Issue 61 Oct-Dec 1997
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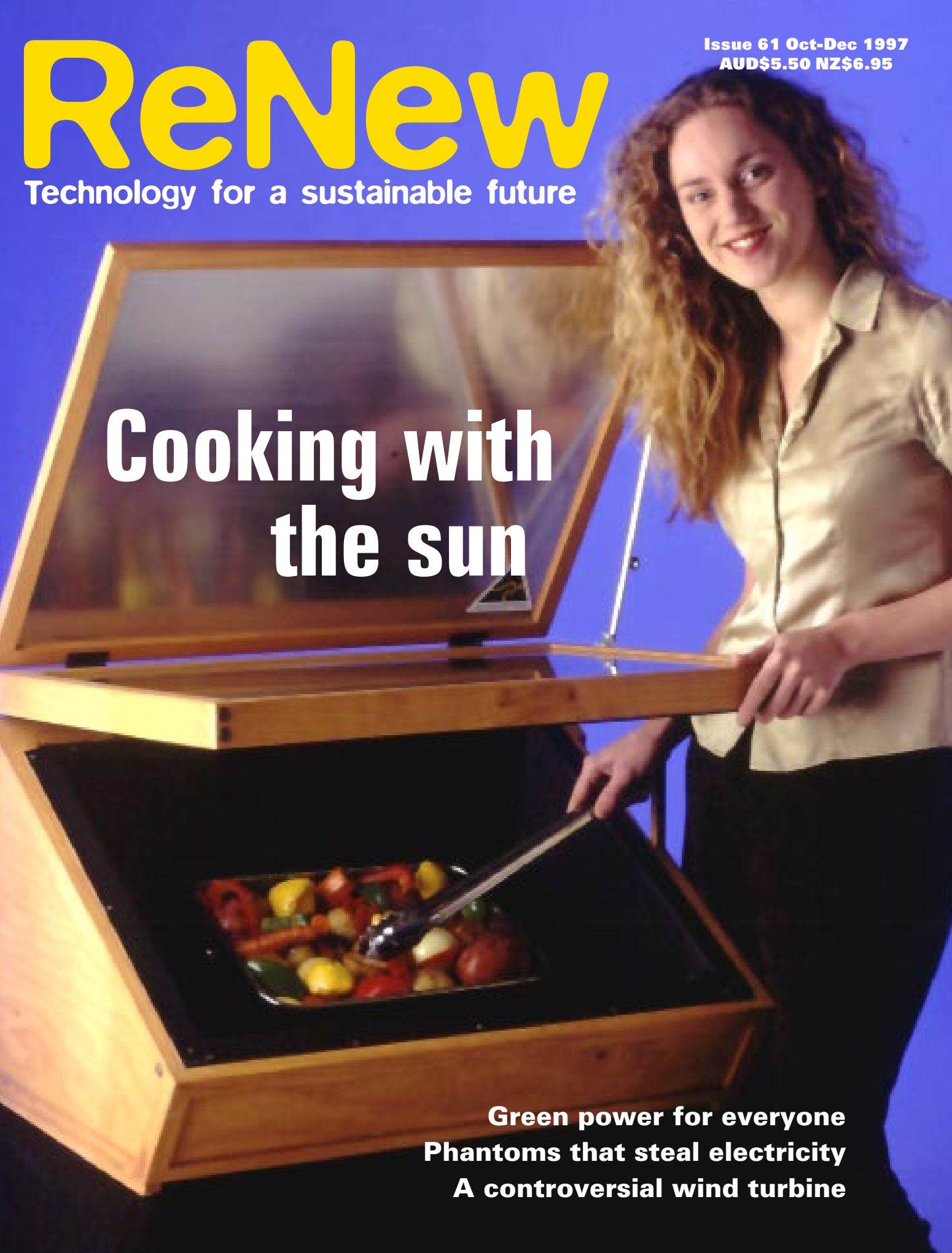
ReNew

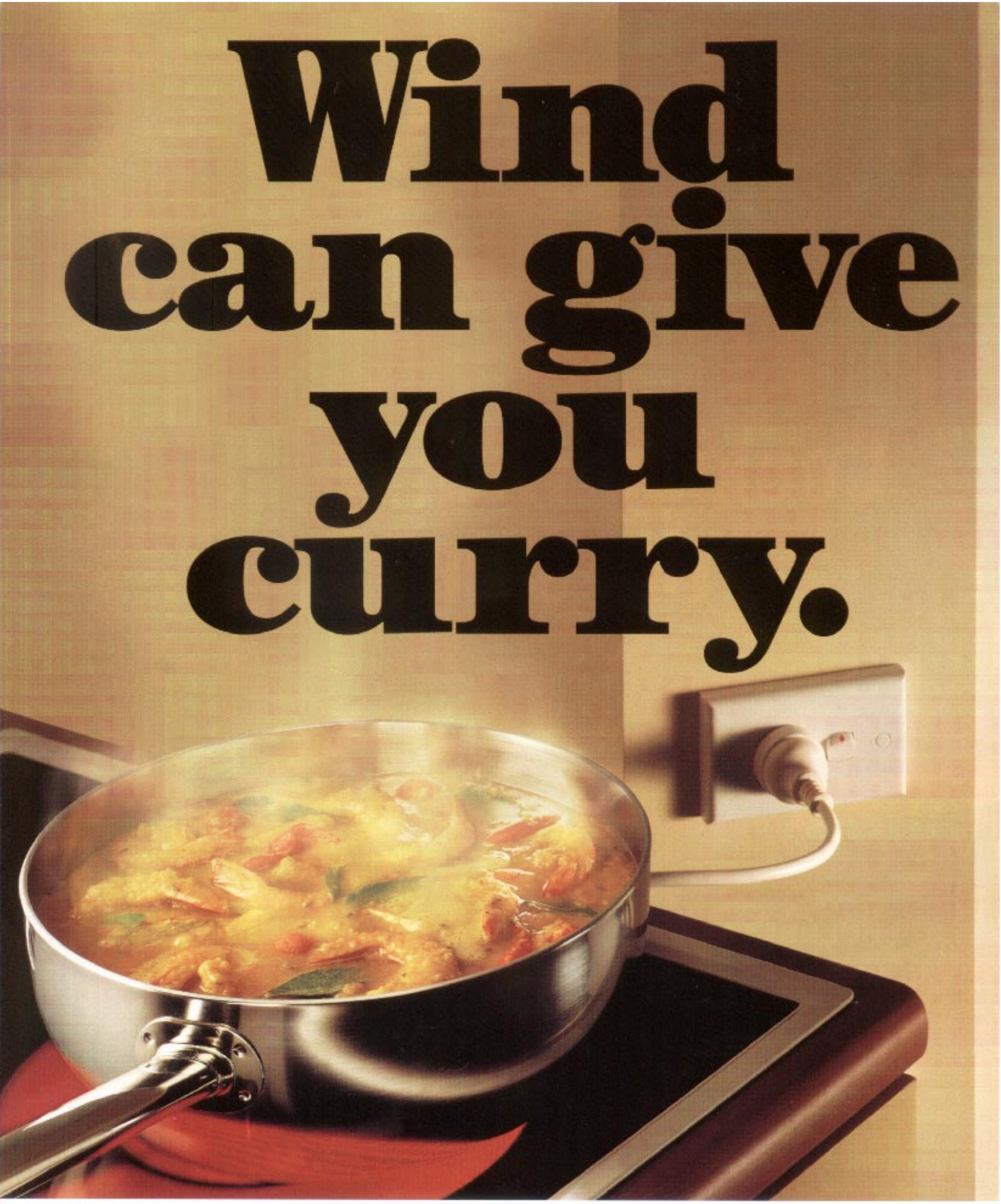
Technology for a sustainable future



Cooking with the sun

Green power for everyone
Phantoms that steal electricity
A controversial wind turbine

Wind can give you curry.



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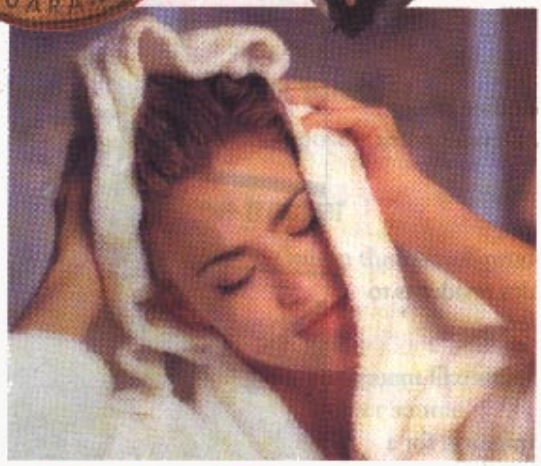

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features

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Led by Cathy Zoi, former advisor to Bill Clinton, SEDA is one government agency that's putting sustainable technology into the mainstream. Find out about SEDA's low energy office on page 24, and their Greenpower program on page 27.

The cover
Model: Tanya Hanby
Photographer: David Johns
Solar Cooker: Jura Sol, supplied by Going Solar, North Melbourne, Vic
Vegetables: Lettuce Deliver, organic food delivery service, Caulfield, Vic

build your own

Product review

If you live with an independent power system and have crinkly clothes, a low power consumption iron could be what you need. See how this Kenwood 'Discovery' iron performed in our product review on page 71.

regulars

About ReNew

ReNew is published by the (Australian) Alternative Technology Association, a non-profit community group involved in promoting and using appropriate technology. *ReNew* features solar, wind, micro-hydro and other renewable energy sources. It provides practical information to people who live with these energy sources, and demonstrates real-life applications to those who would like to.
ReNew also deals with sustainable transportation and housing, conserving resources, recycling and broader environmental issues.
ReNew is available from newsagencies, by subscription, and as part of ATA membership. ATA membership costs $40 per year, and offers a range of other benefits.

Publisher: Alternative Technology Association
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Web site: http://www.ata.org.au/

Internet services provided by Suburbia.net and Suburbia.com.au.

Printed by Enterprise Web, Prahran, Victoria.
Distributed in Aust. and NZ by Gordon and Gotch.

$5.50 Recommended Retail Price.
Registered for posting by Australia Post: No. VBG 4172.
ISSN 1327-1938

ReNew is an ATA publication
247 Flinders Lane, Melbourne 3000, Australia
ph:61-3-9650 7883 fax:61-3-9650 8574

editorial

This issue of *ReNew* is dedicated to everyone who has suffered as a consequence of human-enhanced greenhouse effect.

At the time of writing, the dykes on the Oder River in Germany are at breaking point due to abnormal flooding. Catastrophic storm damage in the US is getting worse. The US insurance industry estimates that it has the ability to meet a one-off payment of $30 billion for a natural disaster. In 1994 a severe cyclone that narrowly missed New York cost the industry $17 billion—it is only a matter of time before catastrophic storm damage attributable to human greenhouse emissions causes a major social and economic crisis somewhere in the world.

Closer to home, we are looking at a very human cost of the greenhouse effect. Many Pacific Island nations are close to sea level, and the slightest increase in sea level will mean that they are more susceptible to tidal waves and severe storms. The lives of millions of our neighbours are at stake.

With these issues in mind, the Alternative Technology Association, *ReNew*'s publisher, has included a postcard in this issue. It is addressed to John Howard, urging action on reducing Australia's greenhouse gas emissions. We hope you will take the two or so minutes that it takes to sign the card and attach a stamp—every one counts in getting the message across.

These 'big picture' environmental and political issues can serve to inspire us to do our own small part by living more sustainably. The rest of this issue is devoted to our usual mix of renewable energy applications and other sustainable technologies. Our cover story on solar cookers demonstrates yet another use for the sun's abundant energy. Sunny Miller's recipes are bound to leave you drooling on your way to making your own box cooker.

We look at the controversy surrounding a wind turbine being developed in New Zealand. The Vortec turbine promises a revolution for renewable energy, but can it deliver?

We also have stories on an electric delivery van that's helping the long-term unemployed; fitting out an office using environmentally sound technology; the Green Power program in New South Wales; composting toilets; a house that uses solar to reduce its dependence on a petrol generator; and plenty of do-it-yourself projects.

Happy reading.

Michael Linke
Editor

Solar scarers

We live in an area that is rapidly filling up with vineyards. Of course, we also have 'millions' of birds! One property owner lost 90 percent of his first crop to them!

There seems to be an abundance of clever inventors around and my mind turns to such things as solar-powered lawn mowers and self-propelled lawn waterers. Why hasn't someone invented a human looking device to 'walk' up and down vineyard rows? A moving human seems to be the only thing that will deter birds. Just a thought anyway.

Alex Hodges, Birdwood SA

A better definition

This is my first letter to ReNew. Congratulations on continuing to bring renewable energy issues to the public's attention.

One small point regarding the article 'A glossary of renewable energy' published in issue 60 of ReNew. While this is a good guide to the terms used for stand-alone power systems, I feel there is one definition that needs clarification for flooded lead acid batteries.

'Equalising Charge: A flooded lead acid battery will normally be charged in 'boost mode' until the battery reaches 2.45 to 2.5 volts per cell at which time the connected regulator should drop into 'float mode', where the battery will be maintained at 2.3 to 2.4 volts per cell. Gassing will occur whenever the battery voltage is over about 2.35 volts per cell.'

Equalising charge is just what it says, the cells are overcharged at 2.5 to 2.6 volts per cell to ensure that all cells have an equal (full) charge. This will normally only be achieved by charging from a battery charger, though some microprocessor controlled regulators will attempt this when energy use is low, such as when the users are not in attendance.

Jeff Hoy, jpetech@ozemail.com.au

Jeff, thanks for the letter. Lance Turner, who wrote the glossary, agrees that the published definition was a bit misleading. I'm glad we have vigilant readers!

Michael Linke

Soft Tech on CD

First, I must congratulate you on a great magazine, which suits my interests admirably. When I discovered 'Soft Technology' a little over a year ago in a local book shop, I was so impressed I filled out a subscription and proceeded to purchase all the available back issues. I keep the mags handy beside the bed and often have a wee read before the light goes out.

Dunedin, might be described as rather borderline for solar energy production, with its cloudy climate, but we own a couple of acres 30kms south, at a place called Taieri Mouth, which is considerably better with great potential.

Has the Alternative Technology Association considered producing a computer CD of the no longer available Soft Technology magazine articles, like the American magazine 'Home Power' has done? I would certainly be in the market for a copy.

Ron Holdaway, Dunedin NZ

Ron, we have considered this project and would like to do it in the near future, as we think it would be quite popular. However, many of the old issues of Soft Technology were produced without the use of computers, so the task would not be a small one.

Lance Turner

Better Dolphin batteries

Regarding the letter on Dolphins in the last ReNew issue, Jaycar Electronics sell a 5 amp-hour gel cell that is a direct replacement for Dolphin batteries. They also have a charger kit to suit these batteries which regulates at 6.9 volts. The charger kit needs a 12 volt input and can be run from a car, home power system (with 12 volt battery bank) or from the mains with the addition of a suitable power supply.

I have been running three of these torches for a couple of years now with no problems at all. Unlike nicad based torches, they can and should be left plugged in to the charger when not in use. This ensures a minimum cycling depth and therefore maximum life from the battery. Conversely, fully discharging any lead-acid type battery will shorten its life, though mine have been have been subjected to a reasonable amount of abuse (the joys of parenting!) and seem to keep coming back fine thus far.

Globes have been a bit of a problem, though I haven't found the 6 volt version hard to get and they seem to return a resonable life, albeit with a somewhat lower light output than the 4.8 volt ones.

The batteries retail for $32.95 each and the charger kit (which is fairly simple to build) is $24.95. They are available from any Jaycar shop or stockist.

Richard Morton, sunreal@netc.net.au

Rechargeable lamps

We use two types of rechargeable lamps at the Cape Tribulation Tropical Research Station. The first are Petzl head lamps fitted with three 2.2 amp-hour nicad cells. We charge them from 12 volt DC. We don't use any form of regulation except a series ballast resistor of 22 ohms (5 watt wire wound type). A LED with a 180 ohm current limiting resistor is connected across the wire wound resistor to indicate that the lamp is charging.

In use, the batteries get warm (not hot) when fully charged, and they can be left on at that charge level for several days. We nearly always charge them when the are completely flattened, but occasionally do a top-up charge.

We have used this arrangement for over eight years (on about ten lamps) and have only had one battery failure. We only use halogen bulbs—the normal bulb is too 'fizzly' to be useful when operated on nicads.

A similar arrangement has been used for 6 volt lamps—Techna diving lights, 'Big Sun' and Dolphins, which are fitted with 4 amp-hour D cells.

The critical part with these lamps is that all connections (except to the bulb) should be soldered wire connections, even to the switch. For charging these lamps, we use a 5 watt, 12 volt halogen bulb as the ballast resistor in series with the lamp batteries (as well as a Shottky diode within the lamp housing to prevent reverse connection of the charger and battery). The lamp glows brightly on the beginning of charge and becomes dull as the charge is completed.

Once again, we only use halogen bulbs in these lamps. Xenon bulbs (which are actually overdriven bulbs) run far too hot for the reflectors of many torches, and melt the plastic reflector in short order, destroying the torch. Halogen lamps do not run nearly so hot and last a very long time—we've rarely had to replace bulbs, and boy, do these torches get a lot of use. We use HPR50 bulbs (5.2 volt at 0.8 amp).

The KISS principle at work!

Hugh Spencer, hugh@altnews.com.au

Red faced ReNew

Congratulations on another excellent edition (Jul-Sep 1997) of the magazine. However, my blood did boil on reading the uncritical 'Greenhouse Challenge' article, for the following reasons.

The 16 single-axis trackers at Kalbarri each support 16 PV panels (85W nominal) providing a total of 21.7kW DC peak, not 320kW as your photo caption states. 'a battery of 256 solar panels' sends shivers down my spine with the potential confusion in using the word battery, (is a PV cell the same as a battery cell?).

Page 37 lists some savings in greenhouse gas emissions but fails to make clear that they are annual savings.

While I applaud the Greenhouse Challenge for helping industry come to terms with its emissions, some critical appraisal of the program would be appreciated. Companies can and have signed, even though they fully intend to increase their total annual greenhouse emissions, if it is profitable to do so. They 'volunteer' themselves to do economically viable 'no regrets' energy efficiency and renewable energy activities, which they should be doing anyway as good business sense.

The reduction of 15 million tonnes you quote on page 35 sounds really impressive until you examine it carefully. What it refers to is in fact that between 1995 and 2000 greenhouse challenge participants will increase their emissions from 73 million tonnes to 78 million tonnes per annum—an increase of 5 million tonnes. This 'translates' to a saving of 15 million tonnes per annum by examining their business growth under the assumption that no gains in energy efficiency occur!

Thus the greenhouse challenge is basically a PR exercise at making the public think that big things are happening! (like the symbolic PV array at Kalbarri). The greenhouse challenge is better than no response at all. It has some worthwhile parts and committed people working for it. However, the Federal government could do a lot more than attempt to look like it is doing the right thing and it is up to us to tell them so.

J Thorn, Bayswater WA

Winter Windows replies

I would like to reply to a letter that appeared in the last issue of ReNew regarding Winter Windows.

Firstly, to the effectiveness of Winter Windows membrane as a device for insulating window glass against heat transfer.

The Australasian Window Council has compared the effectiveness of this product, installed as recommended, and concluded that over a day and night, 365-day annual cycle, Winter Windows membrane applied to an existing window glazed with clear 4mm thick float glass performs equally as well as a conventional double glazed window using two panes of clear 4mm float glass with a 6mm air gap between (whether timber, aluminium or PVC frame). The AWC has issued Winter Windows with the relevant certifying documents for these claims.

Regarding the transparent double-sided tape used to adhere the membrane to the window, we initially used a locally made product which performed well but tended to break down over several years, eventually losing its adhesion.

We now import a significantly costlier product which does not decay over time. We also advise customers to use two strips of tape side by side (in effect doubling the width of the tape) on large areas of glazing. These instructions are contained in our current installation instructions sent out with each kit.

Victoria Grounds, Winter Windows

Adtech too

So Ray Prowse has his nose out of joint about an article detailing a 100 percent wind powered house. Hardly surprising for the paid spokesman for the Solar Energy Industries Association of Australia. As with all industry associations, they represent their member businesses in much the same way as trade unions represent their members. This is not necessarily in the best interests of customers. Perhaps Ray's batteries went flat overnight and he is feeling a bit grumpy.

Still, he has acknowledged that Bergey wind turbines and Adtech towers are 'excellent' products. If you are miffed about the success of a new product in the market and the quality of the product is unassailable, then attack the people marketing it!

We make no apology for advocating wind as an excellent source of remote energy. As is solar, as is hydro, all within their appropriate settings. It is all a case of informed selection of appropriate energy sources.

In this country, given the simple equation between lots of sunshine and solar energy, many people expect solar to be the answer. Very often it is not, as we are repeatedly told by visitors to our stands at field days. It is our observation that the potential of solar has been

seriously over-sold and there are many unhappy customers to prove it, particularly in southeastern Australia.

We find ourselves increasingly being approached by people who have installed a solar and fossil fuel hybrid system dissatisfied at what has effectively become a fossil fuel system with solar back up. With professional and independent assessment of all options before installation, these people could have avoided what is inevitably a costly and frustrating experience. What Ray and his association may wish to explore is the level of frustration among people who have invested in remote energy systems and been disappointed. From the feedback we receive, this is a serious issue which he and his members need to address as a matter of urgency.

With respect to Ray's criticisms of the capacity of the McNamara's system, we undertake extensive site examinations at the time of quoting on systems including reference to the Battelle Wind Charts, and stand by our installation. I look forward with interest to his letter on the next story he sees on a solar only installation, commenting on the lack of a wind component.

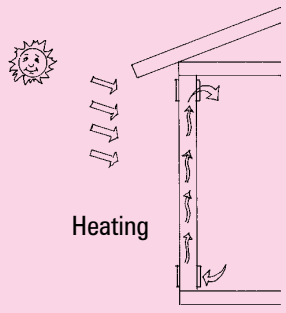
Finally, is Ray seriously suggesting that ReNew adopt a policy of editorial censorship, even concerning advertising? Surely a healthy exchange of views is just what we need. We stand by our advertisement. Since when was stating the obvious a hanging offence? Perhaps when it's effective! It's our view that what this industry needs is healthy competition, new products, professional service and well informed customers. Only when we have this will the industry move from its cottage industry status into the main-stream.

Incidentally, I live with a hybrid wind and solar system. Does Ray?

Gavin Wright, Managing Director
Adtech Australasia

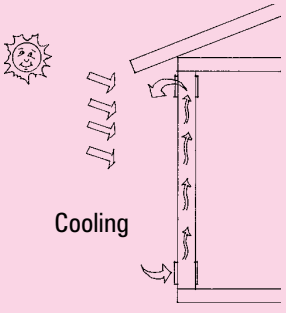
Letter of the month

To give readers some extra incentive to put pen to paper, we are offering a mini solar panel/battery charger to our favourite letter in each issue. The charger takes two AA nicad batteries, and can provide 3, 6 or 9 volts.



I read the story about Michael Linke's solar heater with interest in the last issue. Several months ago I applied for a provisional patent for a design for a solar heater/ventilator which works along the same principles as Michael's but which, in my opinion, will not need any fans to operate. Though I haven't built one yet, I am convinced that it will work as expected.

I eventually intend to produce these solar heater/ventilators commercially but I'm quite happy to share the design with anyone wanting to build one for their own private use. I am also looking for a partner to produce this design commercially.



Last year I built a rumpus room in the backyard. It was a simple square design, metal roof, hardie plank walls and a balcony in front. As winter started, I finished it to lock-up stage, that is, with only the outside walls and a roof on top. On cold days it turned out to be the cosiest room in the house despite also being the draftiest.

After several weeks I finished the inside with foil insulation and plasterboard all round and on top. The room doesn't have any heating and I found, that although it stays pleasantly cool in summer during the day, in winter the temperature doesn't rise much above the coldest outside temperature it was the night before. I was obviously missing out on some free heat!

