oversight, the details are as follows:
Solco International
7 Vulcan Rd
Canning Vale, WA 6155
ph: (09)455 1399

Non-toxic alternatives

I am prompted to write since reading the article ***Non-Toxic Alternatives*** (page 29, Soft Tech #49).

I find the opening discussion in this article to be quite misleading. I don't find it 'a drag' to make up my own laundry detergent based on the recipe of the Australian Conservation Foundation (ACF). Nor am I 'super-human'. I have been making up the following recipe for the past four years and have never needed to add a vinegar rinse to remove any scum!?

Grate a cake of pure soap, add a little water and bring to the boil until dissolved (use a potato masher). In a bucket, dissolve a cup of washing soda in a little hot water.

Add the soap solution and fill the bucket with warm water. The mixture sets to a firm gel.

I use two cups for a full washing machine load. I usually make up two buckets of this mixture at a time. It takes me no longer than fifteen minutes. I think you would agree that the procedure is not complex. It provides us with an inexpensive, non-toxic and highly effective laundry detergent.

Janet Clarke, Drouin VIC

Queensland energy policy?

Keep up the good work! Congratulations for publishing a magazine that is so relevant to today and the future.

Would you like to do an article slamming the Queensland government for its ridiculous energy policy, eg removing a solar power station in the Ton-es Straights that only needed expansion, and replacing it with a diesel power station ($13,000,000). All this while leaving the Cape Tribulation area unconnected to grid and expecting us to cope with only three to four months of good sunlight per year. There is no hope of wind power or hydro power, as both would either interfere with ecologically sensitive streams or require expensive solar pump and water storage systems to operate.

We see one possible alternative of setting up a large solar system over the dry side of the range and feeding the power to our community, but it has never been mentioned by the government.

We are a mere five kilometres from the main power line to Cape York and there is no real problem with connecting us but they won't do it. We think they should give us a grant (ie $30,000 to $40,000 per household) to set ourselves up. What do you think?

P Brooke, Mossman QLD

Letters are edited for length and clarity – please try to keep your contribution brief. In order for us to publish your letter, we require that you supply your name and address.
You can, of course, request that your details not be printed with your letter if you wish.

WHAT'S ON

National electric vehicle field day

- Saturday April 1
  9am to 4pm

Nursery Industry Association of New South Wales Ltd, Lot 8 Annangrove Rd, Rouse Hill NSW

The National Electric Vehicle Field Day will feature trade displays, demonstrations and competitions involving electrathon cars, electric bikes, formula E (electric grand prix) racing cars and road-registered electric vehicles.

The trade displays will feature the latest electric vehicles, produced both here and overseas, along with electric vehicle components such as motors, batteries and controllers.

The aim of the field day is to increase public awareness of the availability, scope and benefits of battery-powered electric vehicles in an ecologically sensitive environment. Entry to the field day is free and refreshments and food will be available.

For further details contact Patrick Berry ph:(018) 400 394, Bob Winley ph:(02)679 1448 or Steve Downing ph:(06)47 5274 (AH).

Advanced permaculture courses

- March 27 - April 2: Bushfoods and natives in permaculture
- May 29 - June 4: Advanced design skills
- June 12 -June 18: Teacher training
- June 26 - July 2: Permaculture for third world and indigenous peoples

Nimbin - NSW

The above courses will be held throughout the next few months and will be conducted by Robyn Francis and Peter Hardwick.

For more information contact Permaculture Education, PO Box 379, Nimbin NSW 2480 or ph:(066)89 1755.

Festival of mind, body and spirit

- March 30 to April 2
  starting 10am each day

Royal Exhibition Buildings, Melbourne

The 1995 Melbourne Festival of mind body and spirit has taken on a whole new focus and is shaping up to be an outstanding event. The festival will feature three distinctly different but complimentary activities.

The fast is an exhibition where you will be able to taste, sample experience, buy and learn about a wide range of products and services that can help you to improve your mind, body and spirit. Included will be displays on natural healing methods, complementary medicine, spiritual awareness, metaphysics and a whole lot more.

The second activity is a series of seminars and workshops where over forty of the worlds finest presenters will speak on a wide range of subjects.

The third activity will consist of free demonstrations and performances of music, martial arts, dance, yoga, and many others.

Admission to the festival will be $10 for adults, $6 for senior citizens and $3 for children under 14 years.