I considered the roof cavity as a supplier of hot air, but was put off by the possibility of dust, and of course hot air needs some help to come down. It was difficult to think of a simple and cheap solution using the roof cavity. Instead, the walls seemed the more likely candidates. I decided to leave several open spaces in the wall frames (by removing the noggins and insulation) so that I had a hollow cavity from floor to ceiling between the inside and outside walls. With a hole down the bottom, and also up the top near the ceiling of the inside wall, the warm air in the cavity would rise, exit the top hole, circulate around the room and enter the bottom hole. This would have the effect of a small heater. If I could close the top inside hole and open another one high in the outside wall, warm air would rise through the cavity, sucking air into the bottom inside hole and out through the top outside hole. This would have the effect of a ventilator.

Adding a bottom outside hole would allow me to warm the room with fresh outside air rather than circulating the inside air. Opening both outside holes and closing both inside ones would provide cooling of the inside wall, and closing all the holes would provide some minor insulation. All the above of course only if the sun was shining. At night, or on cloudy days, nothing would happen at all if the holes were closed, preserving the inside temperature.

Rather than use (probably dusty) wall cavities, it would be preferable to have a device that could be installed in wall cavities as a structural part of the framing or in the case of existing buildings, a slim fitting, wall hugging device on the outside wall. I imagine the morning sun starting to warm the house first thing in the morning through an east facing wall, and later in the day start ventilating the place through the north and west facing walls.

Peter Vandewiel

Good old-fashioned wind power

A Dutch-born couple have built a five-storey windmill near Borden, about 320 kilometres south-east of Perth. The *Lily* is the long-term dream of Pleun Hizert, who emigrated to Western Australia with his family in 1980.

The windmill is a traditional Dutch design, made of recycled bricks which Pleun and his wife Hennie cleaned by hand. The tower is presently being used as a restaurant run by the Hizert's, but they plan to put it to work as a flour mill in the near future. The windmill which Pleun based his design on, from his former home in the Netherlands, supplies flour to the whole village of Puttershoek.

The Weekend Australian, 19 July 1997

Contracting out to *ReNew*

The *ReNew* office recently had an interesting phone call from an employee at a Victorian electricity utility. She reported that she had received an enquiry about her company's interest in wind power. 'Is our company interested in windpower?' she asked us, 'and who is our windpower expert?'

Fortunately we were able to point her in the right direction, but it left us wondering just how well privatisation has eradicated the inefficiencies of publicly owned utilities. Perhaps some internal promotion of renewable energy programs wouldn't go astray.

Rumour mill, July 1997

Eco tourism is a growing industry in Australia. This is the first published photograph of a Westwind turbine at Wilson's Promontory—part of a series of installations providing electricity to Victorian coastal eco-tourism ventures. A full report will appear in the next issue of *ReNew*.

And the winner is...

The long awaited prize draw for our Bergey wind generator subscriber competition has finally taken place. The lucky winner is David Keevers from Killara in New South Wales. David is a truck driver, and he will be installing the Bergey on his block of land in northern New South Wales. David says he has been working long hours to save up for a renewable energy system, so it couldn't have gone to a more appreciative person. We'll show you what he does with the turbine in a future issue of *ReNew*.

ReNew would like to thank everyone who subscribed during the competition, and especially Adtech for donating the prize—a Bergey BWC850 watt wind turbine and controller.

Greenhouse survey

The Australian Consumers' Association has released the results of a survey it conducted on the greenhouse effect.

While only 67 percent of the 1500 respondents actually understood what the greenhouse effect is, 70 percent felt that it is 'extremely important and must be dealt with immediately'. An even higher proportion, 79 percent, felt they were able to personally make some difference in reducing Australia's greenhouse gases.

The survey showed an encouraging sign for 'green' electricity being supplied by power utilities. Over three quarters of respondents were interested in getting solar energy provided to their home.

Over half of respondents were willing to pay a tax on their petrol to help fund solutions to the greenhouse problem. Full copies are available at cost from ACA, phone (02) 9577 3399 for more details.

ACA energy survey summary, July 1997

Hardly a challenge

If the Greenhouse Challenge is the best the Federal Government can do about reducing greenhouse emissions, Australia is in big trouble. Ian Lowe, Professor of Energy and Environment at Griffith University, recently acknowledged the merit of the Challenge in *The Australian*, but went on to point out that none of the participants has actually committed to lowering greenhouse emissions, merely saying they will increase them more slowly. In Lowe's words, 'It is like a Weight Watchers group whose members are not trying to lose weight, instead taking pride that they are gaining weight more slowly than they would if they really pigged out on cream cakes!'

The Australian, 3 July, 1997

Can we aFord not to?

Ford Australia has begun on the long road to making cars more sustainable, with the production of 25 natural gas Falcon wagons this year.

Ford have road-tested the cars since 1993, mainly working as taxis. The gas is the same as that used for household cooking and heating. There are currently around 90 natural gas refuelling stations in Australia.

Ford claims the natural gas Falcons cost around four cents per kilometre to run, compared with six cents for LPG equivalents. Natural gas burns cleaner than petrol, diesel or LPG, and is also more plentiful.

Ford media release, July 1997

Eco-shopping in Brisbane

Brisbane now has a one-stop environmentally-conscious department store. The Ecostore stocks a range of products, from hemp clothing and skin care products through to non-toxic household cleaners and Bio-paints.

Ecostore is located at 1/416 Logan Road, Stones Corner. Phone (07) 3847 8188.

Ecostore media release, 29 May 1997

A bumper catalogue

Australia has a new sustainable technology mail-order catalogue which rivals its counterparts in the US for the range of products it offers. Sustainable Technologies Australia (STA) have been organising the catalogue for many months, and its release will be a boon for renewable energy enthusiasts, especially those living away from major cities with renewable energy retail outlets.

The catalogue includes too many products to mention, but includes solar panels, wind turbines, inverters, low voltage appliances and lights, composting toilets, an electric bicycle and even a yurt. What's a yurt? It's a mobile shelter used by nomads, and at $4200, it represents a cheap housing option.

The STA catalogue is 120 pages long and costs $5. It is available from STA, PO Box 6212, Queanbeyan, NSW Australia 2620. *ReNew* subscribers will receive a free copy with this issue of *ReNew*.

Eco-man to the rescue

An enterprising Sydney couple have started a travelling education program that is powered by a solar panel and tonnes of enthusiasm.

The 'Eco Man and Dr Earth' roadshow teaches primary school students about recycling, land care, and other environmental issues. The dynamic duo are joined on stage by Belinda Bilby, Conan Cassawarry, and the evil Toxashmuck. Music is provided by a guitar, tape deck and amplifier, all powered by a 55 amp-hour deep cycle battery, which is charged by a 55 watt panel donated by Solarex. The panel and battery are on display before and after the show, demonstrating solar at work to the children.

Morgan and Lianne, the Clarke Kents to Eco Man and Dr Earth, have performed everywhere from Canberra up to Queensland, and can be contacted on 014 490 371.

Hey Kids!

Win an Eco Man & Dr Earth Poster

You can win one of fifty full-colour Eco Man and Dr Earth posters if you can answer the following question:

How are Eco Man and Dr Earth's shows powered?

Send your answer on the back of a stamped, self-addressed envelope (with your first name only) to: LPO Box A168, ANU ACT 2601.

Towards a self-sufficient lifestyle

Meet a family who are using solar panels, chooks, and a big vegie patch to help realise their long-time ambition

Ray and Jenny chased their dream of an uncomplicated, self-sufficient lifestyle across Victoria for two years. They set out with a very clear idea of what they wanted: land that had good soil, rainfall and sunlight. Their search took them on weekend forays from eastern Victoria up to the Grampians, until they finally found a 13 acre block in west Gippsland that they instantly fell in love with. Not only did it meet their criteria, but it had the extra bonus of bordering native bushland.

They bought the block, and with their children Lauren and Stephie, Ray and Jenny began on the long, hard road to making their vision a reality. There were blackberries and bracken to clear, fences to make, and a house to build.

The house had to be large enough for five people, as Jenny's mother would be living with them until her own smaller house elsewhere on the property was completed. They opted for an elegant Federation-style weatherboard, and did much of the construction work themselves, using builders only for the sub-floor and pre-fabricated frame.

The winter temperature in the area frequently goes below zero overnight, so insulation and heating were important considerations. The walls and ceiling were 'wrapped' in reflective foil, then fibreglass batts were placed in the wall and roof cavities. The floor is not insulated yet, but it is high on the list of priorities for this year, as are pelmets for the windows.

Ray speaks highly of their Eureka Sovereign wood heater. 'That was the best $1800 we ever spent', he explains. It is located central to the main living areas, and heats the house without needing to use the fan.

Ray and Jenny wanted a verandah around the whole house, but had observed a problem with bull-nosed ve-

Photo: Robyn Banner

Pets: the idea was to end up with one of these cows in a milking shed and the other in the freezer, but those big brown eyes won the heifer closest to camera a reprieve—she's become a permanent house-cow.

Photo: Robyn Banner

Lauren and Stephie both agree: the solar panels are very pretty, especially in full sunlight. The frame can be tilted to optimise power from summer and winter sun, and a concrete strip protects them from mowers and wipper snippers.

randahs on other homes—lack of light. By building the verandah well above the window line, they were ensured good light all year round, without losing the benefits of the verandah. In winter, it provides protection from rain and wind, while during summer it shades the walls and windows from the heat of direct sunlight.

They paid $63,000 for the land, which did not have utility connections of any kind. They installed a septic tank to handle toilet waste, which works well with the well-drained soil and long downward slope from the house.

While getting their house to lock-up stage, they used a Briggs and Stratton petrol generator, which supplied power for machinery and living requirements. It was not a long term option for supplying electricity though, as it could not be run at night because of its noise output, and had to be pull started each time power was required—often meaning a walk outside in the rain.

Investigating power systems

Ray and Jenny liked the idea of being independent from the main electricity grid, but they still explored the possibility of grid connection. Although the nearest power lines are within a few hundred metres of their property, the cost of connection turned out to be $13,000.

They had investigated independent power systems before buying their land, when they went to a seminar conducted by a renewable energy system installer in Seymour. The seminar dealt mainly with solar systems using generator back-up, but this didn't stop them exploring other options.

Micro-hydro

A creek running through the bottom of the property prompted them to investigate micro-hydro turbines. After a couple of phone calls, Australian manufacturer, Platypus Power, sent a representative to their block. After some analysis, Platypus Power found that the creek could supply water to a turbine at 26 litres per second at a sufficient drop, or head, to generate electricity. Indeed, there would be more than enough electricity to meet their needs, and with the spring-fed creek running continuously all year, they would not need a large battery bank for storage. Best of all, the turbine would cost only $4,500, including cable to the house.

The idea of using power from their creek filled them with excitement. The cost was almost a third of grid connection, and apart from occasional maintenance, the micro-hydro unit would mean an end to electricity bills forever. Sadly, the excitement was short lived. Jenny contacted the local water authority for permission to use the water. The water authority said that they would charge a usage fee for the water, even

The house is a Federation-style weatherboard. The bull-nosed verandah is designed to be high enough to allow natural light in, while still shading the house in summer.

Some costs of living

Running costs

Wood for heater	$50 tonne/month (winter)
Petrol for generator	$5 per week
Gas (cooking and hot water)	$42/LPG cylinder/month

One-off costs

Power system	$9000
12 Volt DC fridge	$2000
Land	$63,000
House	$49,000
Eureka Sovereign wood heater	$1800

Savings

Most vegetables supplied by vegetable garden
Eggs and fertiliser supplied by chooks
Land (Equivalent grid connected properties cost $80,000)
Most fruit and nuts from orchard (once trees mature)

though it would be returned to the creek downstream of the turbine! When Jenny explained this, the bureaucrat at the end of the phone responded, 'But you're still using it'. The cost that the authority was going to charge would have made the micro-hydro uneconomical, as water would be flowing through it continuously.

Sadly, red tape that should have applied only to water used for irrigation had thwarted their efforts to use the most appropriate form of renewable energy for their situation.

Back to the drawing board

This led them back to a solar and generator system. Wind power was not an option, with tall trees nearby and the property's position half-way down a hill. They got a quote from a renewable energy installer in Melbourne. The installer estimated a total cost of $28,000 for a system to run all the appliances they had in their grid-connected house.

Ray explains the process they went through when they found out how much their way of living would cost to maintain on a solar and generator system, 'If we are going to do this, we're going to have to change our lifestyle'. They looked at the things they could do without: an air conditioner, electric frying-pan and food processors were obvious choices. They monitored their power more closely, and became aware of 'phantom loads', or appliances that use power in stand-by, even though they are switched 'off'. They also looked at essential appliances, and investigated more efficient alternatives.

By building efficiency into their house, they had reduced the need for electricity-intensive heating and cooling. The long hallway that runs north-south allows good ventilation on hot summer nights, and the east-west axis has windows along it for unimpeded through-flow. There was no need for an air-conditioner.

They minimised their refrigeration requirements by having a well insulated built-in pantry that acts as a cool room. Root vegetables store well in the pantry, and pumpkins last between seasons. They also looked at the refrigerator itself, and decided that a refrigerator running directly from 12 volts DC would improve efficiency.

The end result was a substantially reduced electricity requirement, and a power system that cost $9,000. This included eight 53 watt Solarex solar panels, a 2.2 kVA Honda petrol generator, a Selectronic Invert-a-Power modified square wave inverter, Sunergy amp-hour meter, six 2 volt, 840 amp-hour Dunlop ex-government stand-by batteries and installation by Victorian installation company, Solar Charge.

The installation took just one day. Batteries and control equipment were housed in a shed, while the panels were mounted on a wooden frame that Ray had built especially for the purpose. The frame, which stands in front of the battery shed, has a simple lynch-pin which allows the panels to be set on two angles: 30° for summer sun and 50° for winter sun.

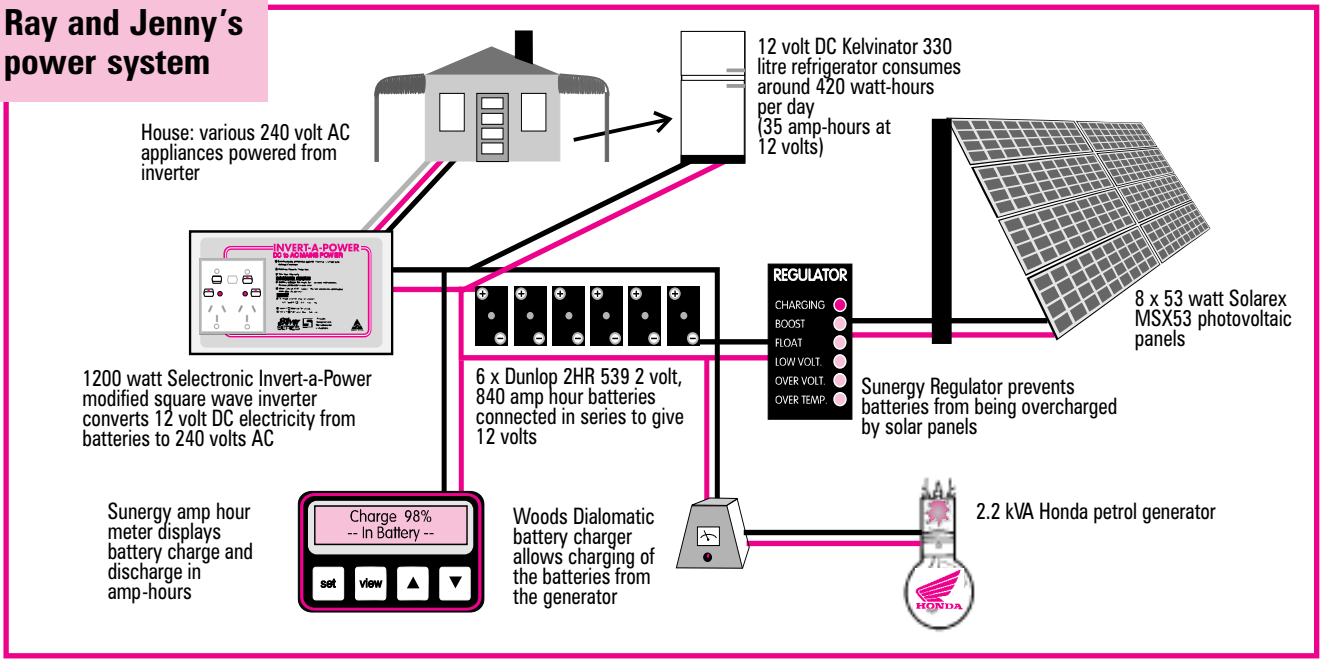
To date, there have been no complaints about the system, which was installed in March 1996. The control equipment is well labelled, and the Sunergy amp-hour meter, which stores and displays data on solar input, battery capacity and daily power consumption, gives them a good understanding of how the system is performing.

They also bought a 330 litre 12 volt DC Kelvinator refrigerator for around $2000 at the time of the installation, and ran cables directly to the house from the batteries. This fridge is also a successful purchase, using an average of around 420 watt-hours per day. This is an outstanding power saving, using less than half the power of an off-the-shelf AC equivalent.

Photo: Robyn Banner

Ray and Jenny's system uses six 2-volt, 840 amp-hour ex-government back-up batteries, shown here with their cover removed. The debate about the life expectancy and value of ex-government batteries has surfaced recently in *ReNew*'s letters pages and articles. Ray is pleased with the performance of his batteries, though he has only had the system for around 18 months. *ReNew* would like to hear more about readers' experiences using ex-government back-up batteries as storage batteries in their systems.

Ray and Jenny's power system



There were a couple of hiccups due to the characteristics of electricity from the modified square wave inverter. Some 240 volt appliances do not work well with this type of inverter. In Ray and Jenny's case, the kitchen rangehood was one of them. The other was the smoke detectors that were wired into the system as part of the legal requirements on new houses. In an ironic demise, the smoke detectors began to overheat and melt, though fortunately the problem was spotted before they caught fire. They have been replaced with stand-alone battery equivalents.

In spite of these problems, Ray is convinced that they made the right decision. Their modified square wave inverter cost around half the price of a sine wave equivalent, which would have run all appliances.

For people who were accustomed to using power supplied solely by a generator, the addition of solar panels and a battery bank has meant a huge increase in quality of life. They don't have to refuel the generator as often, running it less frequently and for shorter periods. In an average week, they run the generator three times for around four hours each, whereas in the past the generator was running whenever they wanted power.

The new system also means that a light can be left on overnight if one of the kids is sick, whereas in the past they would have used a candle. The noise from the generator makes it unsuitable for overnight use, especially with neighbours close by.

Walking around their block on a sunny winter's afternoon, it is hard to imagine what the land was like six years ago. Jenny points out a neighbouring paddock, covered in thick clumps of blackberries, and explains that their land looked like that when they bought it.

We stroll around a well maintained dam, which provides water for the two young house cows, and a smaller spring-fed dam which serves as a swimming hole for Lauren and Stephie in summer. Their chooks have a large free-range area, and there is also an impressive orchard, with over forty fruit and nut trees which they began planting soon after they arrived.

We finish our tour in the kitchen, which is well lit and opens onto the lounge. It is also warm from the wood stove, even though no-one has been inside to put a log on it for several hours. There are no signs that this house runs on a renewable energy system, apart from a disused power-hungry electric frying pan gathering dust on a shelf. It used to make great doughnuts in their grid-connected house, but as Jenny explains, 'I would have given up anything for this'.

Story by Michael Linke

Tackling some big issues

An electric delivery van helps the long-term unemployed in Melbourne

Despite the many advantages of electric vehicles, they have yet to be mass produced. JOHN HOERNER takes a quick look at an electric van being used for deliveries that not only helps the disadvantaged, but may also help change the public's view of electric vehicles

On Tuesday 29 July this year, CitiPower, a major Victorian eletricity retailer, officially handed over the keys of an electric powered delivery van to the publishers of *The Big Issue* magazine.

The Big Issue provides start-up work for the long-term unemployed, aimed at helping them get their lives back together. Vendors sell the magazines on the street, and keep half of the $2 cover charge. It can help homeless people to save for a bond, and helps to restore a sense of self esteem which long-term joblessness has so often taken away. As the title suggests, *The Big Issue* also tackles social problems that are often neglected by the mainstream media.

With support from *The Body Shop*, The Big Issue has grown to a monthly circulation of around 10,000 copies in its first year. The CitiPower electric van will help the publishers cope with their rapidly expanding delivery needs.

The vehicle, a Finnish 'Elcat' van about the size of a Suzuki 'Carry' van, is part of CitiPower's plan to encourage government and the corporate community to use pollution reducing vehicles in their vehicle fleets. The long-term plan is to involve major fleet operators in the CBD in similar trials as a step towards large scale electric vehicle usage. The Big Issue EV will be monitored by the CSIRO to gather data about range, energy usage patterns and

operating costs.

The large scale use of electric vehicles in the CBD will ultimately lead to improved air quality and a reduction in noise pollution. The power used by electric vehicles causes only about 30 percent of the greenhouse gas emissions of petrol powered vehicles, at the same time reducing our dependency on imported fuel oils.

Equally as important is the lower levels of toxic materials caused by electric vehicle use compared to petrol fuelled vehicles, and the fact that emissions occur at the power plant, away from the densely populated cities where EVs are mostly used. Of course, the emissions are reduced to virtually zero when renewable energy is used to recharge the batteries.

David Rand and his team from CSIRO have modified the Elcat vehicle to include a higher efficiency battery bank. The Elcat van now has a bank of eighteen *Optima* 'YellowTops', a highly advanced sealed lead acid battery capable of delivering much greater instantaneous power than most other batteries of their physical size and capacity. Their construction also means they can provide quite high storage densities for a lead-acid battery, even at the high rates of discharge found in electric vehicles.

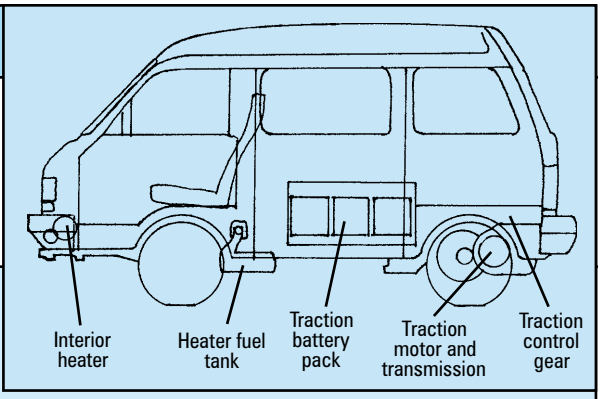
In the long term, CitiPower are looking to incorporate the CSIRO's rapid charge technology into their electric vehicle program, which would allow rapid charging of the vehicles' batteries and greatly reducing the 'refuelling' time. This will help to overcome one of the major criticisms of EVs and pave the way for more widespread use of electric vehicles.

Here you can see the bank of Optima YellowTop batteries. There are 18 Optimas providing 72 volts to the series wound DC motor via a 400 amp controller.

John Hoerner is the founder of the Great Southern International Sunrace, and an avid EV enthusiast.

Technical specifications of the Elcat van

Overall dimensions	Length	3425mm
	Width	1430mm
	Height	1860mm
Kerb weight		1180kg
Gross weight		1435kg
Motor		DC series wound
Nominal voltage		72 volts
Rated/maximum power		13/19kW
Torque		110Nm
Transmission		5 speed manual
Clutch		Conventional dry single plate diaphragm
Controller		400 amp MOSFET Pulse Width Modulation
Traction Battery		18 Optima YellowTop seal lead acid batteries, 50 amp-hour each, wired as three parallel strings of six batteries in series (72 volt, 150 amp-hour total)
Traction battery charger		Switchmode type
Maximum output		28 amps
Input		220 volts, 16 amps maximum
Charging time		12 hours (100% charge) 8 hours (80% charge)
Accessory electrical system		12 volt
Accessory battery		45 amp-hour
DC to DC converter		72 to 12 volt, 380 watt maximum



Cooking with the sun

When 'Sunny' Miller built his first solar cooker in 1976, he realised he was on to a good thing. They are cheap to make, cook great tasting food, and use free power from the sun. Here he explains how solar cookers work, shows a successful design and shares a couple of recipes.

My first solar cooker wasn't very efficient. It cooked a cup of rice in a record-breaking six and a half hours. Still, it *did* cook and on more than one occasion my partner and I ate a summer evening meal of rice and vegie salad and did not heat the kitchen one bit by cooking inside. 'The Cube', as we called it, was a chipboard box about 18 inches on each side. It was built around a cashew nut tin from India. I'd cut down to about a 14 inch inside depth and painted with some tyre black paint. The wall between tin and chipboard was filled with fibreglass insulation scrounged from a building site. The window was double-glazed using wood from a picture framing shop and glass from a neighbour's discarded windows. The only cost was for the cast iron camp oven purchased from David Jones for a going-out-of-business grand sum of $1.50.

How do solar cookers work?

Stand in the sunshine. If your body is of European genetic stock it is probably a rather light shade of 'piggy-pink'. Some of the light striking you will bounce off. If this bounced light strikes the eyes of some other Earth creature it will 'see' you. This bounced light is called 'reflection'. Not all light is reflected. Your body also absorbs some of the light. Absorbed light (both visible and invisible) will heat your body. When you feel warm your body is acting as a solar absorber. Usually a friendly passing breeze will cool you and limit the heating effect and you won't feel uncomfortably warm.

Ah, but this can change! Who has sat in a car on a sunny day? Inside an enclosed space like a car heat is trapped and builds up and up. A chamber heated by sunlight has been given the name 'collector'. As the inside temperature rises all the bits of the collector get warmed from inside. At some temperature the heat being 'generated' by absorption is balanced by heat escaping, for example through air gaps. Let's call this the 'final' temperature.

Some things affecting this final temperature are:

- how big is the window letting in light.
- is light coming directly through or at some angle.
- how dark is the absorbing stuff inside.
- If the walls of our collector have a cavity wall the heat has to 'migrate' across the cavity of still air.
- with something in the cavity which slows the movement of heat we will increase the final temperature.

This is the principle behind a solar *hot water* system, the solar *hot food* system works the same, only more in-

tensely. Food can actually get hotter than the water in your hot water system! How? Keeping the water content of the food to a minimum is one way. Another way is to tightly seal the food container.

An example of the sealed container is at work is the solar sterilizer made by Trisolar Foundation in Perth. With the assistance of a German aid agency twenty-six of these were recently sent to Eritrea to be used for sterilizing medical instruments.

Yet another way is to intensify the heat in solar cooking is to use a liquid which can get hotter than boiling water. The Solker company of Madras in India has a device which uses peanut oil. The oil circulates between a collector much like that of a conventional solar hot water system and a box (inside the kitchen) which has the cooking vessels. Of course, over the years many experimenters have sought to pump in vast sums of solar energy by using concentrators. Some very sophisticated devices have been built. Many have been very dangerous or at least downright uncomfortable. Operation sometimes requires that you stand in the hot sun during cooking.

The Swiss connection

Solar cooking goes back a couple of hundred years in Switzerland. The naturalist Horace de Saussure reported cooking apples in a box round 1770. He achieved the temperature of 87.5ºC. Surprisingly in such a cold climate, Switzerland claims to have today's highest number of solar cookers per capita. But if the box is well insulated against the outside cold, getting to cooking temperature is quite possible. An inventive soul in Basel even has a cafe using solar cookers to supplement conventional appliances.

The cardboard cooker

The inventor of the cardboard box cooker, or eco-cooker, was a retired nurse. Barbara Kerr lives in Arizona and says she 'misunderstood a rumour that in India they had a box that cooked in the sun'. She wanted to make one. 'Box to me meant cardboard' she explains, 'I didn't know they were using metal'. In her garage she had a rather large piece of glass, and being scared to try cutting it, she found a cardboard box big enough to suit and made her first cooker. It worked well, achieving 120ºC. With her neighbour and co-developer Sherry Cole, Barbara was sure 'the conspirators' in the energy industry would patent and lock-up their solar box. She says 'patenting it may have been an empty effort, as no-one seemed to panic at the thought of solar cookers'.

Le cooker Français

There is a French connection for cookers too. His name is Roger Bernard. Roger has a fertile mind and has applied lots of lateral thinking to solar cooking, creating the so-called panel cooker. This is simply half a cardboard box, cut across the diagonal. Half of the inside is then lined with aluminium foil which reflects the light into a 'focal area'.

A focal *point*, you may remember from experiments with lenses in school, is that concentrated hot spot where light rays bent by a lens all come together. The intensity of energy was often used by little kids to fry ants and burn paper. A cooker using a focal point can result in food being burnt black in the middle, yet still frozen on the ends. So if we modify our expectations and work instead for a not-so-hot spot we end up with a hot area which I call a 'focal area'. A cooker like this does not need critical focusing nor does it need to be mathematically calculated and complicated to construct.

Recipes

Sunny Miller's three course solar cooker meal

Pumpkin Soup

3 cups pumpkin cubes
3 cups scalded milk;
1/8 teaspoon cinnamon
grated nutmeg
small pinch of saffron
salt and pepper

Cook pumpkin in black pot for up to three hours until soft (don't add water). Mash and mix with remaining ingredients. Reheat and serve hot.

Ratatouille Provencale *a classic French dish ideally suited to solar cooking*

Cut and layer into a casserole dish:

¾ cup thinly sliced onion
2-4 cloves garlic, crushed
4 capsicum cut into strips
2½ cups peeled, diced aubergine
3 cups zucchini sliced 10 mm thick
2 cups peeled, seeded, quartered tomatoes
3 tablespoons chopped parsley
½ teaspoons oregano
teaspoon sugar (optional)

As you build the dish liberally sprinkle olive oil, salt and grated pepper. Put on the cover. Cook at least 2 hours. It'll stay hot after the sun sets for a nice long time. Serve on rice, bulghur or with warm, thin Lebanese or warm thick Turkish bread.

Stuffed Apples

Cut the core out of some nice big 'grannies' and fill with your favourite muesli. It can stand very slow or even incomplete heating. Serve with lashings of cream.

Making your own cardboard 'Eco-cooker'

Materials

Inner Box, at least 570mm square.
Outer Box, at least 670mm square.
Lid to suit outer box.
Glass window 50mm bigger than the inner box, so usually 620mm square.
Absorber, thin metal painted black.
Reflector as big overall as the lid.
Prop and cardboard brackets.
Other materials: pencil, ruler, scissors, craft knife, brush 50-75mm, 250ml 'Aquadhere' or equivalent. PVA adhesive, margarine container, 20 metres of 300mm wide aluminium foil (the thicker the better), and of course the covered container (preferably dark coloured).

Start with three cardboard boxes. One for the inner box at least 570mm square is cut to 275mm high. This allows for a 225mm high cooking vessel: casserole dish, cast iron camp oven, or painted saucepan, and 40mm for sealing flaps. To support heavy vessels which might otherwise cause the inner box to sag, install spacers between the inner and outer boxes.

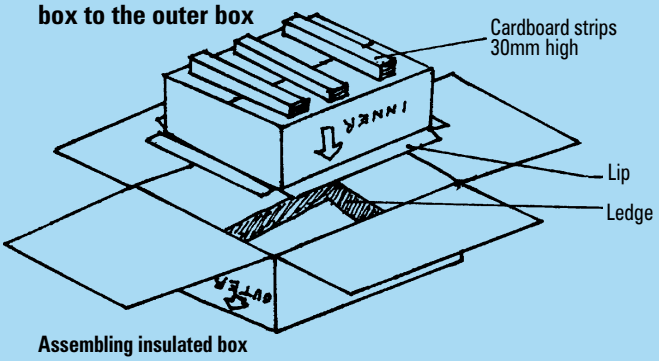
The outer box should be at least 50mm all round bigger than the inner box. This allows a good-sized wall thickness for insulation. Pre-cut the window hole and leave the bottom open. Then assemble the cooker up-side down. The lid is fashioned from the third box. It is made to fit fairly snugly.

Figure 1 shows the lid cross section detailing how to sandwich the glass window in. By this method the whole cooker is built using low-technology PVA adhesive. The reflector, also from the third box, adds perhaps 10 percent to the cooking speed. The reflector also stops loss of heat when closed and protects the glass.

Aluminium foil won't stick without lumps using straight PVA glue. Use a half and half mix of water and PVA and apply it by brush so the foil can be smoothed easily and adhere well to the cardboard. When sticking aluminium foil work in small areas; paint, lay, smooth then repeat as with wallpaper.

Through trial and error I have found that a stick with nails at either end works best to prop open the reflector. These poke into cardboard corrugation brackets as shown in Figure 4.

Figure 3. Fitting the inner box to the outer box



Assembling insulated box

1. Insert inner box to ensure it fits, then remove
2. Apply foil on all surfaces except lip and ledge
3. Apply PVA to lip and ledge, reassemble
4. Glue, fold and weigh down flaps of outer box

Figure 1. Lid detail

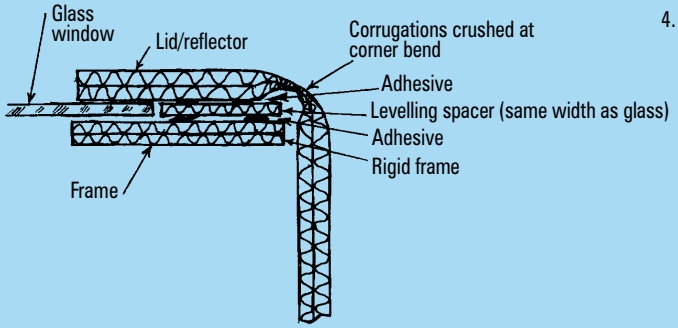


Figure 2. Inner box cross section

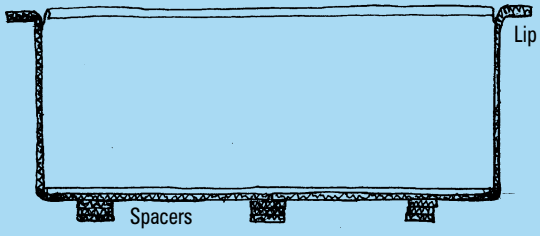
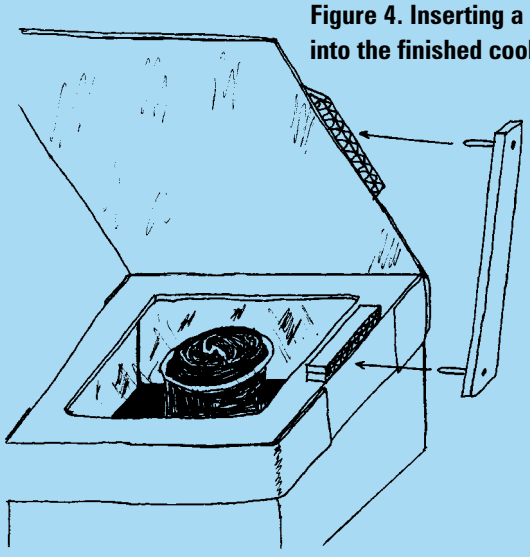


Figure 4. Inserting a prop into the finished cooker



Solar cooking in developing countries

Some time after Barbara Kerr and Joan Cole got their Eco-Cooker design perfected, a group of civic-minded folks in Sacramento, California saw solar cooking as a possible benefit to people in the developing world. Where refugees and others were having to travel ever further for firewood to cook their daily food, Solar Cookers International (SCI) started to spread the word about this alternative way to cook.

Despite many good reasons to use the sun to cook, SCI has not had an easy task. It seems that even in the developing world, people would rather light a fire and see the action. And of course we're yet to see a solar cooker along side a swimming pool in a Hollywood movie, so when the world's poor get enough money to emulate our culture, they want a charcoal barbecue or an electric frying-pan.

Late in 1996, I made my way to the textile town of Coimbatore in the South Indian state of Tamil Nadu. In December the monsoons were finished and skies were clear. It was ideal weather for the Third International Solar Cooking Conference. This was the first conference where all continents on the planet were represented. Solar cooking is truly an idea whose time has come.

India has been involved with solar cooking for quite a number of years. The Avinashiligham Deemed University, where the conference was held, is a 'home science institute'. Over the years many research projects have come from there looking at the practicalities of cooking with solar energy.

The University presented a paper on the nutritional content of foods cooked with solar, as compared to other methods such as pressure cooking and using an open pot over a fire. They estimate that in India over 400,000 solar cookers have been sold. A number of manufacturers make these appliances; some even feature built-in electric elements and thermostatic controls to switch the 'electric boosters' on if the solar temperature drops too much.

Common designs in Australia

The most common cooker design in Australia is probably a slanted-face, double glazed design which can achieve really good cooking temperatures around 160ºC, and is relatively weatherproof (see the front cover photograph). The cardboard eco-cooker is probably the next most common. It's easy for the unskilled to make and will work on days when the sun is high in the sky. Fortunately, that coincides with the time of year when we don't get much rain.

The panel cooker has also had a lot of exposure here. My panel cooker is made of a box about 800mm wide. It is now two years old. I coated the outside of an old, lidded stainless steel pot with high temperature pot-belly stove paint.

To keep away the cooling breeze I covered this with an up-side down glass punch-bowl. While it did function, one modification has improved performance markedly. To raise the vessel up closer to the hot spot I put an empty tuna tin underneath. The mass of the empty tin doesn't absorb much energy and its stubby shape is shallow enough that the vessel is not wobbly and the edge of the punch-bowl still seals down to the floor.

On 20 July, Perth had about 20 percent cloud cover. In two hours the panel cooker almost overcooked a two-person rice pudding. Of course overcooking a rice pudding just means the sugars caramelize and turn dark and chewy...mm-mmm. ✲

Sunny Miller is convenor of the Solar Cooking Interest Group in Perth. If you want more information about how to build or modify your own cooker contact:

Solar Cooking Interest Group
c/ 23 Morley Street, Maddington, W.A. 6109
phone (08) 9459-3606,
fax: (08) 9310-6094 e-mail: <d_miller@central.murdoch.edu.au>

Books available from SCIG include:

Solar Cookers: How to Make, Use and Understand, $A7.00

Cooking with the Sun includes plans for wooden and concentrating cookers as well as recipes. The cost is $A12.30.

The Solar Cooking Interest Group shares hints and recipes through their newsletter, *The Collector*, which costs $6.00 per year for three issues.

For information on how you or your organisation can help people in the developing world save their forests by switching to solar power for cooking, contact SCIG or their affiliate:

Solar Cookers International
1919 21st Street Suite 101
Sacramento, California 95814 USA. E-mail: <sbci@igc.apc.org> or check out their Web page at http://www.accessone.com/~sbcn/index.htm

A very complete work by Barbara Kerr is called *The Expanding World of Solar Box Cookers*. It is available from Kerr-Cole Solar Box Cookers P.O. Box 576, TAYLOR, AZ 85939 U.S.A. (Around $US10).

A good quality Australian cooker is made by Jura Sol Ind., 'Jura Heights', Gowan via Bathurst N.S.W. 2795 (a Jura Sol features on the front cover).

The sustainable office

SEDA is one government department that is putting runs on the board for sustainable technology. Jane Clement visits their office, which was fitted-out using the best in environment and people-friendly products, without compromising on cost or aesthetics

The Sustainable Energy Development Authority (SEDA) is a New South Wales State Government body which has been set up to reduce greenhouse gas emissions from the production and use of energy in the state.

SEDA's initiatives so far include the Energy Smart program, where participating organisations agree to reduce their energy consumption; Green Power, where energy retailers offer domestic and business customers the option of contributing to investment in renewable energy generators (see the following article); and The Energy Star program, which encourages people to activate energy saving features in their office equipment.

An important part of SEDA's role is to commercialise existing clean energy technologies which are struggling to increase their market share. To prove what can be done, SEDA's Sydney city centre office was redesigned to showcase the best in energy efficient technologies and the use of building materials that have a minimum environmental impact. High above the office, which is located on the sixth floor of a high rise block in Sydney's central business district, Australia's first rooftop solar power station on a high rise office building has also been installed.

'I guess we're putting our money where our mouth is,' said Cathy Zoi, SEDA's executive director. 'We wanted to create an interior which met the needs of the corporate world by being comfortable, healthy to work in and aesthetically appealing but was also ecologically sustainable and had demonstrable benefits.'

The SEDA office came in at under $800 per square metre compared to the average NSW Government office fitout cost of $500-1500 per square metre. The refit is saving 11,000 kilowatt hours (kWh) per year of energy—the equivalent of 11 tonnes of greenhouse gases.

Lighting naturally

Interior designers and facility planners HBO+EMTB planned the SEDA office to maximise the use of natural light, favouring an open plan workstation environment. A solar array system was installed on the building's roof to provide SEDA's energy needs (see box on opposite page).

An energy audit showed that the existing fluorescent lighting system was efficient. However, some areas were overlit, with lighting levels sometimes approaching 800 lux. Dimmers were installed; these reduced the lighting levels by 15 percent and saved 30 percent on power consumption.

A number of other energy saving lighting features were installed, including lights that automatically switch off when

A meeting room in SEDA's offices. Chairs are made from plywood rather than plastic, benches and tables are made from plantation timber, and the walls are painted with plant-based paints

natural lighting levels are sufficient; occupancy sensors which turn off lights when rooms are empty; a current controller; and Australia's first commercial installation of 'next generation' high efficiency fluorescent lighting. Some of these features cost relatively little, returning SEDA's investment within the year.

The whole system shuts down automatically after work hours, with extra lighting available for night owls when override switches are activated. In total, the measures saved 3832 kWh per year.

In the kitchen, the two star bar fridge was swapped for a four star one (Australia's most energy efficient 240 volt bar fridge, the Westinghouse 142 'environ', which was developed in conjunction with Greenpeace). This cost a mere $50 more than a standard bar fridge and reduced the annual refrigeration energy consumption by 110 kWh (from 380 to 270 kWh per annum).

Other new kitchen appliances include the country's most energy and water efficient dishwasher (the Global 300 from Dishlex) and a Kambrook Axis kettle that uses 60 percent less electricity than a boiling kettle unit. In addition, there is a 24 hour a day, seven days a week timer on the hot water unit.

Office equipment

An impressive 6850 kWh a year were saved simply by activating the energy-saving capabilities on SEDA's office equipment as part of its Energy Star program.

Energy Star labelled computers, printers and fax machines —which is most of them—contain energy saving features which, when activated, reduce a machine's power consumption by at least 50 percent, and up to 75 percent.

'Running office equipment at full speed, 24 hours a day, is not only bad for our environment, it wastes energy dollars,'

SEDA's roof-top solar system

SEDA's grid connected 7.2 kilowatt photovoltaic (PV) system generates around 11,000 kWh a year. Power is sold back to the grid through energyAustralia's Green Power scheme, Pure Energy, so the PV system is providing a good return on investment for SEDA.

It is the fourth largest grid connected system in the country, making up 10 per cent of today's Australian grid connected PV capacity, and its installation is increasing awareness of the significant potential of PV in the energy mix.

Ninety PV modules in the system convert energy from sunlight into direct current (DC) electricity, then an inverter converts the direct current into alternating current (AC) to make it compatible with grid electricity.

The system is always grid connected, so batteries are never needed, even when the sun doesn't shine. Oriented to the north and on an incline, the SEDA PV system enjoys optimum conditions for generating the maximum amount of electricity.

Technical details:

- Total PV capacity 7.2 kilowatts peak (under standard test conditions)
- 90 modules (MSX83), manufactured in Sydney by Solarex, are connected to form ten strings of nine modules with a nominal DC voltage of 120 volts
- The sinewave inverter is rated at 6kVA continuous, with an efficiency of greater than 90 per cent over its operating range; it was manufactured in Victoria by Power Solutions Australia
- Electrical output is grid connected through a single phase 240V connection
- The array is 11 metres wide, six metres long and three metres high
- The system weighs about 1000 kg
- The installation was designed and carried out by Essex Electrical

Cathy Zoi, SEDA's Executive Director (and a former advisor to Bill Clinton) with the SEDA roof-top array

said Mark Dunk of SEDA. 'An organisation with 1,000 PCs spends about $61,580 a year on electricity to run them, yet the bill could easily be halved using Energy Star.'

Activating the Energy Star features on office equipment is relatively simple and low cost, and can be undertaken by anyone with a computer, printer or other Energy Star labelled machine.

Material benefits

The key selection criteria for materials used in the fitout were their low energy use, low environmental impact and low toxicity, combined with commercial imperatives such as value for money and availability. Unusually in the world of corporate interior design, their environmental and health attributes were the main factors rather than their colour, fashion value or ability to impress visitors.

As SEDA's staff were working in the offices throughout the refurbishment, plant based paints were used. These avoid offgassing toxic fumes and so are more healthy than conventional petroleum-based paints.

As SEDA staff and visitors enter the office, they pass walls constructed of recycled power poles. Inside, they walk on vegetable-dyed coir carpeting and salvaged blackbutt timber floorboards. They sit on hemp-upholstered seating stuffed with coconut fibres and cotton wadding in casual seating areas, and plywood—rather than plastic—chairs in meeting rooms. They work at plantation timber desks, store their files on low emission fibreboard shelves, and place their coffee mugs on counter tops which are covered in linoleum, which is derived from pine resin and other natural materials. They see little of materials which require high energy for their production, such as aluminium, and even the glass is from a salvaged source.

Inspiration to others

Together, all the features of the SEDA office add up to ecologically sustainable development (ESD) in action.

'A healthy and environmentally friendly working environment can be created in our local market,' said HBO+ETMB director, Kevin Fitzgerald. 'It requires a degree of care and persistence from the designers and a willingness from suppliers to accept the consequences of the materials and processes that make up their products.'

Cathy Zoi agrees. 'The customer, whether they are a large corporation or a one-person home based business, needs to drive the suppliers to be creative in their thinking and to give the environment equal consideration with good looks, comfort and price,' she said. 'Any one of the initiatives we have used in SEDA's office could be applied elsewhere.'

'Choosing to build or refurbish an office, or any other living area for that matter, is one way we can all individually be environmentally responsible, because there are positive choices to be made in interior design which can reduce the environmental burden over the lifetime of the room.'

Making a difference with Green Power

Jane Clement explains what is being called the largest 'green' electricity project in the world—the New South Wales Green Power scheme

Green Power, a program launched earlier this year in New South Wales, is one way that householders who get their power supply from the grid can help to support the growth of the renewable energy industry in Australia.

Green Power schemes are operated by six NSW electricity retailers and two from Victoria. Under the schemes, consumers can choose to have the equivalent of a percentage of their power supplied via the grid from renewable energy sources. They may pay their retailer a slightly higher price for this percentage of their power and the retailers then use the extra funds for the building of new 'green' generators.

The Sustainable Energy Development Authority (SEDA) is running a Green Power Accreditation Program to ensure that all the various Green Power schemes meet certain standards and are designed to accelerate the introduction of new Green Power capacity.

'As most *ReNew* readers probably know, renewable electricity currently makes up only five percent of the energy supplied to the grid,' said SEDA's Martin Poole. 'Green Power

The Green Power program allows New South Wales residents to invest in renewable energy generators through their electricity retailer. The money is used to develop projects like this photovoltaic array owned by Citipower in Melbourne.

aims to increase that percentage so that, by 1999, 60 percent of Green Power supplied to the grid is supplied by *new* green generators.'

'One 20 storey office block alone consumes 4 gigawatt hours (4 million kilowatt hours) of electricity a year, the production of which generates about 4,000 tonnes of greenhouse gases,' Martin continued. 'Householders play a large part too; over 30 percent of our greenhouse gases are due to the production of electricity by coal-fired generators for domestic consumption.'

'Businesses and individuals can help to reduce this burden on the environment by participating in Green Power and by encouraging their friends, family and workmates to take part too.

'By making a choice to support Green Power when they pay their electricity bill, consumers will help to increase the demand for 'green' electricity, driving its price down and contributing directly to the building of more renewable energy generators.'

Green Power commitments are currently around 50,000 megawatt hours, equivalent to the power used by 7,000 homes, and the number of actual customers will be known after the first Green Power audit later this year. SEDA fully expects the concept to increase in popularity, a belief backed up the results of a recent research survey they conducted. Over 50 per cent of domestic consumers said they favoured the concept of a Green Power tariff, a figure which reinforces research done by the electricity retailers and the Independent Pricing and Regulatory Tribunal.