For more information contact Ann Morrison Public Relations ph:(03)654 6936 fax:(03)654 6947.

Ten double passes to be won

The ATA has ten double passes to the Mind, Body and Spirit Festival, valued at $20 each, to give away to ATA members.
All you have to do to qualify for the draw is phone the Melbourne ATA on ph:(03)650 7883 during business hours.
Remember, the draw closes on Friday March 24, so ring early to make sure you're in it to win.

Conference on hazardous chemicals

- May4

The Total Environment Centre is to conduct a conference on the topic of hazardous chemicals in school and child-care environments.

The main areas to be addressed will be the use of pesticides/herbicides, floorcoverings, solvents and lead exposure, health effects, and alternatives and approaches.

Participants will be invited to help formulate a strategy for chemical auditing to draft appropriate guide-lines for the use of chemicals in schools in order to develop a healthy school environment.

For more information and registration details contact Total Environment Centre ph:(02)247 4714.

Canberra open day

- Sunday March 26
  10.00am to 4.00pm

The Canberra ATA is having an open day at the home of Ron and Fiona Tito, a house which is powered completely by alternative energy. Guided tours will start at 11am, and there will be displays of solar cooking, energy efficient lighting, wind and solar power and pumping. There will also be books and back issues of Soft Technology to peruse and for sale.

For more information contact Ron Tito ph:(06)235 9172 fax:(06)235 9036.

Renewable energy courses

Fremantle Permaculture and Technology Centre – WA

The Fremantle Permaculture Centre is holding one-day introductory crash courses on alternative energy systems for the home. These courses include such topics as estimating your daily energy needs, power system sizing and design, solar panels, batteries, control systems, inverters, windgenerators, energy-efficient lighting and much more.

For further information contact Christopher Darker ph:(018) 934 607.

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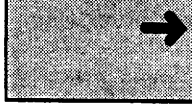

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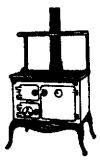

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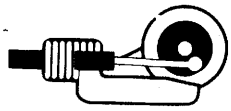

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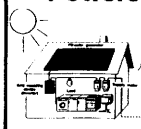

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STOP PRESS STOP PRESS STOP PRESS

First Annual SOLAR CAR RACE

THE first annual Australian solar car race will run from Adelaide to Broken Hill, through Mildura and return to Adelaide in January 1996. Organisers anticipate that the 1237 kilometre *Great Southern International Sunrace* will bring a new focus to solar car racing in Australia.

High-profile solar car racing events provide a showcase for sustainable technology. Event organisers also believe that it will provide a boost for tourism in the host cities -both from within Australia and overseas. The project has been enthusiastically received in Adelaide, Broken Hill and Mildura. The organisers say that they intend to make the Great Southern International Sunrace a community event in these cities.

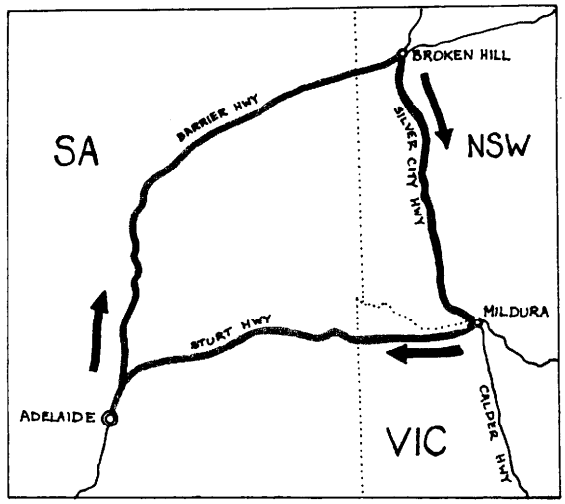
Solar car racing has now become a multi-million dollar sport. Since Hans Tholstrup instigated the triennial World Solar Challenge (WSC) from Darwin to Adelaide in 1987, the World Solar Challenge has become the Grand Prix of solar car racing. The Great Southern International Sunrace will provide a second major solar car racing event in the Southern Hemisphere.

The organisers say that the Great Southern International Sum-ace will reinforce Australia's position in international solar car racing by providing an annual race to maintain the enthusiasm of the competitors, the media and the public between successive WSC events. This, they claim, should lead to a wider audience and improved prospects for support and sponsorship for all involved in the sport. In turn, the importance of the technologies being developed - and the application of these technologies -will become better understood by the public, governments and industry. The activities surrounding the Great Southern International Sunrace weekend should also provide an opportunity to display and promote existing examples of the use of all kinds of solar technology.