These are the most commonly asked questions about Green Power:

How can I participate?

Basically, there are two ways consumers can support their electricity retailer's Green Power program:

1. Choose to have the equivalent of a percentage of their power consumption supplied by their energy retailer into the grid from 'green' generators. This may involve paying a slightly higher cost for that percentage.

2. Make a direct financial contribution by rounding up a bill or by joining their retailer's renewable energy supporters' club. That money is put into the retailer's special Green Power account.

Supporting Green Power doesn't require the installation of any new equipment or rewiring of your home. Just contact your electricity supplier directly and ask about their Green Power products.

What happens to Green Power account funds?

To have its Green Power products accredited by SEDA, an energy retailer must agree to put the money earned from selling Green Power into a separate account which is independently audited.

Participating energy retailers agree to use the Green Power account funds specifically for investment in new renewable energy generators. To build customers' confidence that their contributions are being used as proposed, a financial statement for the Green Power scheme must be made available to the public every year.

Accreditation also requires that any participating energy retailer is a Green Power customer themselves, so they will also contribute money to the account.

The resulting increase in demand for renewable energy will drive investment in renewable energy projects. Investments are already being made in energy projects such as the building of Australia's biggest grid connected wind farm at Crookwell and the largest photovoltaic power station in the Southern hemisphere at Singleton in NSW

What kind of renewable energy sources are used?

To supply Green Power energy to the grid, energy retailers are sourcing electricity from a variety of generators, mainly solar, wind and small scale hydro-electric. Some retailers own the generators while others buy the 'green' energy they require for Green Power.

At the moment, thirty renewable power generators are connected to the NSW power grid. The new renewable power generators being built by the energy retailers as a result of SEDA's Green Power Program will greatly increase the amount of 'green' energy available to Australians (see box for details of acceptable Green Power sources).

Which energy retailers are involved?

For details about Green Power products, contact any of the power retailers listed below, or ring the Green Power information line on 1800 351 777.

Retailer	Green Power product	Telephone number
Advance Energy	Green Power	13 27 95
Australian Inland Energy	Solar Future	08 8080 2444
CitiPower	EcoPower	1800 650 540
energyAustralia	Pure Energy	1800 648 326
Great Southern Energy	earthsaver	13 23 56
Integral Energy	Community Sunpower	13 10 81
NorthPower	EcoPlus	13 20 66
Powercor Australia	Green Power	13 23 34

Can anyone choose Green Power?

At this stage, Green Power is available only to NSW customers. Green Power electricity must come from your local power supplier, unless—like many large businesses—you spend more than $75,000 a year on electricity, in which case you are classified as a contestable customer. A contestable customer can choose any power retailer and any Green Power product.

From 1 July 1999, all customers—domestic and commercial—will be contestable.

At present, Green Power products are being offered by the eight suppliers of power to the NSW market, two of which are Victorian companies.

Some retailers offer contribution schemes which can be joined by people living anywhere in Australia. Ring the Green Power information line on 1800 351 777 for a list of their names.

How much does Green Power cost?

Most Green Power products involve paying a slightly higher cost, so supporting Green Power will cost your household just a few dollars extra. For instance, you might decide to round up a quarterly $52.35 bill to $54; or you may choose to pay an extra few cents per Kwh on top of your existing rate. It may only amount to the cost of a can of soft drink per week.

Exactly how you can make a Green Power contribution depends on the type of products offered by your energy retailer. The scale of the commitment is up to you.

Where does Green Power come from?

SEDA's list of acceptable green power sources was derived from consideration of Greenhouse gas reductions and public perception. For instance, even though power from coal bed methane prevents this greenhouse gas from entering the atmosphere, the general public do not recognise it as a clean power source.

In	Out
Solar pv and solar thermal	Any fossil fuel fired generation
Wind power	Hydro requiring new dams
New hydro on existing dams	Fossil fuel fired cogeneration
Biomass including landfill	Mass burn incineration
Geothermal/hot dry rocks	Coal bed methane
Wave and tidal power	

The future of Green Power

Power retailers with accredited Green Power products are now making considerable investments in the marketing and supply of their renewable energy schemes. With the majority of power consumers in favour of Green Power, the NSW State Government is expected to continue its support into the next century.

Composting toilets
avoiding the pitfalls

If you want to install a composting toilet or greywater and sewage system, there are a few things you will need to consider beforehand. **Penny Simsen** looks at how to avoid problems, and the laws governing 'alternative' toilet installation.

If you are thinking about installing a composting toilet as an alternative to the reticulated sewage system, or a septic tank, there are many things you need to consider. A toilet is normally installed into a house without much forethought, but when installing a composting toilet or greywater and sewage treatment system, there are a number of problems that may arise if you don't plan ahead. After all, an 'alternative' toilet will be located in the most used room in the house, just like a conventional one. Do your homework, know what you need and what you're prepared to spend. Make the right initial decisions, and your toilet will give you many years of reliable service.

Initial purchase prices may seem high for an alternative system compared to the cost of a conventional flush toilet connected to a mains sewerage system. However, a conventional toilet costs about $6000 for installation and connection, with the ongoing annual costs of council water and disposal rates adding to this figure. In the long run, biological waste water systems can work out cheaper to own and maintain. Once installed, the upkeep costs are negligible and nutrients are returned to the earth, rather than discharged into our waterways to cause environmental damage.

Do some serious comparisons between different models in relation to the

Composting loos can look great, like the top end of this 'Wheeliebatch' installation.

money you have available for the project. You will also have to evaluate your requirements for the toilet system, and ask yourself a few questions. For instance, how many people will be using the system? Plan not only for now, but try to anticipate future demands on the system. Allow for extra kids, more house mates, and any extended parties. Some composting toilets have the facility to expand with your family, while others are produced with a fixed capacity.

One of the most important considerations is whether you want separate sewage and greywater or a system that handles both. Weigh up the extent that you want to be involved with your system. Do you want it to look after itself or do you prefer the hands-on approach?

Where will the toilet be located? You will need to allow for space under the floor if your chosen model requires it. Try to take into account the best position for the toilet. For example, you may find that the north wall will keep the pile warmer than the south wall.

I've heard of one woman who planned to design and build her own environmentally conscious dream home. Much to her surprise she found that the toilet needed to be situated in a particular area of the house for optimum efficiency and performance. Reluctantly the toilet was given 'pride of place' and everything else built around it. Long after the home was completed she still praises the forethought of putting the toilet's requirements first—its performance has exceeded her expectations.

Meeting the standards

Obtain as much information as you can about composting toilets, greywater systems and what is expected from you when it comes times for installation. Don't forget to factor in the cost of installation as well, because some local councils insist that only qualified tradespeople do the job. It's better not to tempt the wrath of the local council by installing a toilet yourself without approval, because they alone hold the power to grant approval for use of your toilet.

A caution to toilet anarchists

If you are caught with an illegal toilet, hefty fines may be forthcoming. Under the Environmental protection act (in Victoria, at least) it is illegal to install or operate either a composting toilet or greywater system without adhering to the guidelines contained within the EPA publications, *Code of Practice – Septic Tanks* and *Guidelines for Wastewater Reuse*. Currently, composting toilets are assessed under the heading of septic tanks, but this may change in the future as more government departments become familiar with this alternative technology.

These booklets contain a set of rules that stipulate how black water (sewage) and grey water (water from sinks, drains, baths and basins) have to be treated to ensure safe health practices, avoid contamination and spreading disease. Treatment of the water, quality of the finished product, handling and disposal of the finished product and other requirements are covered. Most commercially produced toilets already have an EPA certificate of approval, meaning they meet the standards set out under the EPA Environmental Act and subsequent Code of Practice. However, some of the cheaper models or cabin/holiday house types do not have this approval.

The Australian Standards set the minimum standard for the design, manufacture and safety of manufactured products. The Australian Standards for manufacture of composting toilets are recommendations only, but they are currently under review and are likely to become law in the future. Most ready built commercial composting toilets comply with the Australian Standards. However, if you intend designing and constructing your own composting toilet you may be required to fulfil the guidelines set out for Waterless Toilets under the Australian Standards.

Local Council

Once the unit has an EPA certificate of approval it is time to approach the local council. On the first visit you may get a few strange looks, have your sanity questioned or have to deal with staff that have never heard of a biological toilet. Be patient and persevere. Your local council representative will become the human face of installing your toilet—particularly the health inspector or surveyor—and you'll be seeing a lot of them. This is the person that will approve or reject your application. Be friendly towards them.

Get copies of the relevant local council applications for building permits and installation of sewage system. Take them home and read them. When you put these applications in for assessment take care to present them as professionally as possible. An application that is neatly presented in a folder will get a better response than one drawn freehand on a serviette the night before. Include copies of plans and results from any soil samples you may have obtained, information leaflets, the number of the certificate of approval for the toilet, and a statement about fulfilling the Australian Standards if appropriate. Give them more information than they require. Go out of your way to be helpful even if you believe the red tape to be excessive and time wasting.

Site appraisal

After your applications are assessed there will be various visits to inspect the site where you intend to build your toilet or greywater system. Soil samples may need to be taken if they haven't already. The individual characteristics of your site will have to be considered. If you are installing a composting toilet and greywater system, the composition and soil type will have a bearing on the length of transpiration trenches re-

quired for your site, as will the gradient of the land, proximity to any waterways, and the depth of ground water. If the inspector orders ten metres more of transpiration trenches, and your neighbour is an engineer and recommends only two, nod, smile and do your best to accommodate the inspector's specifications. Only after the council inspector is completely satisfied will you be allowed to commence construction so it is in your best interest to comply with their requests.

After many inspections, alterations and changes, you will (hopefully) be given a Permit to Install, which means you can start building. After construction, the site will be inspected again to ensure all specifications have been met. Once the local inspector is satisfied, you will be given a Permit to Use. Once you have this permit, you can happily and legally use your composting toilet to your heart's (or bowel's) content.

Designing your house to suit can make fitting a composting toilet much simpler. Excavating after the house is built can be a costly exercise.

Beating the red tape

Most councils have a tendency to heap copious quantities of red tape and over engineer projects they have had no experience with or do not understand. If you make allowances for this from the beginning, and go out of your way to make their job easier, you will get your toilet approved without a legal battle.

Take the attitude that you may be doing something that no one has done before. If you make things difficult for the local council, they may be less responsive to the next resident that attempts to install an alternative sewage system. It's all about educating local authorities to accept and promote the viable alternatives that are healthier for us humans and our environment.

Generally, regional councils seem to be easier to deal with than their city counterparts. For some reason they are more open to the idea of alternative sewage treatment.

If you are lucky enough to live in the municipality of Lismore in northern NSW, getting your toilet approved will be much less of a hassle. The local council actively encourages both the installation of composting toilets and the reuse of greywater.

Keeping it legal

What does it all mean? Basically a local council will not approve a system that does not meet the EPA requirements. If the council does not approve your toilet they will not issue a Permit to Install or a Permit to Use. If you still use the facility illegally and the authorities find out, you could be prosecuted.

In one case I heard of, the owners installed and used an unapproved system for years. However, when it came time to sell the dwelling, several potential buyers pulled out because the toilet wasn't legally installed and did not have council approval. Think carefully about the red tape. It is a necessary evil and although it can be overwhelming, with some effort it can be dealt with.

Building your own composting toilet

Building your own legal composting toilet is a complicated process. Your plans must be submitted to the EPA for assessment. Thorough testing and analysis of the unit and final product will have to be carried out before issuing of a certificate of approval. The designs may be referred back to the Australian Standards before it is even

assessed by the EPA. The process may take months or years, depending on the depth of bureaucracy encountered. If the unit is approved by the EPA, applications are then made to the local council for permits to install and build.

After reading about all the government rigmarole it is a natural question to ask 'is it all worth it?' Consider for a moment the havoc that sewage can cause in our environment. Poisoning of marine life, pollution of beaches, algal blooms, and contamination of ground and drinking water can all be caused by sewerage mains outfall.

Sewage contains many useful nutrients. When managed correctly it becomes an asset and a valuable resource. If each of us took responsibility for our own bodily wastes, the burden on our oceans and waterways would be greatly reduced. Only through the commitment and perseverance of individuals will the 'system' change to accommodate alternative technology. Despite the governmental inconvenience and bureaucracy, a composting toilet or sewage and greywater system is a worthwhile investment if you are serious about self sufficiency and ensuring a clean environment for all to enjoy in the future.

Remember, requirements may vary from state to state. If you have any doubts about what is required in your area, consult the relevant authorities and obtain advice. ✲

Penny Simsen's Composting toilet buyer's guide, which appeared in issue 60 of ReNew, provides an overview of composting toilets and greywater/sewage systems that are commercially available in Australia.

Essential reading

Goodbye to the Flush Toilet. Edited by Carol Hupping Stoner. Rodale Press 1977

Considered to be the bible on composting toilets. Contains diagrams for those wanting to investigate designing and building their own system.

Draft on Waterless Toilets. 1996. 17pp. Includes design principles and health regulations. Available from the Standards Association of Australian, 19-25 Raglan St, South Melbourne at a cost of $12.55 plus postage.

Code of Practice—Septic Tanks. (On-Site Domestic Wastewater Management) EPA publication 451 March 1996, and *Guidelines for Wastewater Reuse.* EPA publication 464 March 1996. Available from the Environmental Protection Authority, 477 Collins St, Melbourne at a cost of $5.00 each plus postage.

These or similar publications should be available from the EPA or equivalent authority in each state.

A controversial wind turbine

A New Zealand company is taking the world by storm with a new wind turbine development, but as **Michael Linke** explains, many in the wind industry believe it could have dire consequences for the future of wind power.

The world's wind-energy community is split over a radical new turbine, the developers of which say it will be more efficient than conventional technology. A New Zealand company claims that the turbine will produce electricity for NZ 3.45 cents per kilowatt hour (around 3.2 cents Australian). Critics within the industry contend that it is an expensive farce that is likely to damage the credibility of wind power.

A controversial wind turbine—the Vortec 7 is a test model for a New Zealand company's ambitious plan to revolutionise the wind energy industry. Vortec Energy Ltd. say its scaffold base structure would not be used on commercial turbines, which would be installed on conventional wind turbine towers.

The turbine, which uses a system known as diffuser augmentation, has a shroud surrounding a more or less conventional turbine. The shroud looks something like a funnel, which diffuses wind around the blades. The diffused air creates a low pressure area behind the blades, allowing increased air flow through the blade area and reducing blade-tip inefficiencies.

The diffuser's history

The diffuser concept is not a new one. It has been tried for decades, coming to prominence in the US in the 1970s when it was developed by Grumman Aerospace in response to the oil crisis. To date, it has not been economical because of the high cost of materials required to construct the shroud. Grumman Aerospace sold the rights to develop the turbine to Vortec on the basis of their ability to utilise new wire reinforced ferro-cement created by another New Zealand company. The ferro-cement shroud, claims Vortec, is stronger than conventional materials, yet costs significantly less.

The Vortec 7, the first Vortec to be tested in real conditions, is so named for its 7 metre blade diameter and has a 1 megawatt (MW) generator. Vortec envisages the finished product to be released on the market in 1999, and to have a 20 metre blade diameter with a larger generator. Robin Johannink, Managing Director of Vortec Energy, estimates that a 2 MW turbine would cost around NZ$3.8 million (A$3.4 million).

The most significant of Vortec's claims is that their turbines will be able to generate six to eight times the power of a conventional turbine for only three times the cost. This, claim Vortec, will see it compete directly with fossil fuel generators without the need for tax breaks or other subsidies. Conventional wind turbines are most competitive with fossil fuel generation in remote locations, or where incremental increases in capacity are required. There is, of course, a case for arguing that conventional wind power would be much more competitive if the hidden cost and subsidies attributed to fossil fuel generation were included in the equation.

Potential benefits

Due to this increased efficiency, Vortec says their turbines will need less land mass to do the same job as conventional turbines—an advantage where land is scarce.

Vortec believe the turbine is an aesthetically pleasing design. Commercial turbines are expected to be mounted on conventional white single-column towers. Robin Johannink says that visitors to the test site universally find the design acceptable, even though the prototype has a very prominent, squat scaffold-like support structure.

While rotating Vortec blades are no more visible than conventional turbine blades, there may be a reduced risk of birds flying into them due to the high visibility of the diffuser. Early testing also indicates that the Vortec will produce very little noise. Noise is often an issue in gaining public acceptance of wind farms.

Vortec say the effect of the design will also work at low wind speed sites, though not as dramatically. The technology can also be applied to smaller scale turbines, though smaller turbines are currently outside the scope of Vortec Energy's objectives. As Johannink explains, 'We see ourselves as suppliers to utility level'.

What the critics say

Technical criticisms of the Vortec are fairly general, as trial data is not yet completed and available for analysis. Indeed, it is the lack of data that is probably the greatest cause for scepticism. Some observers have raised concerns about the stresses on the turbine in turbulent conditions, especially if the wind direction controls fail. There is also debate about whether the diffuser can sufficiently increase wind speed through the blade area, even in laboratory conditions. The pathway to the development of today's successful turbines is littered with designs that worked in a wind tunnel, but fell apart in the field.

There are doubts about the economic viability of the ferro-cement to undercut the cost of using steel. The wind industry journal *Wind Power Monthly* claimed in a recent article that using steel could make the diffuser five percent cheaper. Indeed, Vortec Energy's company prospectus cites the potential of the ferro-cement not being 'an economically viable material to construct future diffusers' in its statement of risks to investors.

There is potentially a case against Vortec for holding back wind development. Through negotiations with Vortec Energy, the Dutch government has signed a declaration to the effect that they will not invest in further wind energy projects until more is known about the Vortec turbine's performance. Speaking at a wind energy workshop in Melbourne in June, US wind energy analyst Paul Gipe suggested that this has stalled the Dutch wind energy program until 1999, when commercial production of the Vortec turbines is due to begin. Robin Johannink countered this claim by saying that the Dutch wind energy program was already dormant, and that the Vortec turbine has the potential to revitalise it.

The Electricity Trust of South Australia is monitoring a site on the Fleurieu Peninsula with a view to installing a Vortec turbine

The high profile of the Vortec, which is beginning to attract mass media attention, effectively puts wind power out on a limb. To date, *New Scientist* has published two uncritical articles about the Vortec. No doubt it will attract further interest as more installations occur. Critics say that the turbine is raising expectations of wind power beyond what is reasonable for an unproven technology. The wind energy industry does not stand to gain anything from a high profile failure.

The financial costs of developing any large-scale renewable energy project are enormous. To date, Vortec Energy has been granted NZ$500,000 by the New Zealand government, and with private funding has raised a total of NZ$2.25 million ($A2.05 million). Critics suggest that such investment diverts funds that could be used to develop existing technology, or install more wind farms.

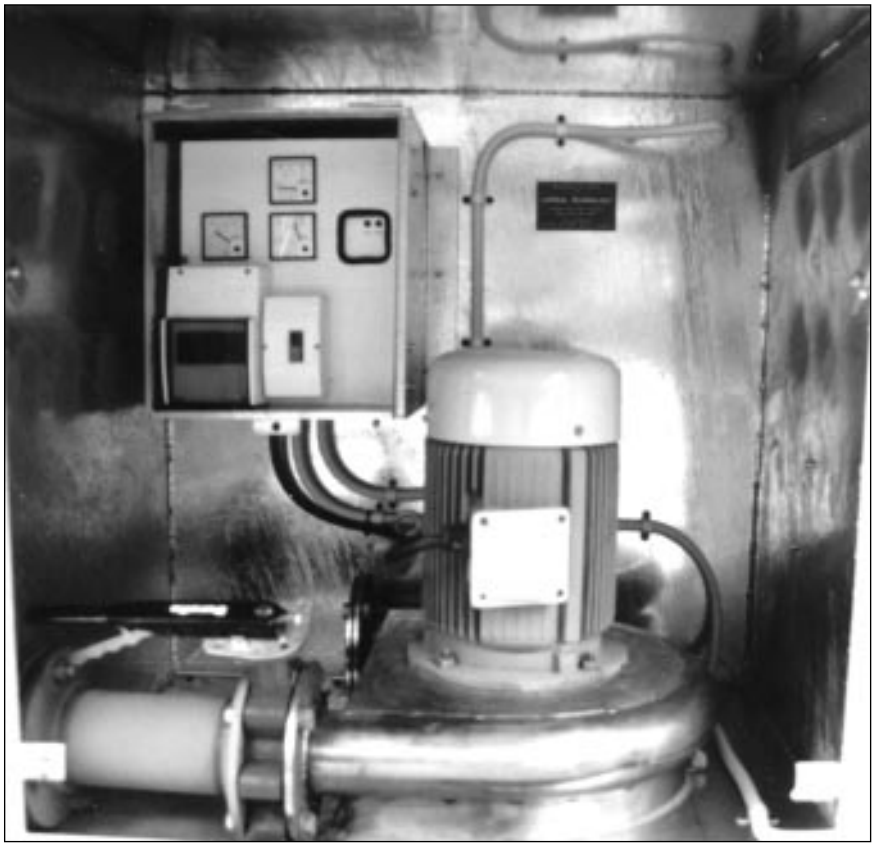
The South Australian government has also been talking to Vortec. Under pressure to meet the government's self imposed renewable energy target by 2004, Treasurer and Minister for Energy, Stephen Baker, has visited the test site in New Zealand. ETSA, the Electricity Trust of South Australia, is monitoring a site on the Fleurieu Peninsula with a view to installing a Vortec turbine—if the early trials prove successful. According to a spokesperson from the Department of Mines and Energy, any arrangement is far from finalised, and it is not certain whether ETSA would purchase electricity from Vortec Energy, or purchase the turbine outright.

With 90-day performance figures on the first Vortec prototype due to be released within a few weeks of *ReNew* going to print, the wind energy industry is waiting with bated breath. If the Vortec turbine does what its makers claim it will do, it could be a great leap forward for renewable energy at a time when only gradual improvements were thought possible. If the Vortec fails, it will be an expensive and highly publicised setback for the reputation of wind power.

ReNew will be following the progress of the Vortec turbine in coming issues.

A new use for micro-hydro

Without some sort of protection, mains water pipes quickly corrode away. But protecting pipes that are isolated from mains power is not so easy. We take a look at how renewable technology is helping solve this problem.



Whether they are carrying water, oil or gas, most metal pipes will slowly corrode away until they have to be replaced for safety and environmental reasons.

During this corrosion process, electrolysis occurs, whereby a current flows between the pipe and the ground. This current causes the metal of the pipe to chemically react with air and water, thus causing corrosion.

Normally, pipes are protected using what is known as 'cathodic protection'. There are several ways this can be achieved, either through 'sacrificial' metals like the zinc blocks used in hot water storage tanks, or by passing a low-level electrical current through the pipe to help counteract the current that flows during the corrosion process. When it comes to protecting pipes, low-level current is the preferred method.

This current is usually supplied by using mains power, but when the pipe to be protected is several miles from the nearest mains power line, a bit of creative thinking has to be done to solve the problem.

Such was the case with a large mains water pipe in the middle of a state forest in the Gippsland region in Victoria. This pipe is 1.8 metres in diameter, and runs from the Moondarra reservoir to supply Traralgon and other outlying areas. Gippsland Water needed a way to protect this pipe without running a cable through the forest, which would have caused considerable environmental damage.

The answer was to use the energy contained in some of the water flowing in the pipe to run a micro-hydro turbine. In turn, this would provide the power for the cathodic protection system.

The turbine was supplied and installed by Lateral Technology, a Victorian company with experience in providing renewable energy systems for remote area power supplies and specialised applications.

'There are many instances where conventional power sources either don't work, are too expensive and have the potential to cause damage to the environment.' explains Geoff Collins from Lateral Technology. 'The beauty of alternative power sources such as hydro, solar or wind is that they can usually be adapted to fit a particular circumstance. In some cases we have used a combination of all three to solve a problem which otherwise would have required costly conventional methods.'

Above: The Platypus Power turbine provides 2.5kw of continuous power.

Right: The turbine enclosure (shown here with covers open) is only about one metre cubed in size.

The turbine, manufactured by Platypus Power, provides up to 2.5 kilowatts of 240 volt AC power (which allows tools used on-site to be powered from the turbine) from a flow of 20 litres per second taken from the pipe, at an effective head of 24 metres. The water flows to the turbine through a four inch diameter (100mm) inlet pipe, and exits through an eight inch 'exhaust' pipe. The clean exhaust water flows into a nearby stream without any adverse environmental impact.

Economic sense

The huge water main has a water flow rate of around one metre per second, which means that over 2500 litres of water flow past a given point in this pipe every second. The turbine's water consumption is less than one percent of the available water flowing in the pipe.

Using the hydro turbine was not just a case of environmental common sense, but an economic one as well. The estimated cost of running a power cable to the pipe from the closest mains grid line was more than twice the cost of providing the turbine.

Cathodic protection maintenance technician John Marden, of Maxma Enterprises, worked on the project with Gippsland Water and Lateral Technology. He is more than happy with the system's performance, and says that 'normally in a water main of this size, corrosion is a problem within a year.'

'A good rule of thumb is that for every amp of current flowing out of bare steel, you lose about 60 pounds (27 kilograms) of metal each year to corrosion.'

'The cathodic protection afforded by the hydro turbine system is working well, has no environmental impact and has zero cost to run apart from a little maintenance.'

The system is a unique application of a micro-hydro turbine. It is believed to be the first time that hydro power on this scale has been used to provide cathodic protection. ✲

Story by Lance Turner.

Fighting for wind power

Harold Ford explains how he tackled a neighbour who took a dislike to his wind turbine

When I think of windmills I automatically have a childhood association with Don Quixote, and in particular him jousting with one. Just why he took such an objection to them eludes me, but when I came across his modern counterpart it was only natural to christen him Don. Don objects to wind generators, or to be more precise, he objects to the prospect of seeing the one belonging to my wife Maureen and I.

Don lives on the hill above us, so if we are to have a windmill he is almost bound to see it. It would be very easy to shrug or laugh off his objection but we are neighbours, we have to live with each other. I have to accept his genuine concern and concede that if they erected one of those beautiful SEC structures at a similar distance and position from our house I too would object. But I very much doubt that my objections would have any effect.

Don was also apprehensive about the effect on his television reception and has other concerns; that there may be objectionable noise; and that it may affect the value of his property. So rather than settling for a jousting match, Don lodged an official objection.

Council policy

Some time previous a verbal enquiry to the shire office established that as we were on sixteen hectares; and so long as it was more than twenty metres from the boundary; no permit was required for a wind generator. When Don's objection was lodged there was no mechanism to deal with it. So, as we had only dug the substantial foundations but not actually erected the wind generator we were asked to apply for planning permission. This was subsequently granted by the local council with some conditions on noise level and appearance. This opened up the avenue for Don's objection to be processed.

The appeal

The objection now took the form of an appeal to the Administrative Appeals Tribunal against the council's decision to allow the wind generator and as such we did not have to defend our application. The procedure to be followed is very clearly laid down, together with who should be informed of what. As an interested party we had the option, providing that we notified the tribunal within 28 days, of making a submission in support of the council's decision.

Our submission

The form that this should take is laid down and we found it quite easy to prepare a document. We highlighted the areas of concern that we thought the council representative would be least familiar with. We tried to get the technical facts right and very carefully measured the site, taking a series of photos from all the public vantage points.

Photo: Harold Ford

We also had photos showing how restricted the site was for a wind generator. In all, the submission was six pages plus photos, and six copies had to be prepared.

The hearing

This was a fairly informal affair with a clearly defined procedure. Although lawyers are used in some cases the parties are allowed to appear for themselves or use other professionals. The tribunal turned out to be one person for our case, and each party made its submission in turn.

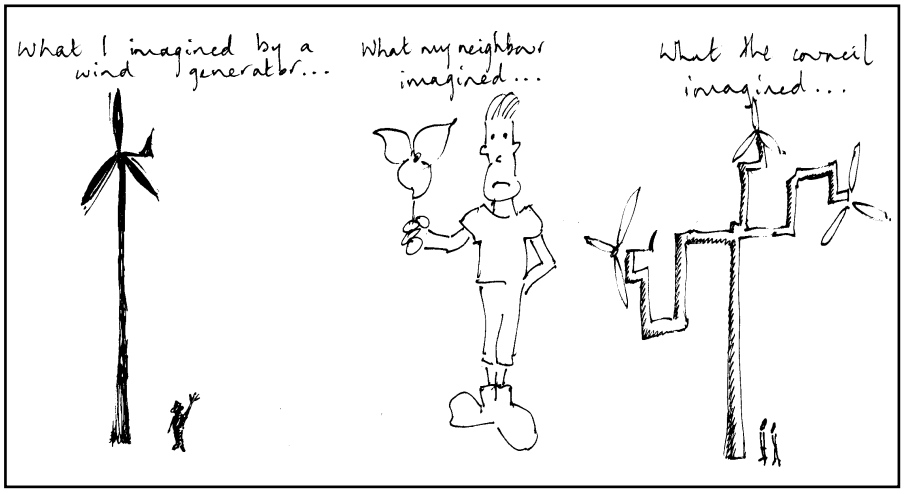
The council officers first stated their case, Don's professional planner then showed that he had not done his homework and finally I was allowed to put our case. I found it very difficult in the informal atmosphere not to comment when facts were presented inaccurately and even more difficult to note all those things that needed correcting. The chairperson was very tolerant of my interjections.

As it turned out I need not have worried. Don's planner left it wide open by specifying an acceptable distance from Don's house that was already exceeded by the distance to the wind generator. All that was needed was for me to point this out.

Handing down the findings

Some two weeks later we were notified that the Tribunal had found in our favour with some conditions! One that we had agreed upon was that we were to have a green wind generator (most appropriate I thought), as it was below the skyline from Don's viewpoint. We also had to plant yet another group of trees on the sight line.

While I have every respect for the tribunal, they do have to operate over a very wide range of situations and it must be impossible for them to be experts in all of them. In our case the conditions were technically incorrect and in any case far too specific. For example, we are allowed to have *three* wind generators with fibreglass blades on an 18 metre mast. This later caused problems when we had to replace the blades with metal ones, but Don agreed to them as we were able to show that they did not affect his television reception.



Artist: Jonathan Mallalieu

The results

Don is still our neighbour and we have managed to continue some form of dialogue through all this. With the erection of the windmill and the passage of time I hope that in his eye it has shrunk to the insignificant blot on the landscape that it really is. It was very difficult to imagine its height or bulk before it was up.

We have had some problems with the reflection of the sun flashing on the blades but this has improved as the paint has become more matt with time. Neither noise nor television reception have been a problem to either of us, any noise that there is seems to come from the gear box and is lost in the general wind noise that surrounds us. We have only found one point outside of our property where the generator shows above the skyline—so green was a very good colour!

What we learned

The first lesson is that the use of alternative technology may be perceived to have an impact on others. It also surfaced that we know little of the effects of alternative energy sources until we see and hear them in action.

There is more than one way to look at an issue but there is no way to hide a wind generator. Wind generators need to stand well above neighbouring objects to catch the most wind, so they can be seen from all directions. The more serious the attempt to use wind power, the more visible is the resultant structure. A small Rutland mounted on some left-over plumbing may pass unnoticed. But a 200 watt machine on a twelve metre mast is a different matter. The type of machine suitable for a larger system is in another league again—bigger and needing a more substantial tower to support it.

While those with a passion for alternative technology may see the shape and functionality as an acceptable component of the landscape, others have a very different view. It helps little to point out that the pylons that march from one end of the state to the other are not exactly things of great beauty. Nor that the average rural property seems to need at least half a dozen concrete poles and a transformer in order to be connected to the grid. Such things are 'normal', wind generators are not.

You can read about Harold's ingenious turbine in issue 60 of ReNew. Write to him at RMB 2407 O'Connor Rd, Toora Nth, Vic 3962.

Living in the '70s

Can everyone in the world share a standard of living equivalent to that achieved by western countries in the 1970s? **Bob Fuller** examines an equitable model for the future of the world's energy distribution

Earlier this year we all had the opportunity to read the discussion paper entitled Future Directions for Australia's National Greenhouse Strategy, distributed by the Federal Government for public comment. Unfortunately, the measures proposed in the document fall far short of what is required, and will have little significant impact on the most pressing global environmental problem we face.

The discussion paper said nothing about our lifestyle and its effect on energy consumption. Energy is used in all of our activities, and most of it currently comes from sources that pollute the environment. The goods we buy, kilometres we travel and services we use all influence the quantity of energy we consume.

This article reminds us all of how much energy we are using, collectively and individually. It also looks at what this energy use is doing to our environment, and then it examines three possible energy scenarios for the future. Might any of these get us 'off the hook', or are we firmly impaled?

How much do we use?

Let us begin with some home truths. We Australians each require about eight kilowatts of power continuously to sup-

Can the developing world acheive western levels of power consumption without pushing greenhouse emissions out of control?

Photo courtesy PLAN International

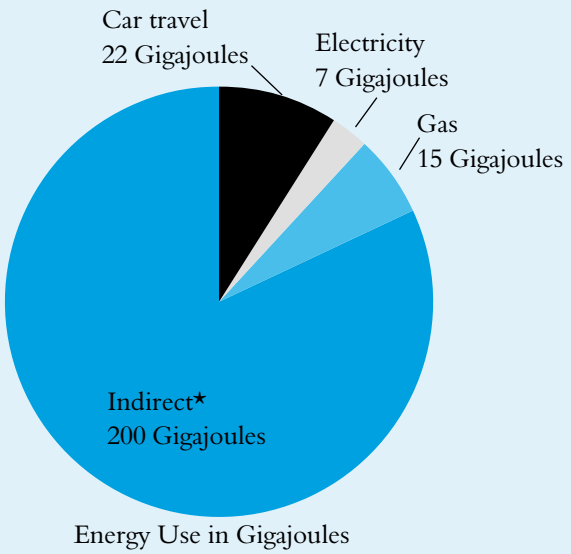
port our lifestyle. That's about eight times the amount of power required to run a small electric bar radiator. Over a year, this adds up to about 250 Gigajoules of energy.

We can comfort ourselves that we are not the biggest consumers of energy, but nor are we, by any means, the least. By comparison, the average US citizen requires about ten kilowatts continuously to sustain their lifestyle, while the average Bangladeshi requires about half a kilowatt.

It is worth considering for a moment how much energy we consume directly in our homes. The average Australian's energy budget might look something like that represented in the pie graph above.

We can see that the balance of about 200 Gigajoules used by every Australian goes into all the services, infrastructure, manufacturing, and agriculture that goes to support our lifestyle. Put another way, 80 percent of the energy use in this country goes indirectly to support our way of life, while 20 percent is consumed directly by each of us in our homes and by our cars.

The average Australian's energy budget
Approximate annual energy consumption for the average Australian.
*Indirect refers to energy consumed to provide services, infrastructure, manufacturing, agriculture etc that goes to support our life style.



Environmental effects

The most widely publicised effect of our energy use has been the changes to the composition of the earth's atmosphere. These changes to the atmosphere and our climate have been occurring since the industrial revolution.

The latest report from the Intergovernmental Panel on Climate Control (IPCC) released last year summarises the magnitude of these changes. These were that since the 1800s there had been a 30 percent increase in carbon dioxide, a 145 percent increase in methane, and a 15 percent increase in nitrous oxide. Their effect had been to raise the mean global temperature by 0.3 to 0.6 °C, and to cause a global sea level rise of 10 to 25 centimetres over the last 100 years.

It is worthwhile reminding ourselves of our personal contribution to these climatic effects. Each Australian is responsible for about 16 tonnes of carbon dioxide per annum going into the atmosphere. Globally we contribute about 1.5 percent of the total, but before we get too complacent, we are second only to the US in emissions per capita.

There are other well documented effects of burning fossil fuels. These include the production of acid rain from the gases, sulphur dioxide and nitrous oxide, and an increase in particulate matter in the air.

A summary of the damage from energy related pollution is given in the table (left).

Damage from energy related pollution

	People	Plants, Animals & Ecosystems	Materials	Climate
Nitrous Oxides	Eye irritation and coughing	Plant and forest growth disturbance	Corrosion to rubbers, textiles, paints, stone & plastics	Global warming
Sulphur Dioxide	Respiratory Problems	Acid rain, depletion of fish stocks & plant damage	Corrosion to metals, stone & textiles	
Particles	Impaired vision and breathing trouble	Possible effects on plants and animals	Soiling and some corrosion	
Carbon Dioxide				Global warming

The driving forces

Before we speculate about what future energy usage might be, we should first remind ourselves of the main forces driving energy demand.

Firstly, there is population growth. The world's population is currently growing at a rate of 1.74 percent. This means by the year 2015 the population will probably have grown to 8 billion from its present level of 5.75 billion.

A second force driving energy demand is the level of economic activity.

On average, the world's economy is growing at about two percent per annum. In some places it is much greater. For example, it is 8 to 10 percent in some countries in South East Asia.

A third factor that determines energy demand is how efficiently we use the energy (or energy intensity). There is huge scope to reduce the energy intensity of most goods and services, especially in the so-called developing countries.

Scenarios for the future

Usually, two future energy scenarios are discussed. The first is known as the 'Business as Usual' scenario. In this, energy demand will continue more or less unabated, driven by economic demands and constrained only by market forces.

In 1992, global energy use was 392 Exajoules—or the same amount of energy that would be consumed if 12 billion small bar radiators were left switched on for a year. The World Energy Council is a body containing representatives from most of the private and government energy institutions, and it meets every three years to try to predict future energy trends. Their 1993 report forecast an increase in oil use of 60 percent and a doubling of coal use over the next 30 years. Their projections indicate energy demand of nearly 600 Exajoules by the 2025 (Flavin and Lenssen, 1995).

This forecast compares with the IPCC's 'Business as Usual' prediction of approximately 700 Exajoules by 2025. If the average of these two predictions is correct, energy use will have increased by 66 percent in 32 years.

The International Energy Agency, another world energy body, predicts similar growth, forecasting that primary energy demand will rise by more than 44 percent between 1995 and 2010 (IEA, 1995).

The implications for the environment are not difficult to imagine. The ABARE (Australian Bureau of Agricultural and Resource Economics) model predicts global emissions of CO_2 from the combustion of fossil fuels are projected to grow by 85 percent, or 19 billion tonnes, between 1990 and 2020 (Weir, 1996).

A more optimistic future energy scenario is envisaged by some technologists. In the 'Energy Efficiency plus Renewables' scenario, they suggest that by implementing energy efficiency technologies together with renewable energy technologies on a massive scale worldwide, that the damage done by our consumption of fossil forms of energy can be mitigated.

One such scenario has been developed by the Worldwatch Institute which annually publishes its 'State of the World' reports. Assuming continued economic growth of 2.5 percent, their 'Efficiency plus Renewables' scenario predicts global energy will peak at just below 600 Exajoules by the 2050, and then demand will start to decline and fall to below 500 Exajoules by the year 2100 because of continued technological advancements (Flavin and Lenssen, 1994).

energy demand is predicted to rise 40 to 50 percent in the next 25 years

If achieved, such a scenario would dramatically affect atmospheric carbon dioxide emissions, but a 'technical fix' scenario such as this denies the need for conscious human involvement in the change process, the lack of which up to now has contributed greatly to the current environmental predicament. The authors of this 'Efficiency plus Renewables' scenario also fail to put any limits on the process, and nor do they suggest ways in which the three quarters of the world's population who live in developing countries will 'catch up' with those of us lucky enough to live in the rich industrialised countries.

A 'limits and equity' scenario

A third future energy scenario is possible. It departs radically from the two scenarios discussed above. Why? Firstly, because it introduces the concept of global equity, and secondly it raises the idea of setting limits to our material standard of living.

The two previous scenarios have been based on continued economic growth and consumption. Neither of these scenarios challenged the discrepancy between the living standards enjoyed by those in industrialised countries and those in developing countries.

The origin of this 'Limits and Equity' scenario is the book by four energy experts, published by the World Resources Institute (Goldemberg et al., 1987). These authors hypothetically calculate the amount of energy that would be required by a developing country to support the standard of living enjoyed in Western Europe, Japan, Australia and New Zealand in the late 1970s, assuming it used high efficiency technologies.

This lifestyle assumes a family of four, living in a well constructed house with running water, plumbing for sewage, gas cooking, electric lights, a refrigerator-freezer, hot water, a clothes washer, TV, a car for every 1.2 families and 350 kms of air travel on average per person per year. In addition, all the industrial and service infrastructure to support this level of lifestyle was allowed for.

The study concluded that one kilowatt of continous energy consumption per person was sufficient to support such a lifestyle for all the people in developing countries. This incidentally is not significantly different from their present level of energy demand. The difference lies in the assumption that efficient energy carriers and technology would be used. Huge savings are then possible, particularly in the domestic sector where most of the energy is presently consumed. These savings would then offset increased consumption in other sectors, particularly in industry.

The authors also looked at the energy

savings possible in the industrialised countries where the remaining quarter of the world's population require on average about five kilowatts to support their lifestyle. The introduction of energy efficient technologies could, the authors calculated, reduce this to 2.5 kilowatts, 'at the same time that standards of living improve *significantly* (emphasis added)'

For some reason, the authors did not challenge their conclusion that it was still justifiable for those in industrialised countries to consume 2.5 times those in developing countries, nor was the premise of a continued increase in living standards challenged.

If we look back at our lifestyle of the mid 70s, can we justify what we are now doing to our environment for the extra material consumption of the 80s and 90s? Surveys conducted in countries like Australia confirm that people don't believe their quality of life has improved over the last two or three decades.

This anecdotal evidence can be supported by real data. The Physical Quality of Life Index (PQLI) is a composite index which includes life expectancy, infant mortality and literacy. It shows not only that the PQLI curve flattens with increasing energy consumption, but significantly that this occurs somewhere between 1.1 and 1.3 kilowatts per capita.

So how much energy would the world's population consume, assuming there were 8 billion of us on the planet, and that we all consumed about one kilowatt. The answer is that the resulting energy use would be about 252 Exajoules. This is just 63 percent of the 1992 demand.

Conclusions

On our present course, energy demand is predicted to rise 40 to 50 percent in the next 25 years. The global environment is already creaking under the strain of the past 200 years of unrestrained growth in consumption.

Even the most optimistic scenarios are predicated on continued economic growth. This and population growth are the two factors 'fuelling the fire'. However, quality of life has been demonstrated not to be dependent on ever increasing energy consumption.

What is required is a shift in our thinking to embrace concepts of global equity and limits to our consumption. If this could be achieved, all the world's future population could live at the standard of living we enjoyed in the 1970s, and we would still be able to reduce our energy consumption by over one third. ⁎

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Mainstreaming renewable energy what's involved?

Alan Pears reveals some astonishing figures on Australia's energy consumption, and some ways forward for renewables and energy efficiency

Readers of *ReNew* see renewable energy as a key element in a sustainable energy future. The Australian government, in its December 1996 Green Paper on (un)Sustainable Energy, took the position that renewables would continue to play a minor role in Australian energy supply for decades to come.

Who is right? And what would be involved in placing renewables in the energy mainstream? This article takes a brief look at how renewables—with complementary energy efficient technologies—could deliver most of Australia's energy. It highlights possibilities, rather than trying to predict the future. And, in such a brief article, it cannot claim to be comprehensive.

Some background

Australians spend around $35 billion on energy each year, more than half of this being for transport fuel. They also spend more than $20 billion constructing buildings. Households spend more than $1.5 billion each year on major appliances. Around $15 billion is spent buying new cars. The renewable energy industry has recently been valued at around $800 million each year.

Superficially, renewables look quite small. But:

- wood and bagasse (sugarcane waste) used in Australia displaces the equivalent of around $1.5 billion worth of natural gas each year.
- hydroelectricity replaces coal-fired electricity worth around $500 million each year.
- Australia's annual solar energy resource is 16,000 times its annual primary energy use.
- Australia's total fossil fuel and uranium resources are equivalent to less than 13 days' sun falling on our land mass. Clearly the long-term financial value of Australia's renewable energy resources far exceeds the value of its non-renewable energy resources.

Less than a fifth of Australian energy is supplied by electricity. Transport, provided mainly by oil, consumes 37 percent; heat used by households consumes seven percent; and industrial and commercial heat consumes 38 percent. Yet much of the focus of the Australian renewable energy industry is on electricity supply.

Renewable energy supplies nine percent of Australia's energy requirements (as recorded by ABARE, the government energy forecaster). Almost a quarter of this is in the form of hydroelectricity, a third from bagasse and over 40 percent from wood.

Renewables in a sustainable future

Increasing the use of renewables depends on application of very high efficiency technologies and sophisticated electronics. Without these complementary technologies, the cost and reliability of renewable energy sources would make renewables unworkable and, in many cases, potentially unsustainable. For example, widespread use of wood in open fires to heat homes would rapidly deplete fuelwood resources—and cause major urban air pollution problems. An inefficient solar car would take a lot longer than the four days taken by Honda's *Dream* to travel from Darwin to Adelaide.

Serious application of energy and resource-efficient technologies would cut Australia's energy requirements to less than a third of today's level over the next few decades. This sounds surprising to many people and impossible to some, but consider some examples. Amory Lovins' hypercars will carry families while consuming less that two litres per 100 kilometres—while a Commodore uses 12 L/100km. An average Australian fridge consumes more than 800 kilowatt-hours of electricity each year, while best existing technology can provide the same service using less than 200 kWh and optimum technology could use less than 50 kWh. Ford recently replaced five boilers and 22 kilometres of steam pipes at its Broadmeadows factory with point-of-use heat sources— and cut that component of its gas consumption by 75 percent.

Australia's total fossil fuel and uranium resources are equivalent to less than 13 days' sun falling on our land mass

If our target is to supply around a third of today's energy consumption—all that an energy efficient Australian society would need, the good news is that renewables are already more than a quarter of the way there!

Transport

More than a third of our energy requirements are for transport. How can renewables deliver these services? They must build on a base of strategies that reduce the need for travel, such as sensible urban planning and increased use of telecommunications. Options include:

- Ethanol: new processes that utilise crop and plantation wastes mean that the traditional concerns regarding potential conflict between food and fuel production are much reduced, while ethanol production improves the economics of plantations. Recent studies indicate that renewable ethanol could be cost-competitive with fossil fuels within a decade.
- other fuels from crops, such as vegetable oils and their derivatives: rapid development in biotechnologies and techniques such as emulsification underpins development of these options.
- renewable electricity, which can drive conventional trains and trams, as well as a wide variety of vehicles from electrically-assisted bicycles to cars and trucks.
- hydrogen from renewable sources: improving storage technologies, better fuel cells and very fuel-efficient vehicles are all making this option increasingly feasible.

Heat

Around 45 percent of Australian energy supplies heat at temperatures varying from a few degrees above ambient to very high temperatures. Energy efficient technologies and improved processes are both reducing the amount of heat needed and delivering heat more efficiently. Solar building design, solar water heaters, wood and bagasse already provide large amounts of heat. Solar thermal technologies are becoming cost-effective for a wide range of applications, while biomass gasification, energy from waste and other options are beginning to look attractive.

Where biomass is used for large-scale energy supply, it is important to ensure that it is used sustainably—Australia's existing fuelwood use may not yet achieve this.

Electricity

The range of renewable energy technologies that can supply electricity seems to expand daily, and their economics continues to improve. When these technologies are combined with energy efficient appliances and equipment, and the benefits of dispersed locations (including higher reliability, lower transmission and distribution costs and losses) are considered, they will be able to satisfy our needs for energy services cost-effectively.

How do we mainstream renewables?

All this shows that it is feasible to satisfy our energy needs through energy-efficiency and renewables. But how do we make it happen? Clearly, we have to divert some of the billions of dollars spent each year on buildings, appliances and infrastructure to investment in systems that either complement or use renewables.