The event will essentially take the form of three races, with winners in each leg and aggregate results producing an overall winner. For the first time, there will be opportunity for low-budget entries to participate in solar racing. Other classes and categories will be considered when the organisers receive more feedback from intending competitors.

Details of the event are currently being finalised, but the route, car design rules and schedule are already in place. ☼

For further details contact John Hoerner,
Sustainable Energy Enterprise Developments
ph:015 320 831 fax:(03)820 2027



A WORD FROM THE PAST

This article is abridged from an item by J Blackburne in the Agricultural Journal of Victoria, 1905. *We believe it is even more relevant today than when it was written. Although the author refers only to Victoria, his remarks could refer to almost anywhere in the world.*

No country can maintain a prosperous position among nations, unless a certain proportionate area of its surface is retained in perpetuity under arboreal cover.

If our sanguine dreams about the magnificent future that lies before Victoria are to be realised, if she is to become great and powerful, a fit home for thriving millions of progressive people, such results cannot be attained, unless we guard with jealous care, wisely maintain, and intelligently conserve, the forests that the Creator has entrusted to our keeping for the express purpose, I firmly believe, of being used by us in a proper manner, for the supply of our wants, and handed down in an unimpaired state to our posterity.

The late Baron Von Mueller beautifully expresses his opinion on this subject as follows: 'I regard the forests as an heritage given to us by Nature, not for spoil or to devastate, but to be wisely used, reverently honoured, and carefully maintained. I regard the forests as a gift entrusted to any of us for a transient care during a short space of time, to be surrendered to posterity again, as an unimpaired property, with increased riches, and augmented blessings, to pass as a sacred patrimony from generation to generation.'

What we once had

Those of us who came here in the early fifties can well remember that in those far off days it was pleasant and fair to look upon, a country good to dwell in, a veritable Australia Felix. Our rivers were then clear, pellucid, ever-running streams with umbrageous gum trees growing upon their banks, our noble mountain ranges were clothed with magnificent forests, our gullies and flats in the spring time were golden with colour, and odorous with the breath of wattle. We had, therefore, at the outset of our career as a nation a generous assortment, an apparently unlimited supply of forest trees of great excellence and utility at our service.

What have we now?

When selection started many years ago, by some mistaken policy, much of the good land eminently suitable for agricultural purposes passed into the hands of the capitalist and became 'big estates'. Subsequent selectors were forced into the heavily timbered mountain ranges of Gippsland, Cape Otway, and other places, and forests worth many millions sterling were consequently destroyed.

A large proportion of Gippsland is now covered with dead trees. Steep mountain ranges, the heads of important rivers, and springs have not been exempted in any way from the general effacement of forest cover, although the fate of other countries clearly points out the danger into which we are drifting. Climatic changes must be brought about, for no sensible man [sic] can now assert that forests do not attract rainfall, conserve humidity, and regulate by springs the flow and permanency of our rivers. In a country like this, where an assured policy of irrigation must play an important part in national development, we cannot afford to continue the folly that has been rife in the past, and must, therefore, safeguard the mountain forests, upon which the future of water supply so largely depends.

Hopeful views for the future

The past being irrevocable, we can only trust futurity to bring about a new order of things. We are promised this session by the Hon. the Premier a Forest Bill, to permanently reserve and intelligently control the limited territory that we have now under woodlands. No good can be accomplished with forestry in Victoria until this important measure becomes law. Then again, by legislative enactment, a universal Arbor Day can be secured for tree-planting all over the State.

Mr Ellwood Cooper, a Californian expert, asserted some years ago that: 'Trees can be grown in places where nothing else can be cultivated. Waste lands, and ravines and slopes too steep for other useful product are the favourite seats of timber. It is known and proved that the three-fourths of the surface will produce more, if protected by trees planted upon the other fourth, than the whole would without trees, and without the protection. Consequently the owner loses nothing in the productiveness of his farm, but, on the contrary, he increases the certainty of his crops, decreases one-fourth of his labours, beautifies his home, improves the climate, doubles the value of his land, receives inspiration from the work of his own hands, elevates his own condition, and adds to the refinement of himself, his family, and all of his surroundings.