We need a comprehensive framework that takes us down the sustainable energy path, including:

- the right products, technologies and services: consumers must be able to buy super-efficient products and reliable, effective renewable energy technologies backed-up by competent, professional businesses.
- appropriate methods of comparing the costs of options on a fair basis.
- clear and fair rules (not yet achieved under the National Electricity Market) which make the real cost of supply visible, and allow fair access to markets.
- where it can be shown that subsidies for fossil fuel use continue, compensating assistance to promote commercialisation and application of renewable, efficient systems with a view to reducing total community cost.
- investment in technologies which make sense for existing energy suppliers and users, but which help smooth the path for renewables. Energy efficient equipment obviously fits this criterion, but other possibilities include dispersed storage (with ultra-capacitors, flywheels or advanced batteries such as the zinc-bromine and vanadium redox systems being developed in Australia), cheaper grid-interactive inverters, wood gasifiers, multi-fuel fired boilers and cogeneration systems.

Let's stretch our minds to develop a picture of a renewable, efficient energy system which initially supplements, then replaces our present one. And we should be thinking in terms of spending tens of billions of dollars—because that's what is now spent each year supporting environmentally-unsustainable energy infrastructure!

About our postcard

Bound into this issue of ReNew is a postcard that we hope you will fill in and send. We are directing the cards to John Howard, urging action on Australia's poor performance on greenhouse gas emissions. ReNew's publisher, the Alternative Technology Association, feels that it is time our government took a more forward-thinking position on greenhouse gas reduction. With the leaders of the world meeting in Kyoto, Japan in December this year to decide emission limits for every country, the postcard sends a timely message to our Prime Minister. This issue is too important for complacency!

What happens to the world WHEN THE OIL RUNS OUT

Oil may be too expensive for developing countries to afford within 30 years, leading to mass starvation as agriculture and food transportation collapses. But salvation lies in sustainable transport, energy efficiency and renewable energy generators, writes **Alan A. Parker**

Oil drives the world economy. Every day tens of millions of barrels of it are consumed. We burn it in its refined state as petrol to drive our cars, as diesel in agricultural production, and use it to keep the machinery of the global economy running. Yet this essential economic ingredient is a finite resource, and at current depletion rates, will become scarce some time in the next fifty years.

Surprisingly, then, there is no reliable database of international oil reserves to show when increased oil prices are really going to become a major problem for oil importing countries. What we know for certain is that the demand for oil is growing as oil discovery rates slow, and there has to come a time when it is physically impossible for supply of oil to meet the growing demand. Graph 1 shows the worsening relationship between the discovery rate and consumption rate.

The age of cheap oil is rapidly coming to an end. Cheap oil, or oil that does not require high technology and large amounts of energy to get it out of the ground, is now being used up nearly three times faster than it is being discovered. The world's largest oil fields were discovered over 30 years ago and are fast being emptied. Cheap oil, known in the oil business as conventional oil, cannot be recovered at low cost for much longer because there is only a finite amount of it and it is increasingly difficult to extract.

Uncertain oil reserves

It is now 100 years since the science of petroleum geology was first established. New computerised oil detection techniques can determine when the 42 largest and most important oil fields will be exhausted. Most of the recently discovered oil fields are many metres below the oceans in tropical cyclone areas or subject to arctic winter conditions, and are very small in comparison to these key fields.

The less energy used to extract and produce any fuel, the greater is its economic worth. Energy has to be used to extract oil from the ground and get it to the refinery. In the early days cheap oil was extracted by drilling down a few metres into the oil field then capping the well head with a valve to control the flow; the oil field pressure was high enough to pump the oil out of the ground. Relatively little energy was wasted in getting the oil from the well head to the consumer.

Once the pressure in the oil field was gone, most oil rigs were shut down, leaving around 15 percent of the oil behind. This remaining 'heavy' oil can now be extracted using new technology, but at a heavy energy and financial cost.

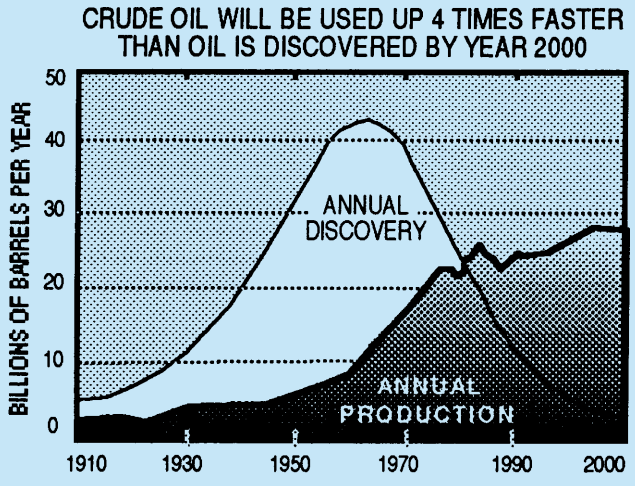
As oil exploration progresses, the size of the average oil field decreases, as does the amount of oil found per unit of exploratory drilling. The latest study of petroleum depletion shows that national oil companies choose to exaggerate oil reserves. The methods used by different countries to estimate reserves are very different and in many cases flawed so they need to be standardised in line with best practice. *The Oil and Gas Journal* does its best to update remaining reserves in its annual survey of world oil production and reserves, but many national oil companies supply the same figures for reserves every year despite high levels of oil production eating into them.

Analyst C J Campbell sums up what needs to be done in the April 1997 issue of *The Oil and Gas Journal:* 'At the risk of understatement, we may conclude that the world's political and economic stability which relies on an abundant supply of cheap oil, is in serious jeopardy. In these circumstances, it might be a good idea to determine what its reserves really are. It is more a political than a technical problem.'

Transport and oil demand

The technical reason for growing oil dependence is the range of low cost, easily distributed fuels for transportation that we make from oil. By 1970 oil had

Graph 1



become the most important of all the fossil fuels in the developed world, accounting for 49 percent of the world energy market.

By 1987 oil production was 56 million barrels a day, the population of the world was 5 billion and the global fleet of motor vehicles numbered 525 million. In agriculture, millions of tractors and farm machines replaced people on the land and most of the farm workers had migrated to cities. Oil was also indispensable as a raw material for the thousands of new products produced by the chemical and plastic industries. In 1993 cheap oil accounted for 41 percent of world energy demand and renewable forms of energy only accounted for three percent of energy use. In Australia, petroleum products provided 99 percent of transport fuels and road transport accounted for 79 percent of petroleum used. Graph 2 shows growth in per-capita car ownership in a number of countries.

Once world oil production has peaked it will no longer be cheap. According to the World Resources Institute, oil production will peak between 2007 and 2014, but other analysts think it will peak well before then.

Most OECD governments, except the United States and Canada, already have high petrol prices at the pump. In the coming years these countries will be implementing new petroleum conservation measures and trying to introduce new fuel efficient technologies because of a commitment to reduce greenhouse gas emissions. Up until now, apart from high petrol prices, very few encouragements have been put in place to enable people to use clean energy by using renewables or conserving energy. In 1997 all developed countries are locked into oil dependence with little hope of breaking free because of the long lead time in developing clean alternatives to oil.

Future oil demand

The future demand for oil will be increasingly driven by a population growth of around 85 million people a year until at least 2020. Most of the population growth (95 percent) will be in cities of more that one million and by 2010 there will be 400 million new middle class consumers most of whom will want to own cars.

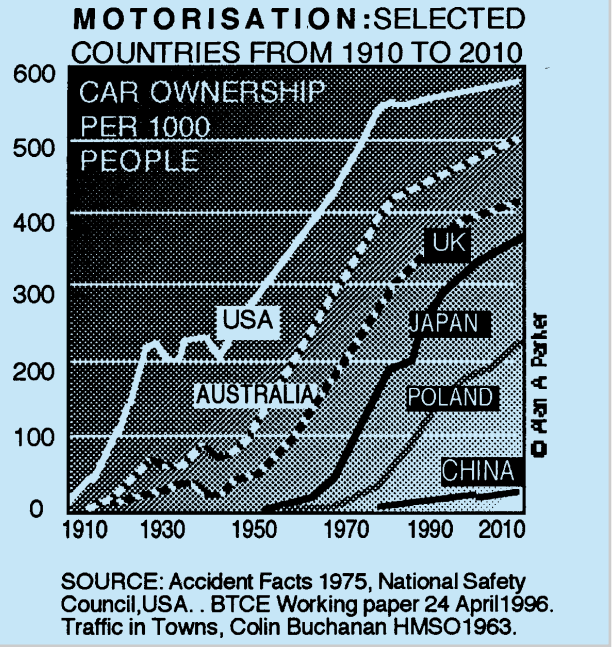
Due to economic growth now under way in most developing countries, per capita oil consumption is predicted to at least double, however the demand for oil will triple because of population growth.

Development without oil

The most positive changes have been in China, where the national goal of a car for all families was dropped in 1996. Even though several motor vehicle manufacturing plants have been set up in the last five years, China retreated from its pro-car policy in favour of Chinese families being able to own their own homes and to promote advances in the electronics and information industries. Furthermore, many years of female schooling, birth control programmes and the manufacturing of 250 million bicycles since 1990 are a most important contribution to oil conservation and sustainable development.

The Chinese ruling elite in Beijing and Shanghai have seen the potential for motorised gridlock in other Asian cities and have decided to go another way. More importantly they recognise that the only way to reduce the high birth rate is to improve the health and welfare of the urban and rural poor. Only when women have more freedom and can improve their families' welfare will birth rates drop. Perhaps the most

Graph 2



SOURCE: Accident Facts 1975, National Safety Council,USA. . BTCE Working paper 24 April1996. Traffic in Towns, Colin Buchanan HMSO1963.

important measure is to increase the status and opportunities for women.

The relationship between the number of children women have and the lack of formal education they receive is well known. On average in 1995, Chinese women received 3.6 years of schooling compared to 1.2 years in India and 0.8 years in Pakistan and Bangladesh. Without this educational support it is doubtful whether China's 'One Child' family planning policy would have worked so well. Note the 10.8 years of schooling in Japan, which is approaching zero population growth.

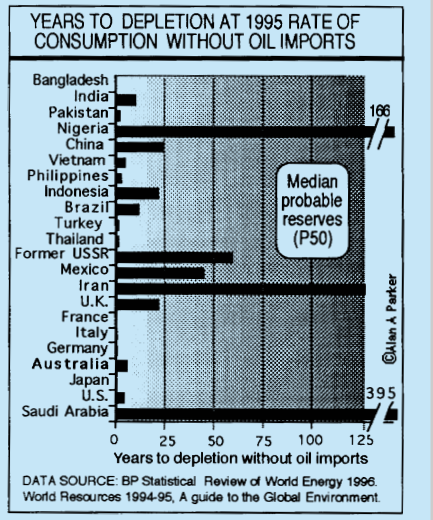
Impact on national security

By 2005 most of the cheap oil from the western perimeter of Asia will have been used up and supplies of coal will be starting to run low in some regions, particularly in the Indian subcontinent. Asia will face an energy crisis a few years after the 190 electricity power stations now under construction in India, China and Indonesia come on line. The inability of developing countries to pay for increasingly expensive oil could result in hundreds of millions of people starving to death, as agricultural production and food transportation collapses. The situation will only be averted if the bigger oil consuming countries work with these developing countries to free themselves from oil dependence and bring population growth under control.

Graph 3 is an indicator of oil self sufficiency in selected countries. For developing countries like India, Bangladesh, Philippines, Brazil, and Thailand, oil depletion is a major risk to national security. These countries would benefit from a strategic alliance to enter into barter arrangements with OPEC.

When the price of oil doubles and then triples, many countries will no longer be able to afford to buy it. The countries most at risk are those with no or very small oil reserves of their own with few export earning industries to pay for oil imports. National oil companies and oil cartels are preventing the governments of the developing world from knowing exactly when the oil crunch will hit. Commercial secrecy in this case needs to be regarded as a potential threat to their national security. There is a need to push for an independent United Nations agency to audit and physically check estimates of oil reserves. This can be done on the grounds that cheap oil is crucial to increasing food production and will become even more important when global warming impacts on world food production.

Graph 3



Environmental costs of oil

The environmental cost of burning oil should be reason enough to seek alternatives. However, environmental costs also compound economic problems, and this may become the driving force behind a timely move away from oil.

Climate change is likely to do more damage to cereal production in the developing world (ten percent) than in the developed world (five percent). Scarcity will increase cereal prices and the proportion of people dying from hunger is likely to increase.

The poorer developing countries do not have the resources to build the costly preventive measures to control more extreme floods, droughts, cyclones and rising sea levels so they will most likely bear the brunt of both climate change and oil depletion. They will not be able to afford oil for essential purposes and millions will die in the places most vulnerable to climate change like Bangladesh—unless global prevention strategies begin soon.

'Green' products to help the world move beyond oil

- 100 billion solar electric roof tiles.
- 30 billion new energy efficient electric light bulbs.
- Three billion bicycles; durable high quality designs for transportation.
- Three billion 'ozone friendly' refrigerator/freezers.
- Two billion solar flat plate hot water heaters with a range of backup systems.
- One billion power assisted bicycles, powered by batteries fed by solar electric (roof tiles) or ethanol fuel cells
- 500 million heat pumps, mostly solar powered.
- One hundred million energy efficient hyper trucks and hyper buses.
- Ten million medium and large wind power generators.
- Five million small hydroelectric power plants for rural villages and isolated farms.
- One million light-rail vehicles with regenerative braking systems.
- 100,000 eco-villages designed from ground up as sustainable non motorised settlements.
- 10,000 wave power units.
- 100 solar cell manufacturing plants worth over $1billion each.

Towards a solar economy

Lip service is given to achieving ecologically sustainable development (ESD) in many international trade agreements. ESD needs to be seen as a collective nation building process designed to bridge the technological and political gap between the age of oil and the solar age.

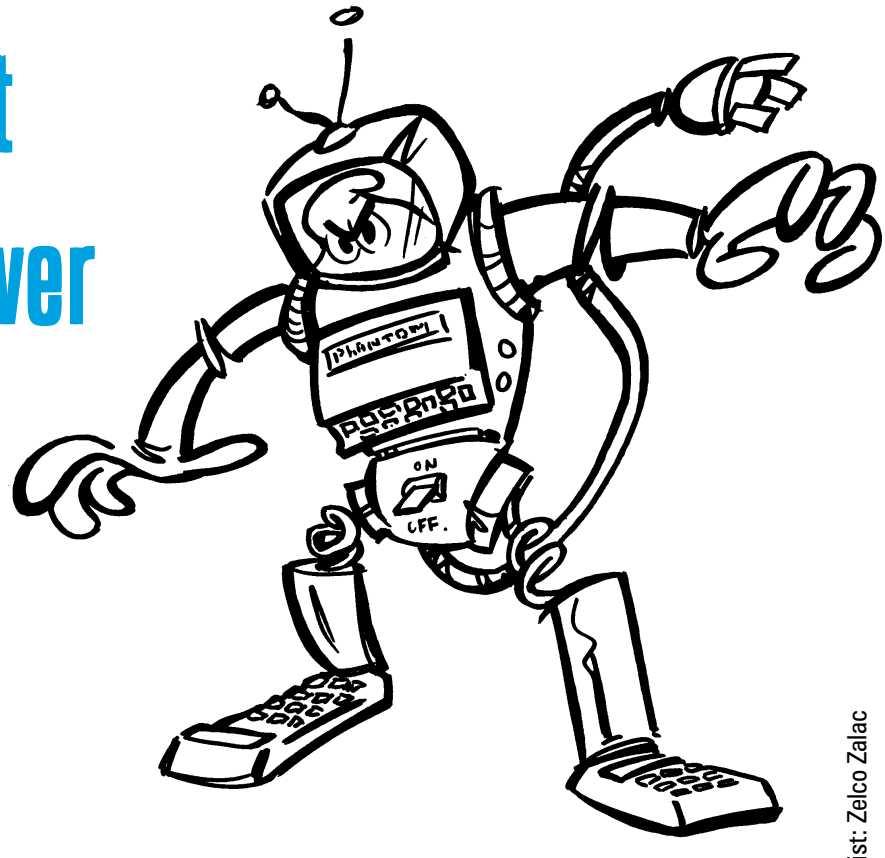
The technology now exists to collect energy in ways that were impossible a few years ago. In the transitional period between the age of oil and the solar age, there will be many stages of development where renewable energy sources must be initially subsidised. Renewables must be given priority because they can only get cheaper the more they are used due to the economies of scale, but oil can only get more expensive.

There is now a window of opportunity to green the world's major industries, to replace most fossil fuels by renewable energy sources and eliminate poverty. There is an excellent case for putting a heavy carbon tax on oil and using the proceeds to accelerate the introduction of renewable energy resources.

The potential world market for new green products that use or collect renewable energy is so big it will make today's market for white goods seem like a garage sale in comparison. The profits are limitless, greenhouse emissions could become negligible, and world poverty greatly reduced.

There is also a need to address transport at a global level, encouraging new green technologies such as power assisted bicycles, as well as conventional bicycles and public transport. To make this happen the world needs international treaty, like the agreement phasing out ozone depleting substances, to conserve oil for essential food production and to phase in the transition from the age of oil to the solar age in a rational, coordinated way.

Phantoms that steal your power



Artist: Zelco Zalac

Are you using more power than you think you should be? The problem could be that you have a few phantoms in your house. **Lance Turner** explains what these phantoms are, and how you can exorcise them

No, the phantoms we are talking about here are not the ones that make things go bump in the night. These phantoms are present in virtually every home, and are electrical in nature. These are phantom loads.

So, what is a phantom load? Put simply, it is that load placed on the mains electricity supply by an appliance which is not in use but still consumes power. This is common to many appliances that we seem to take for granted nowadays. Things like clock-radios, microwave ovens, VCRs, TVs, stereos, fax machines and every device that uses a plugpack (they feel warm because they are wasting the energy as heat) all draw power, even when they are not being used.

However, there are many other 'unseen' loads in a home that can also be considered phantom loads. The table on the opposite page lists some appliances and the range of their phantom loads, as well as what they may cost you to run each year. As you can see, the list is quite large, and may include appliances that you may not have realised are consuming power when they are 'turned off'.

Phantom loads can be responsible for a considerable amount of the total power consumption of the average home. Indeed, these sneaky little power wasters could potentially use up to 20 percent of the total power used. And, with the increasing popularity of 'smart' appliances, the level of phantom loads in houses is steadily increasing.

Why are they there?

Phantom loads are there because of convenience. We like to be able to look at the clock radio at night and see what time it is, or be able to turn the TV or video on or off without having to get up off of the couch. Or we may like to start the dinner cooking and have the oven turn itself off when it is done.

For these devices to function in this way, they must be using power. You can't have a glowing clock display without using electricity somewhere, and the video needs power to not only run its clock, but also the remote control receiver and microprocessor that picks up the signal from the 'remote control', which is actually only the transmitter

Your appliances and their phantom loads

Appliance	Phantom power consumption	Running cost per year (at 12c per kWhr)	Greenhouse gas produced per year (kgs)
VCR	2 watts to 20 watts	$2.10 to $21	17.5 to 175
Television	0.1 watt to 10 watts	$0.10 to $10.50	0.9 to 88
Microwave oven	1 watt to 5 watts	$1.05 to $5.25	8.8 to 43.8
Answering machine	2 watts to 10 watts	$2.10 to $10.50	17.5 to 88
Cordless phone	2 watts to 7 watts	$2.10 to $7.35	17.5 to 61.3
Fax machine	3 watts to 30 watts	$3.15 to $31.50	26.3 to 263
Clocks and clock radio	1 watt to 6 watts	$1.05 to $6.30	8.8 to 53
Antenna signal booster	2 watts to 5 watts	$2.10 to $5.25	17.5 to 43.8
Outdoor security sensor light	1 watt to 3 watts	$1.05 to $3.15	8.8 to 26.3
Burglar alarm	2 watts to 20 watts	$2.10 to $21	17.5 to 175
Security timer	0.1 watt to 2 watts	$0.10 to $2.10	0.9 to 17.5
Night light	0.2 watt to 5 watts	$0.20 to $5.25	1.8 to 43.8
Intercom	2 watts to 5 watts	$2.10 to $5.25	17.5 to 43.8
Air freshener			
Ion generators			
Touch lamp	0.1 watt	$0.10	0.9
Doorbell	2 watts to 5 watts	$2.10 to $5.25	17.5 to 43.8
Rechargeable tool or appliance	1 watt to 10 watts	$1.05 to $10.50	8.8 to 88
Automatic garage door/gate opener	1 watt to 5 watts	$1.05 to $5.25	8.8 to 43.8
Washing machines and dishwasher	1 watt to 10 watts	$1.05 to $10.50	8.8 to 88
Pond/aquarium pump	2 watts to 40 watts	$2.10 to $42	17.5 to 350
Aquarium heater	50 to 300 watts (10 to 50% duty cycle)	$5.25 to $157.50	43.8 to 1314

part of the whole remote control system.

But they don't use that much power!

While this is true when you measure the instantaneous power that each of these appliances use, when you consider that they all use electricity 24 hours a day, you will realise that it can soon add up to quite a lot of power usage. I tested a few appliances at my home, and found phantom loads ranging from 0.5 watts for a non-remote TV, up to 13 watts for the VCR. The total for my house was about 20 watts, which, over a 24 hour period, is 480 watt-hours—and I thought I wasn't wasting power! Another member of our staff measured the loads in her home and found they totalled 39 watts—that's nearly one kilowatt-hour of wasted power every day!

Let's look at a more general example. Say, for instance, that your VCR uses five watts of power on standby (this is a pretty conservative figure). To find out how much power this device uses each day, you need to multiply this figure by 24, which gives 120 watt-hours per day. Multiplying this by 365, you get 43.8 kilowatt-hours (kWh), which is how much energy this device uses per year, just being plugged into the powerpoint.

Now let's look at some other figures. The average suburban house would be very likely to have at least five such phantom loads, totalling 25 watts. Again, this is a very conservative figure, as some devices are likely to draw more power than this, and many houses will

have a far greater number of phantom loads. Multiplying this by 24 and then by 365, we get an annual consumption of 219kWh.

Now, if we were to take our average 25 watt phantom load and multiply it by the number of households in Australia (at least six million, but probably more), then the wasted power works out to be a staggering 1.3 gigawatt-hours per year. This is enough to run over 200,000 all-electric households!

Looking at a single house situation again, the cost of this power totals $26 for a grid connected house each year (at 12 cents per kilowatt-hour), which may not seem much, but it's a $26 dollar donation to your power utility.

If you are living with an independent power system, however, the costs may be far greater. Your system may require more solar panels, or more generator fuel, adding substantial costs. For an extra 25 watts continuously all day (600 watt-hours), you would need to add up to 220 watts worth of extra solar panels, which would cost you over $1500, assuming that the rest of the system components could handle the extra power being generated and wouldn't need upgrading.

Environmental cost

Where power is supplied by burning coal or other fossil fuels, the environmental cost of phantom loads can be considerable. In Victoria, 1kWhr produces around 1.4 kilograms of carbon-dioxide gas. So, looking at our previous example of a single 5 watt load, over 65kg of this greenhouse gas would be produced in the course of a year—and that is just from a single tiny load.

Taking this a bit further, if a house has phantom loads totalling 25 watts, then the total CO_2 emissions produced by just this one house will be over 300kg each year for a house in Victoria (where the less efficient brown coal is used for power production) or around 220kg in NSW and most other states. In Tasmania, the figure is zero, as all of their power comes from hydroelectric generation.

Now, if we multiply this figure by the number of households in Australia, (around six million) then there are 1.3 million tonnes of this damaging greenhouse gas produced every year just by all the residential phantom loads in this country.

While these figures are based purely on estimates, the reality is that an enormous amount of power is wasted each year in this manner, all in the name of convenience.

A simple exorcism method

So, what can you do to stop you appliances wasting all that power and producing atmosphere damaging gases in the process? The answer to that one is simple—turn the things off!

There are some phantom loads that need to be running—if you switched off your alarm clock each night, you would have to set it just before bedtime—an annoying chore, especially if you forget! But there is no reason why the microwave needs to display the time continuously, unless you really need to have it start cooking dinner when you are out of the house.

The TV that sits dormant for 20 hours each day can simply be turned off at its main switch, if it has one (many don't any more). However, if after hitting this switch there is still a little red light glowing somewhere, then the TV is still consuming power, so you will need to turn it off at the main wall switch. Don't worry about it forgetting the preset stations, it should have a backup battery for its memory.

This is the simplest way to deal with all phantom loads, and can save you quite a bit of power over the course of a year.

Measuring your phantoms

To measure the phantom loads in your house, just follow these simple steps.

1) Turn off all major appliances, such as the fridge, computer, heaters and lights.

2) The appliances you suspect are providing phantom loads, such as the VCR, TV, clocks, microwave etc. should be in the normal state they are while not being used, ie switched on at the wall but in their off or standby modes.

3) Go outside and look at the electricity meter. If the disk is spinning, then there are phantom loads in your house. You can calculate the total power consumption using the simple formula below:

Power = 60/(mins per rev x revs per kWhr).

Mins per rev is the time, in minutes, that the metal disk takes to spin once. It will have a large mark on it, so one rev is easy to time. Remember to express this as a decimal, ie 1 minute and 45 seconds is 1.75 minutes, not 1.45.

The *revs per kWhr* rating of the meter will be written on it somewhere, usually with the other ratings just below the spinning disk.

The constant 60 is used as this is the number of minutes in an hour.

So if the disk was spinning once every two minutes, and the meter had a rating of 800 revs per kWhr, then the power being used would be 60/(2 x 800), or 0.0375kW or 37.5 watts.

4) Multiply the kilowatts by 24 to get kilowatt-hours per day used and then by 365 to get the total yearly consumption. For the example above, this would be 328.5kWhr—which is nearly one kilowatt-hour per day!

5) Now multiply this figure by the *kilograms of CO_2 per kWhr* rating for your state to get the amount of CO_2 produced by your phantom loads. This figure is around 1.4 for Victoria, 1 for NSW and most other states except Tasmania, which uses hydro power. So, for the above example in Victoria, the phantom loads would be producing around 460kg—almost half a tonne—of CO_2 per year!

RAPS system wiring—12 or 240 volts?

If you are abaout to set up a RAPS system, one of the biggest decisions is whether to use 12 or 240 volt wiring and appliances. **Martin Nichol** explains the pros and cons of each

Many installers of independent power systems are often asked if it is worthwhile installing 12 (or 24) volt lighting, or what the pros and cons are of 12 volt versus 240 volt wiring. There is no simple answer to these questions and the various advantages and disadvantages need to be weighed up before a decision is made either way.

The wiring options available are:

- Have only 240 volt AC wiring (as in any standard domestic installation) and use standard appliances.
- Have only 12 (or 24) volt wiring and use appliances specially made (or converted) to run on these voltages.
- Use a combination of these two systems.
- Forget the above and use candles.

Candles are certainly romantic, but most folks are really just looking for a house that will function in much the same way as any other. They want to be able to use the gizmos and gadgets that they already have, be able to go to the supermarket and get replacement light bulbs, and they want to use the radio cassette in the workshop and the hi-fi in the lounge. Life shouldn't be more complicated than it already is.

The control centre of a combination ELV and LV RAPS system. The 240 volt AC wiring is on the wall at left, while the ELV DC wiring is completely separate in the enclosure.

Which appliance, which system?

ELV DC power systems
- Lighting
- Smoke detectors
- Radio
- Refrigeration
- Pumping

240 volt AC (inverter) power systems
- Vacuum cleaners
- Washing machines
- Microwaves
- Computers
- Televisions & VCRs
- Kitchen appliances
- Power tools

Convenience and practicality are two words that come up when discussing the pros and cons of the various systems. There is no doubt that it is much simpler to get an electrician to wire up the house as usual and power the house from a suitably sized, good quality inverter. End of story. Well, not quite.

While it is convenient to run everything off an inverter, there are questions of efficiency to consider.

Take, for example, the situation of one or two people living in a house. They may spend a lot of time in the evening reading. There might be a couple of 15 watt compact fluorescent lights running from a 1200 or 2000 watt inverter. This is definitely not the best use of the available power. We have measured a 15 watt compact fluoro running off a 1200 watt inverter and found that it uses 21 watts of power from the battery bank due to inverter inefficiencies at this low level of power consumption.

Efficiency may not be a concern if your system has been designed to supply a given load. But it costs money to supply power to all those little inefficiencies, especially small loads like clocks and radios that could possibly be run directly off the extra low voltage (ELV) supply of the battery. Another problem with an inverter-powered house is that if the inverter fails, there won't be any power until the fault is found and the inverter is repaired.

Load suitability

Some loads are more suited to the AC power from an inverter, while it makes more sense to run others on DC from the batteries. See the list for a guide to which appliance is best suited to which power system for maximum efficiency.

Let's get back to our three main choices. The all-240 volt house is going to suit most people who want the conven-

ience of not having to worry about buying different appliances, having dual circuits and wondering whether that is a 12 volt or a 240 volt fitting in the guest room. It also applies to people whose power systems have been correctly designed and properly installed to make sure that they have the power available to do the job required.

All RAPS systems have some extra low voltage wiring in them somewhere, even 240 volt-only systems. All the connections from solar panels, regulators, batteries and inverters are ELV and should be sized and installed properly to ensure peak performance and efficiency, as well as safety.

The all ELV house has greater applications in holiday homes/cabins or small houses where the overall power requirements are smaller and there is little need to run 240 volt appliances. After all, with a holiday home, you are trying to get away from the rat race and all the razzamatazz that goes with it!

ELV systems are also ideally suited to caravans and recreational vehicle situations where there are 12 volt circuits and power supplies already available. The main drawback is the cost of the cable and the special fittings and switches that might be required.

Special switches

Special electronic switches are available for ELV circuits. These switches do away with the need to run heavy DC cable from the light to the switch. Any light gauge wire (e.g. telephone cable) can be used to switch up to a 50 watt load. Cost savings are made by reducing the amount of heavy DC cable required. What's more, they allow any sort of switch to be used—from a standard 240 volt architrave type to a mini toggle switch, without the need to worry about voltage and current ratings.

The combined system is good for those who are trying to get the best efficiency out of the system they have or for those that have a particular liking for quartz-halogen lighting. Because halogen lights are designed to run from a 12 or 24 volt supply it actually makes more sense to run them directly off the battery rather than through another inefficient transformer.

With a combination system, you can start out small. A typical small system might include some basic 12 volt lighting with a 12 volt circuit for the radio, and a small inverter for other appliances, such as a television, kitchen appliances and computer.

As already mentioned, you will still have lighting available if the inverter fails and you have to wait a couple of days for it to be repaired or replaced.

One problem with a combined system, however, is the possible confusion of having low voltage and extra low voltage circuits in the same place. This can be a safety concern if somebody thinks they are dealing with 12 volts when it is actually 240 volts. There is also the possibility of connecting a 12 volt appliance to a 240 volt circuit—it won't last too long!

Special steps need to be taken to make sure that each circuit is clearly marked and that the correct fittings are used so that appliances cannot be plugged into the wrong circuit.

Cost-wise, there isn't really much difference between the two systems. What you save on the roundabouts you lose at the casino. Electricians are pretty efficient at wiring up houses for 240 volt systems but often know next to nothing about ELV wiring. You can do ELV wiring yourself, but make sure that you know what you are doing—it is just as easy to start a fire with a 12 volt electrical fault as it is with a 240 volt one.

Some terms defined

Extra Low voltage (ELV): Voltages such as 12 or 24 (and up to 110) volts DC, and up to 32 volts AC.

Low voltage (LV): Mains 240 volt AC power is classed as low voltage. Strictly speaking, it is a voltage exceeding ELV but not exceeding 1000 volts AC or 1500 volts DC. This wiring must be installed by an electrician.

AC: Alternating current. As found in 240 volt mains power or what you get from an inverter.

DC: Direct current. The sort of current that you get from batteries and solar panels.

You can get your local RAPS installer to do the 12 volt wiring for you, in which case it will cost about the same as 240 volt wiring. Remember that the cable costs and fittings are usually more expensive in ELV systems because the cable has to be much bigger and the fittings are less common. (see Richard Hepworth's article on wire sizing—ReNew #59, April–June '97).

Your final decision is really a bit of a lifestyle choice and a matter of just how many bees you have under your particular bonnet. No one way is better than any other. But make sure that you talk it over with whoever is designing your power system or find someone to give you some advice to make sure that you end up with the best solution for your situation. ✲

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PROS	CONS
Extra Low voltage (12/24 volts DC)	
• greater efficiency • DIY installation • suits quartz-halogen lighting • possible higher installation costs	• limited choice of lighting & appliances • possible higher cost of cable & fittings • dual systems can lead to confusion
Mains voltage (240 volts AC)	
• straightforward installation • can use any type of light/appliance	• wiring must be done by electrician • possible inefficiencies

BUILD YOUR OWN

A mouse-free compost bin

Michael Linke explains how to turn an old drum and some water pipe into a deluxe composting tumbler that's completely rodent-proof

For a long time I had one of those big green plastic compost bins with a lid and no bottom. I have never been happy with the results from this 'beehive' shaped bin though: the heap often ends up with thick, sludgy damp layers that take months to decompose. Turning the heap is always a difficult task because of the narrow opening, and getting at the finished product at the bottom of the bin is almost impossible without the top layers spilling out everywhere. To add insult to smelly, anaerobic sludge, mice were breeding in the bin and migrating to the house. Lots of mice.

I got the idea for a compost tumbler at the CERES environment park in Melbourne. The display models there are all well made, some from plastic, some from old 44 gallon drums, but they all cost more than I was prepared to pay. The obvious answer was to make one myself.

Making a compost tumbler

1. **Choose a barrel.** Large or small, steel or plastic; it depends upon your application and what's available. If you have kids who will be emptying the compost, you might choose a smaller size so that they will be able to rotate it when it is full. If it's plastic, make sure the lid fits tightly with a steel clamp, or can be locked in place with screws.
2. **Cut some steel water pipe** to the length of the drum, plus 60 centimetres. This pipe will be the 'axle' of the tumbler.
3. **Cut holes in the centre of each end of the drum**, slightly larger than the diameter of the pipe. I used a holesaw, which costs around $10 to $20 for a cheap one.
4. **Slide the pipe through the centre of the drum,** in one of the drilled holes and out the other, allowing a 30 centimetre overhang on either end.
5. **Attach a hose clamp** (available from hardware shops in a range of sizes) to either end of the pipe, butting up against the bin. These are to stop the bin sliding off the pipe, so you may also need to put a washer between them and the bin.
6. **Cut a square or rectangular hole** in the middle of the drum large enough to empty your household compost container into. Don't mangle the cut-out because it will become the door of the tumbler—drawing an outline with a texta or pencil is a must. I borrowed a neighbour's jig-saw, drilling small holes to get started, but a hand saw would do.
7. **Attach the cut-out to two hinges**, and screw the hinges to the drum. For a plastic drum, wood screws work fine; use self tappers or bolts for a steel drum. I used fairly large hinges which bent to the contour of the drum when screwed into place.
8. **Fix a latch to the door.** My latch is a series of nuts and washers bolted to a flap of aluminium and a plastic pipe offcut as the handle. You can probably get something less cumbersome from a hardware shop.
9. **Elevate.** You may wish to build an A-frame rack to hold the tumbler up, or simply use a couple of sturdy fence posts with holes drilled through the middle. I used a couple of old concrete water trough stands, holding the pipe in place with wire. They do the job, though they're a bit ugly.
10. **Add compost.** Horse poo, straw and human urine are my favourite compost starters. Put all your organic household waste in there. Pizza boxes and newspapers disappear quickly if added in moderation. Empty when the material becomes rich brown humus.
11. **Say goodbye to your mice.** A few weeks after I replaced my old compost bin with the tumbler, the mice disappeared from the kitchen.

Other construction tips

Both plastic and steel bins may begin to warp if the material on the ends is too thin. You may need to attach a sheet of steel over each end to prevent warping. The blue HDPE plastic 'wine barrel' that I used had a thick base, and the lid is holding up well.

Try to find out what the drum or barrel was used for. If it smells suspicious, or has the names of nasty chemicals on the side, avoid using it. Your microbes will thank you.

A compost tumbler is cheap and easy to make from an old drum and a length of water pipe. Your microbes will thank you, because the tumbling motion aerates the heap, but mice and rats will find it much harder to penetrate than a conventional compost bin.

The principle behind compost tumblers is simple: add organic material to a container and spin it regularly to aerate and enhance aerobic decomposition. Aerobic composting, where microbes that use oxygen do all the work, is faster and not as smelly as anaerobic (without oxygen) decomposition.

All up, my compost tumbler cost around $15 for materials. The plastic barrel was $10 from a garage sale, while hinges, screws, washers and hose clamps totalled $5. I chose a plastic barrel because it is easier to work with than steel, doesn't have sharp edges and won't rust.

The tumbler is fairly easy to empty, though a good thing to remember when building a stand is that you may wish to empty compost directly into a wheel barrow. Choose a height that makes both filling and emptying the bin easy for the end user.

A fix for Suntron Suntrackers

Many people have Suntron solar panel trackers that have failed in some way.

Hugh Spencer shows us what goes wrong and how to fix them

Suntron, a Melbourne based company, made two designs of solar trackers which were aimed primarily at the water pumping market. One was incorporated in our Pyramid renewable energy system, and failed on start-up. Upon pursuing this matter, we were told that the company had 'walked away' from their trackers (and in fact closed up shop in December of last year).

Now, I understand that there are quite a lot of pumping systems with Suntron trackers out there, and a few associated with solar systems as well. Failed (and unrepaired) trackers are bad for the solar image, to say nothing of losing 20 percent of available power!

The tracker designs are basically good, but it is the classic case of the ship sinking for want of a h'penny's worth of tar. One tracker (suitable for up to 12 panels) uses a motorised screw actuator. The other, a smaller tracker for up to eight panels, uses a semi-circular gear drive. Both use the same controller and magnetic stops. We have both types of tracker, and both have failed in the past, but are now operating well.

The controller is a clever design based on a simple quad comparator driving four FETS in a 'H-bridge' configuration—essentially an electronic two-pole reversing switch configuration with a 'centre-off' position, used in a wide range of devices including inverters.

The control compares the relative solar intensity from two small solar cells mounted on the array and controls the direction of the motor drive (and hence the angle of the panels), so as to balance the signals from these two cells. Magnetic switches limit the east and west travel of the panels, as well as providing a night-time 'park' position, with the array horizontal.

A wind detector input is incorporated (although I have no documentation on its requirements, and haven't had time to experiment) which also presumably forces the panel into the 'park' condition during high winds—a good idea. The controller also includes a small 12 volt lead-acid battery to provide the motor power charged by a small switcher-charger which 'steals' power from one of the panels.

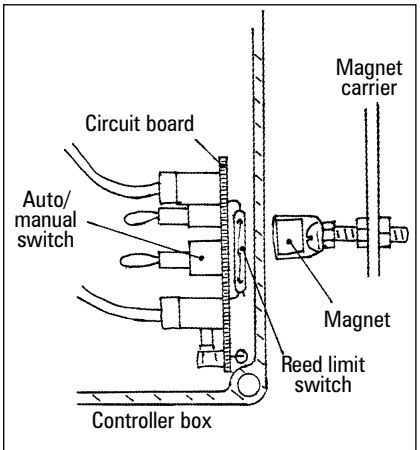
The reed switches that didn't

However, one of the places where the design comes unstuck are the clever little reed switches, mounted on the circuit board, that limit the travel of the solar panel frame. These are normally 'on', and the approaching magnet on the frame causes them to switch 'off'. Unfortunately, these miniature type-C reed switch inserts are very fragile, and appear to fail by cracking. This causes the drive in that direction to stop, or to stay on and drive the array hard against the stop (eventually causing the fuse or FETS to fail).

I have replaced all the reed switches on our controllers, and have had no further trouble. The actuating magnets themselves are poorly designed, and the outer plastic case which holds the magnet onto the stainless steel bolt splits and the magnet drops off. Result—the tracker continues to the end of travel and goodbye FETS (which at $20-odd each is no laughing matter). I have had to repot some of our magnets with epoxy resin. Increasing the fuse to 8 amp capacity will also help reduce failures due to temporary overloads.

On the big tracker, Suntron used two galvanised bolts running in what appear

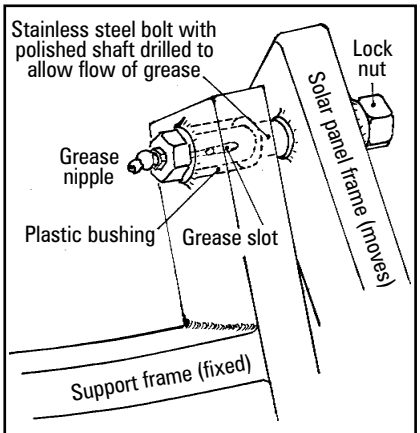
to be nylon bushes to take the entire weight of the array, as well as acting as hinges. Unfortunately, this is not a winning combination, and after a few months (at least in our climate) they seize (more dead FETS or fuses). These bolts should be replaced with polished-shaft stainless steel bolts (ours are fitted with stainless steel grease nipples as well to allow regular lubrication), and the tracker now works like a charm.



Location of the reed switches on the controller board, and the correct position of the magnet.

Another problem is that the frame of the tracker, because of the use of nylon bushes, is electrically isolated from the post—except through the motor, which in our case corroded horribly. A grounding wire corrects this state of affairs, and saves the solar system from lightning related mishaps.

We also put aluminium extensions to the magnets to reduce the total angle of travel, and relocated the two switches that permit manual control of the tracker to the main system compartment, where they belong, rather than being inaccessible inside the tracker's control box on a mast. Now it is easy to shift the tracker angle for cleaning or service (or for the benefit of visiting TV crews!). We also powered the tracker from the system batteries, instead of its own little battery that is far too small, eliminating another source of failure. However, this option isn't really available to those with pumping systems. ✲

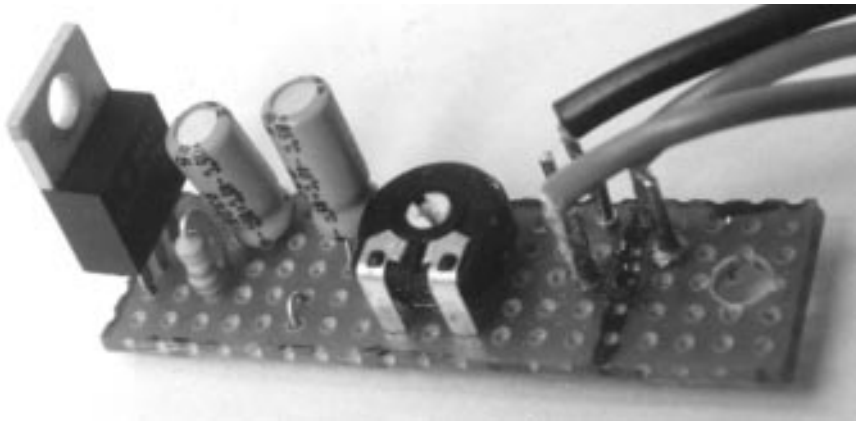


Mounting frame of the 12 panel tracker showing changes to the pivot bolt.

Hugh would be happy to answer any queries that readers may have. He can be contacted from his web site at: http://www.altnews.com.au/AusTrop/index.html, or you can send mail to: Hugh Spencer, Cape Tribulation Tropical Research Station, PMB 5, Cape Tribulation via Mossman, QLD 4873.

Power your answerphone from 12 volts

I have been asked many times for a simple circuit that would allow low-power DC devices like answering machines and radios to be run directly from a 12 or 24 volt power source. **Lance Turner** describes a simple circuit does the job nicely.



There are many household devices, such as radios, answering machines and battery charges that run on DC power. However, most of these appliances are powered from some sort of AC to DC adapter.

While this may be fine if you have mains power, if you are living with an independent power system then you could be wasting a lot of power keeping that 2000 watt inverter running just to power tiny loads like these. In fact, I have been asked by many ReNew readers about just this problem, and what is the best way to solve it.

There are several solutions. The first is to go out and buy one of those DC to DC voltage adapters designed to allow such devices to be run from a car battery. There are several problems with these, however—many of them are poorly made, offer only low power outputs (a few hundred milliamps or so) and may have very poor regulation at high or very low loads. They can also get very hot, due to inadequate heatsinking, which can be a real hazard.

A better option is to build a circuit like the one described here, which uses a purpose made but readily available and cheap voltage regulator IC to provide a fully regulated output.

Very simple design

The circuit described here is about as simple as a voltage regulator circuit can be. It is based around an LM317 adjustable voltage regulator IC (which has only three pins) and has only four other components. The LM317 is a versatile IC, and despite its name, is very simple to use, as the circuit diagram (figure 1) shows.

The circuit is capable of regulating any input voltage, up to 30 volts DC or so, down to an output voltage which is adjustable from just 1.25 volts up to nearly the full input voltage.

How it works

The LM317 works by maintaining a fixed voltage of 1.25 volts between its output and adjustment pins (the output pin is 1.25 volts more positive than the adjustment pin). When the adjustment pin is connected to ground, as it is when the trimpot (a small variable resistor) is turned fully anticlockwise, then the output pin is held at 1.25 volts.

However, as the trimpot is rotated clockwise, its resistance increases. This increasing resistance works in conjunction with the resistor, R1 to cause the voltage at the adjustment pin to rise. As a result, the output voltage also rises—simple really.

The two capacitors, C1 and C2, are connected between the input and output pins to ground respectively. These just act as filters so that the regulator works properly. And that's it, there are no other parts!

When mounted on an appropriately sized heatsink, the LM317 can supply up to 1.5 amps of current, which should be more than enough for most devices.

Efficiency

The LM317 is what's known as a linear device, which means that it is connected

Parts list

U1 ..... LM317 adjustable voltage regulator
R1 ..... 390 ohm, ¼ watt resistor
C1, C2 .... 10μF, 35 volt eletrolytic capacitor
VR1 ..... 5k (10k for 24 volt) horizontal trimpot

between the power source and the device to be powered, and the excess voltage (and therefore power) is absorbed by the regulator itself. For small loads, such as a couple hundred milliamps, and where the voltage is only being reduced by a few volts, say twelve down to nine, then the regulator will only require a small heatsink, if any at all. This also means that the regulator has quite good efficiency, around 75 percent for the example given above.

However, when the voltage drop is larger, say twelve down to three, or even 24 down to twelve, then a larger heatsink will be required. When larger voltage drops are required, the efficiency also drops, and can be quite low. However, because the circuit eliminates the need to run a large inverter for a tiny load, you will still come out way on top as far as power consumption goes, especially when you factor in the amount of power that is also lost in the 240 volt plugpack that you no longer need!

Making the regulator

I built my regulator on a small piece of veroboard, which was just five holes wide and 19 holes long, with the tracks running lengthways (see figure 2).

The circuit board took about ten minutes to complete, and was laid out so that only one track needs to be cut. This is between the pins at one end of the trimpot, and means that one leg of the trimpot is left electrically unconnected, though you should make sure that the pin is soldered to the track for strength.

The only components you have to be careful of, polarity wise, are the LM317 and the two electrolytic capacitors. Get these backwards and they will go bang! Also, don't forget the tiny wire link.

The orientation of the LM317 becomes obvious as soon as you see it. You want to have the metal tab at the outer edge of the board so that it can be mounted directly to a heatsink, so it can really only go in one way. If you get it backwards, it won't work, and may even be damaged. The capacitors have a stripe near their negative terminal, which is marked on the layout.