I consider that a yearly sum of money should be devoted by the State as bonuses for tree planting, especially in dry arid districts. Preference should be given as far as possible to our indigenous trees, neglected here, but much esteemed in other lands.

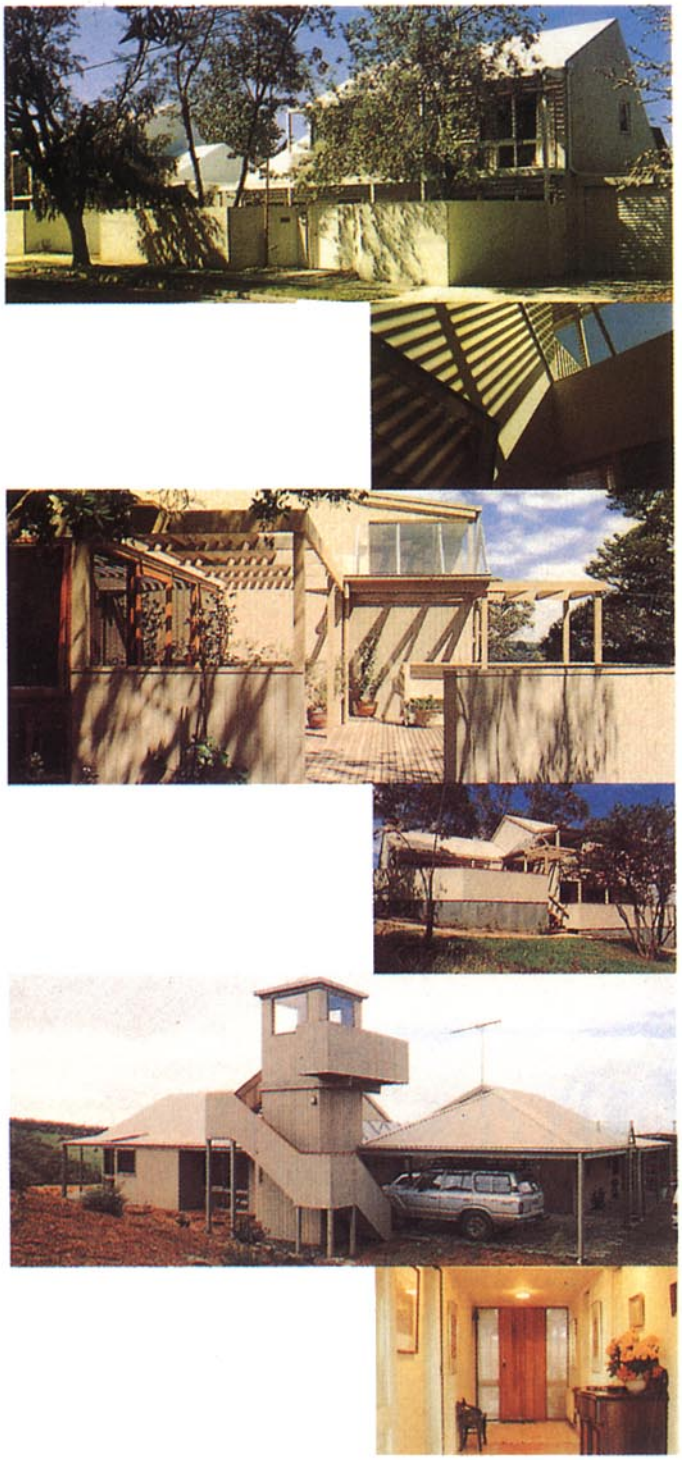
The balance of power in Nature has been disturbed, but the mischief done is not past remedy. Perhaps a Victorian Morton* may arise and by a crusade bring about a new era of universal forest protection and systematic tree planting. Let us hope so. If such takes place, undoubtedly in years to come it will push us forward greatly as a nation in the path of human progress. ☼

Contributions to *A Parting Shot* are welcome. If you have something you'd like to get off your chest, why not drop us a line?

The Editor – Soft Technology
247 Flinders Lane, Melbourne 3000 AUSTRALIA

A PARTING SHOT

** Julius Sterling Morton, born 1832, who campaigned for forest regeneration in the US. As a result of his efforts, an Arbor Day was instituted and his home state, Nebraska, became known as 'The Tree Planters' State.*



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