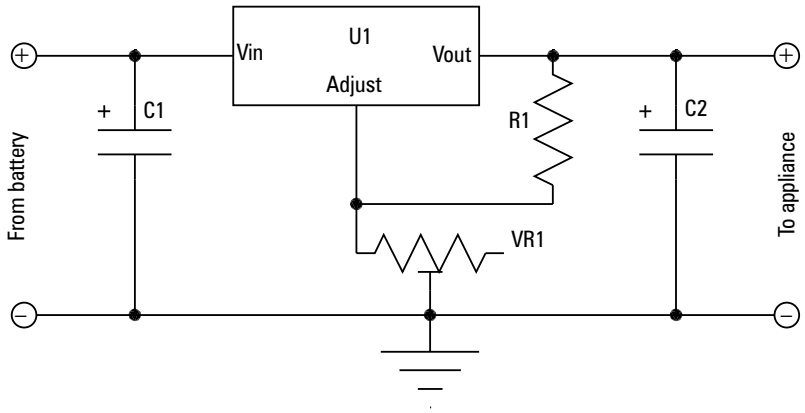


Figure 1. The circuit diagram of the simple regulator. Not much to go wrong here! Note that the three pins on the LM317 are not in the same order as they are on the actual device, but this is not a problem if you use the veroboard layout of figure 2.

After you have soldered your components in, you need to attach leads to the board. I soldered some PC pins into place—two for the ground connection, and one each for positive voltage in and out. You must be careful to make sure that there are no short circuits here!

I mounted my regulator in a small cast aluminium box, and ran wires from the circuit board to a terminal block mounted on the outside of the case. I also made a small label to allow easy identification of the connections. You might want to attach the regulator to a heatsink and build it inside the device to be powered, effectively converting the appliance to 12 or 24 volt operation.

You need to be careful when attaching the heatsink, as the metal tab of the regulator is electrically connected to the output of the device. Unless you can guarantee that the heatsink will be protected from contacting any other voltage sources (like ground!), you should place an insulating washer between the metal tab and the heatsink. I like the silicone rubber ones, they are strong and there is no messing around with heatsink goo that you have to use on the mica ones. You will need a 3mm by 10mm long bolt and nut to attach the heatsink, as well as an insulating bush for the screw, otherwise, it will short the tab to the heatsink.

The smoke test

Now you need to test your regulator. Connect a multimeter (set to read DC voltage) across the output, rotate the trimpot fully anticlockwise, and apply 12 volts to the circuit. The output voltage should read 1.25 volts or so. Rotating the trimpot clockwise should make the output voltage rise up to a maximum fairly close to the input voltage. If your regulator passes this test, connect a load across it and make sure that the voltage doesn't sag. If it passes this test, then it is ready for use.

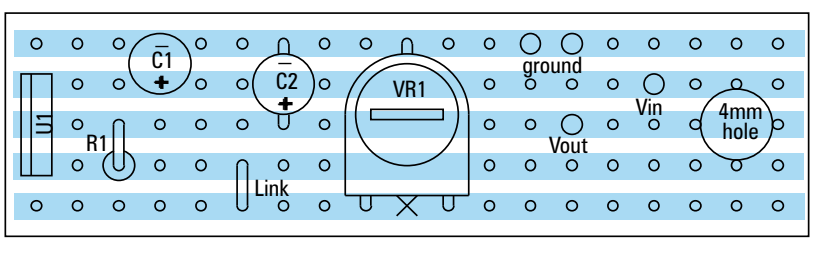


Figure 2. The circuit board layout for the regulator. Don't forget to cut the track between the pins of VR1.

Send us your questions

If you have a problem you just can't solve, or want to know the answer to a general question about sustainable technology, drop us a line and we will do our best to answer your query.

Send your questions to: ReNew, 247 Flinders Lane, Melbourne VIC 3000.

Home-built windpower

I am a member of Alternative Technology Association and have a passion for renewable energy. To this extent, I am undertaking various training courses and home experiments with a view towards more serious intentions in the future.

I want to build a wind generator on a small scale, say 20 watts, and have a few ideas but what I need is info or ideas on how to transfer the power from a horizontal axis generator down a tower. Something like sliprings or similar, which would enable the generator, mounted on a pedestal, able to rotate through 360° to pass power to cables mounted on the tower.

I guess any information on the topic would be appreciated.

Robert Underhill,
undrhil@alphalink.com.au

Sliprings are used in many commercial wind generators for transmitting the power down the tower, and are probably the best solution, provided they are installed correctly.

You may want to try to make a set yourself, or use some commercially made gear. You might even be able to use a slipring and brush set from a car alternator. These are readily obtainable from auto wrecking yards (or new from auto electricans) and quite cheap.

Another method of getting power down the tower is by using cables directly. The theory is that the wind generator will rotate a roughly equal number of turns in both directions over a given period, so the cables will stay pretty much untwisted. However, this is often not the case, and if you choose this method (by far the easiest), then be prepared to have to go up the tower occasionally to untwist them.

We wish you luck with your efforts, though, to be honest, most home-made wind generators are failures. They can also be dangerous failures, so make sure your design is a safe one. You might want to get yourself a copy of the book Windpower Workshop, which is reviewed elsewhere in this issue.

Lance Turner

More on rechargeable torches

I have noticed there have been a few discussions in your magazine about rechargeable torches, including the conversion of a dolphin torch. I have converted a few torches and I thought you would be interested in my findings.

I converted a small penlight torch into an LED torch by breaking the glass of a blown bulb and soldering an LED and resistor into the casing. This can then be used to replace the standard bulb of the torch. I use rechargeable AA batteries, although ordinary batteries could be used as they would last a very long time due to the low current drain of the LED.

I find this torch useful for navigating around the house at night. It is also great for checking on our new baby as the red light doesn't seem to wake him very easily.

I also converted a Dolphin torch. I didn't use LEDs because I wanted a lot of light—the torch is used for searching for our cats, and general security. I used a 6 volt, 4 amp-hour sealed-lead-acid (SLA) battery. I considered using a rechargeable lantern battery, but as they only held one extra amphour of charge and cost almost twice the price I decided against this.

I bought a small battery charger designed for SLA batteries from Jaycar. This is a small plugpack unit that is fully automatic, switching to trickle charge when the battery is charged, and has an LED to indicate the charging state.

Initially I used the bulb that came with the torch, but I too found that it blew after a short period. I then tried a higher voltage bulb (6 volt), but I wasn't happy with lower brightness. I decided to try using a 5.2 volt, 0.85 amp Halogen bulb from Dick Smith Electronics. These bulbs are not recommended for use in torches not designed for them because of the extra heat produced. However, I have been using the torch regularly for months now, sometimes for long periods. I have found no signs of heat damage at all.

As a final modification, I connected an LED and resistor in parallel with the bulb. The LED is mounted inside the torch and protrudes through the black plastic that holds the bulb and switch. If the bulb were to blow in a dark location the LED provides sufficient light to install the spare bulb.

It ended up costing about $80, ($39 for the torch, battery and connectors, $11 for the bulb, and $30 for the charger) which I guess is a lot for a torch. However I am pleased with it and find it suitable for my needs.

I enjoy reading your magazine and look forward to reading the next issue.

Garry Edmonds, Armidale NSW

Solar battery chargers

I wonder if you could help me? I'm starting to get into some alternative technology and have recently purchased some AA & AAA nicad rechargeable batteries for our torches and remote controls. I have also purchased a solar battery recharger.

I wish to avoid the problem of battery memory, so I try to discharge my batteries completely and conversely recharge them fully. I have considered buying a cheap multimeter so I can tell if they are fully charged, but a colleague tells me that because of the particular properties of this type of battery, a multimeter may not clarify the situation. Can you? Do these batteries need to be fully charged in one hit? If not, will this also contribute to memory problems?

Dave Graham & Annie Leschen,
grahamd@salty.agvic.gov.au

What you propose is basically the best way to treat nicads without resorting to a special pulse-type charger. Your friend is correct when they say it is difficult to tell when a nicad is fully charged. When they reach this stage, their terminal voltage actually drops slightly, so it is not easy to tell when the battery has finished charging.

With the solar chargers you are using, you should be able to calculate roughly how long the batteries need to charge fully, and then add an hour or two extra, just to be sure. The extra charging should not hurt the batteries, and will ensure a full charge.

Complex chargers, like the Smart Fastchargers unit in the Products column of ReNew issue 60, use quite complex algorithms to determine the battery state of charge, and are very good at charging nicads properly—but at a price!

Only partially charging your nicads should not be a problem, so long as you discharge them fully before recharging, though I am not 100 percent sure about this—the people at Smart Fastchargers have done a lot of research on nicads, and could provide more details on any problems you may experience.

Lance Turner

More compact fluoro problems!

Thankyou for a good magazine!

I have successfully repaired one 'Performer' compact fluoro. What would be the reason why, at irregular intervals of approximately 10 to 15 minutes, the fluoro wants to talk to me? Unfortunately, I don't understand the language, which sounds like a cricket. Do you have any specialised interpreters?

My other problem is that I have three Philips SL25 DL fluoros which gave up their ghosts after a life which I thought was not sufficiently long. After breaking the plastic case on one, I managed to get another one apart without too much damage. They look quite different to the fluoros you describe, and to the Performer fluoro I repaired. Is there any way of fixing these Philips units?

Martin Forster

Martin, sorry I can't tell you what your Performer is saying, it may just be warning you of its imminent demise (again).

As for the Philips fluoros, it is good to get some feedback on these units, even if the news is not so good. The Philips SL series use the older style ferro-magnetic ballasts, similar to those in a standard fluoro fitting, but a bit more compact. There is not much to go wrong with these, other than a burned out starter bottle or tube filaments. The former could be replaced with the contents of a standard fluoro starter, but if the tube filaments are blown, there is little you can do.

I have a Philips ferro-magnetic ballast unit which is about three years old and still going strong.

Lance Turner

Heat storage system

Some years ago I heard on the radio of a heat storage system being developed by CSIRO. Needing to replace my ageing electric hot water system, I awaited developments, but have not seen anything of it since.

As well as I can remember, it relied on the energy released or absorbed during the conversion between anhydrous and hydrated forms of calcium chloride (there are other salts which exhibit a similar effect). The process is reversible at around 60 or 70 degrees celcius—about the range of domestic hot water systems. The energy density is many time that of the heat capacity of stored hot water.

Was the idea ever developed to a practical level? If so, are any systems being marketed? Do you have any information on this or a similar system? Could you tell me how to contact a relevant agency within CSIRO? Maybe they encountered insurmountable practical obstacles.

Peter Burger, Emerald QLD

I have asked a friend at CSIRO about this heat storage system, but as yet he has had no luck in tracking down any information.

However, in a past issue of Soft Technology, we ran an article on a company in WA that was using phase-change salt heat storage systems to run motors on low-grade thermal energy. Their system uses heat energy at around 58°C, which is almost in the same temperature range that you stated in your letter.

The company is called Thermal Energy Accumulator Products (TEAP). The contact details for TEAP are: PO Box 724, Subiaco WA 6008, ph:(08)9244 1665, fax:(08)9244 1667.

Old car batteries

Is there a way of rejuvenating 'sulphated' batteries. I've got some that I want to use on a 12volt lighting system (old car batteries). Could you suggest a book or web site where I could get an answer please?

Dave Watt, allisonw@arach.net.au

Dave, in all honesty, don't bother. Car batteries are not suitable for independent power systems, and even new ones won't last long if they get discharged too much.

As yours are sulphated, I would suggest that they have been abused in the past, or they are just old. The best thing to do is recycle them and buy a battery made for the job.

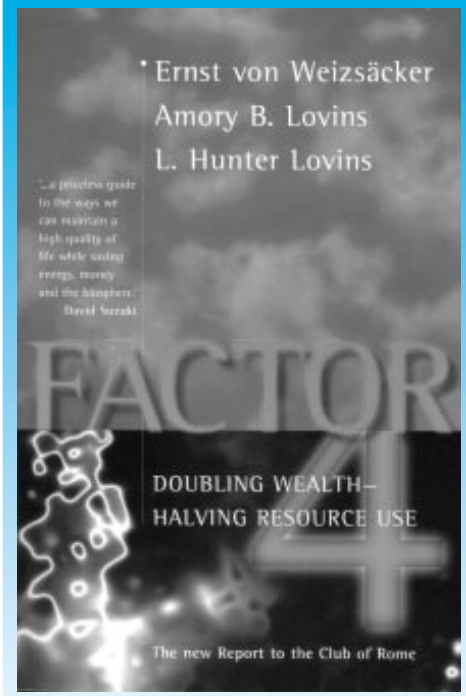
There have been numerous claims of people being able to rejuvenate sulphated batteries, I have even had some minor successes with doing this, but they have been on batteries with far stronger construction than car batteries. If you tried any of these methods, the plates in car batteries are likely to fall apart and settle in the bottom of the battery case.

Sorry to dump water on you ideas of rejuvenation, but when a battery is gone, it is gone! (especially a car battery).

Lance Turner

Factor Four: Doubling Wealth—Halving Resource Use

by Ernst von Weizacker, Amory B Lovins, L. Hunter Lovins
Allen & Unwin, 1997. rrp $24.95



About 1990, Amory Lovins gave a seminar on energy efficient equipment to the Victoria business community. A representative from an international company making compact fluorescent light globes stood up and asked Lovins, "If energy efficiency is such good business, how come no one is buying our light globes?"

Quick as a flash, Lovins answered, "How much are you selling them for?" Looking suddenly sheepish, the representative answered defensively, "About $40 each."

"That's why," Lovins shot back. He went on to question why on earth the company was charging such extortionate prices, when equivalent globes cost about $10 in the US.

That was one of the first time I saw Amory Lovins in action. His calm, matter-of-fact, slightly geeky demeanour belied a searing ability to annihilate poor logic, intellectual dishonesty and most of all, self-interested claptrap dressed up as 'expert economic analysis'.

Delightfully, Lovins has kept and indeed honed this ability, which is clearly reflected in his new book, 'Factor Four', co-authored with partner Hunter Lovins and Ernst Weizacker.

The basic premise of 'Factor Four' is that the amount of wealth we can extract from one unit of natural resources can be quadrupled. In doing so, we can live twice as well, while using half as much. The authors posit that instead of being so obsessed with labor productivity, governments need to focus on resource productivity. The 'wasting disease' has a vaccine, the authors say, and it is the 'efficiency cure'.

Like other books by the Lovins', Factor Four provides a nice balance between policy, theory and practical case studies. Indeed, the book provides fifty examples of how to quadruple resource productivity. In one section, on improving transport productivity, the authors detail the case of strawberry yoghurt in Germany. Analysis from the Wuppertal Institute in Germany revealed that one cup of strawberry yoghurt was the result of accumulated journeys (for the strawberries, sugar, other contents and packaging) totalling 3500 kms—and that was before the suppliers even shipped the finished product! The latter could add up to another 4500 kms to the total. This revelation became headline news in Germany—the research had shattered the illusion held by so many average people that their strawberry yoghurt came from just around the corner. Using the Factor Four analysis, the authors showed how the strawberry yoghurt could be produced in a far less transport intensive fashion, thus saving on use of fossil fuels and Greenhouse gas emissions. Importantly, a more local approach to the yoghurt—relying on local dairies and using recycled glass jars returned to the supermarket—would also provide more local jobs.

One of the strongest points of Factor Four is that it is not about more heavy-handed, rigid government regulation. The authors recognised the value of economic incentives and instead of trying to squash them, as some environmentalists have mistakenly sought to do, they have suggested ways of using market forces to produce a desired outcome.

The best of these is 'feebates'. New buildings provide all the wrong incentives to architects, planners and builders. They are encouraged to use cheap materials, and to build without any concern for how much water, electricity or gas the building will use in future.

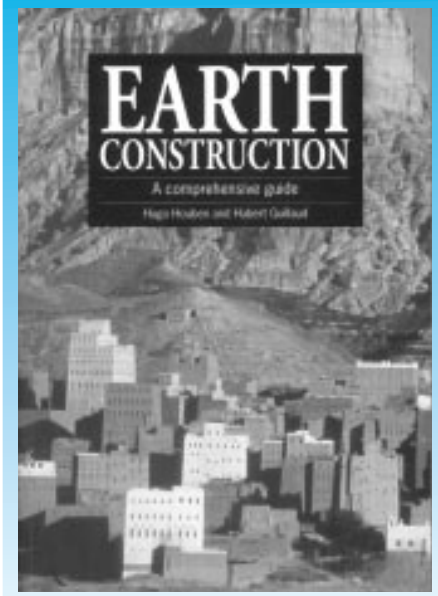
Under a feebates scheme, new buildings would be rated on a points system according to how much of society's resources they would use on an on-going basis. When a building was connected to the electricity, sewage or water grid, the builders would either pay a fee or receive a financial bonus depending on this rating. Best of all, the system would be revenue neutral. As the authors stated: 'Read our lips: Not a new tax.' Poorly designed buildings which had no insulation and lots of water-intensive fixtures would face whopping fees—which would pay for the rebates on the passive solar designed, draught-free, low water-use buildings. As technology improved, the standards for receiving a bonus, rather than facing a fee, would be slowly increased, thus forcing the industry to constantly improve its product. Thus, government would be able to respond to the dynamic nature of technology.

'Factor Four' is a well-researched, thought-provoking book and is well worth a spot on anyone's bookshelf.

Review by Suelette Dreyfus

Earth Construction: A Comprehensive Guide

by Hugo Houben & Hubert Guillaud
Intermediate Technology Publications, 1994
ISBN 185339193 X
Distributed in Australia by Astam Books, 57-61 John St, Leichhardt, NSW, 2040. Phone: (02) 9566 4400



This important and scholarly book should grace the library of every Architecture Department, and may be of use as a reference for anyone claiming expertise in building with earth. It is more than a 'comprehensive guide', covering every topic of even marginal interest. For example, the authors are not content to describe the soil characteristics relevant to building, but spend 143 pages densely packed with information on soil science. This is both a benefit and a fault. Everything a building professional might want to know about soil is there, and there is a great deal of useful information (e.g. how to test soil suitability in a variety of situations). However, this is extremely boring reading, and many gems might be missed because of the great deal of material included. Very little of this kind of detail is necessary for the owner-builder, or even the contract builder using earth as a material. In the end, the best test is to make samples using various techniques, and see how they stand up to abuse.

I found the 37 pages on construction methods to be far more useful and interesting. Each of 12 types was given a double-page spread. I wish there was more information on some of the less well-known techniques, but I learnt from what was there. The long chapters on construction techniques and design are useful and accurate, and illustrate a number of approaches that are new to me (after over 20 years in the field). For example, I have only built one kind of earth dome and one kind of vault. The book describes 16! A chapter on disasters (earthquake, cyclone and flood) is also useful, although ignores Australian evidence from Cyclone Tracey in Darwin, showing the resistance of earth walls to such forces.

The final chapter is on wall finishes, and is very comprehensive. I like the general approach of first explaining what something is to achieve and why, and then describing how. Example: four pages on what earthquakes are, two pages on how they affect buildings, and six pages on how to cope with them. This book conscientiously covers all techniques, but there is a clear and commendable preference for ways of using soil that have low environmental impact, and social benefit. The photographs of many unusual buildings from around the world are a delight, and the many drawings are illuminating. In conclusion, this is not a book for the wide public, or the one-time owner-builder, but for the teacher, researcher or policy-maker.

Reviewed by Dr Bob Rich. Bob is the author of *The Earth Garden Building Book* (3rd Edition, with Keith Smith, Viking) and *Woodworking for Idiots Like Me* (Aird Books).

Windpower Workshop

by Hugh Piggot
Centre for Alternative Technology Publications, Machynllyth, Powys SY20 9AZ UK.
1997, ISBN 1 898049 20 3, 160 pp.

Windpower Workshop by Hugh Piggot is a well written book aimed at people wanting to build a small wind generator. It provides practical advice on how to design and build a wind generator of the specific type and size range (up to 5 metres diameter) recommended by the author.

Does this sound restricted? You bet your socks it is, and most people will be delighted.

Delighted, because Hugh Piggot has directed the builder down a path that avoids many hidden traps.

He does not get into heavy general theory, but rather gives the results of his practical experience and his understanding of the theory to generate valuable design guidelines for the reader to apply to the design of his or her own wind generator. For example, a guideline for the correct size of tail compared to the rotor. This sort of information would be difficult to calculate from theory and time consuming or worse to discover by trial and error.

He also explains why certain designs are not recommended, using arguments where practical considerations such as reliability win over theoretical benefits or 'clever' design. The passage where he dismisses designs that have the rotor downwind of the tower is a gem: *'Under certain circumstances a downwind windmill may decide to run upwind. This is difficult to explain, but impressive to watch when it happens.'*

No waffle, no disaster stories, but the point is made.

Design calculations are made easy by tables calculated from formulae that are tucked away in the appendix. Another nice point is that formulae are specified in a way that enables entry into a spread sheet so that one can easily run 'what if' scenarios when trying to settle on a design detail. However, there is a down side. There are no explanations, so verifying the formulas is difficult. I thought I understood how the blade angle setting (pitch) calculation worked but I couldn't get the same result as the book.

Hugh covers the issue of safety thoroughly and with obvious authority that completely removes the feeling that you are reading 'the obligatory section on safety'. His attitude is that nothing should be left to chance. He spells out not only what you should not do but what you must do to avoid threat to yours and others' physical and financial health.

There was only one chapter that fell short of the high standard set by the book overall—Electrical Controls.

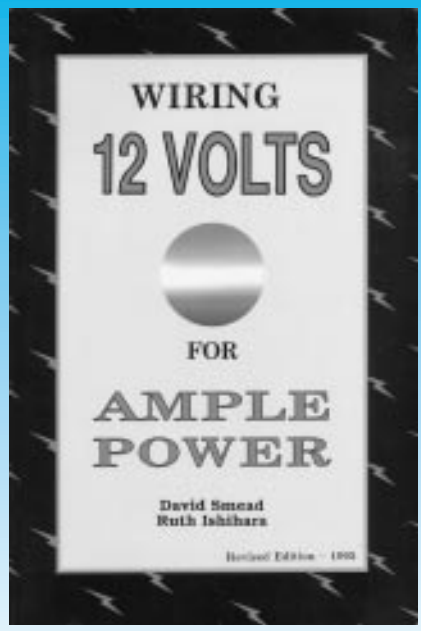
The focus is not as tight. He covers heating systems, direct AC systems and battery charging systems. For Australian situations, battery charging is probably the preferred focus.

The chapter I enjoyed most was the one on generators. It covered every conceivable type with a constant focus on effectiveness, cautions and characteristics, cost and availability. Even how to design and build your own.

Reviewed by Alan Distel

Wiring 12 Volts for Ample Power

David Smead and Ruth Ishihara
Rides Publishing Company, 1995, 238pp
rrp $50.00, from Ample Power Technology, ph:(03)5971 4802
ISBN 0-945415-03-6



To many people, low voltage wiring is something of a black art, yet many people attempt to wire their own systems with very little knowledge, often resulting in dangerous and inefficient systems.

Wiring 12 Volts for Ample Power is the sort of book that can provide you with enough information and common-sense safety rules to allow you to do your own wiring, provided you read it thoroughly and take heed of the warnings. The book is written by two people with considerable low voltage wiring experience, and not all of it on dry land. Many of the references in the book include terms that apply to boats, but generally these can be easily understood in relation to a home power system.

The book includes a lot of detailed information on such things as wire sizes and types, batteries, fuses and circuit breakers, connectors and terminals, loads, instrumentation and battery chargers, yet also deals with the basic concepts of what electricty and elecromagnetism actually are.

One chapter (albeit a short one) deals with sizing a RAPS system, including calculating the loads, working out the battery bank required, and giving guidelines on other aspects of the system.

One thing the reader should be aware of when filtering the information in this book is the numerous references to 'Ample Power Technology' monitoring and control devices. Ample Power is a company owned by the authors in the US which makes battery monitors and other equipment, aimed mainly at the marine market.

All in all, I found this book well written and a very useful source of reference material, and I would expect most independent power system owners would also, despite the American units and measurements used throughout. Wiring 12 volts is quite detailed in its explanations, is clearly written, and would make a valuable addition to the average independent power system owner's library.

Reviewed by Lance Turner

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Info Days

Going Solar, Victoria Pde Nth Melbourne (opp. Vic markets)
✻ 13 September—Beekeeping
✻ 11 October—Introduction to solar
✻ 8 November—Composting toilets
✻ 13 December—Solar hot water
Contact: Liz or Peter on ph:(03)9328 4123.

Landcare Conference

✲ 16-19 September, 1997
Adelaide, SA
Speakers at the conference will include John Kerin, Professor Mike Tyler, Dr Wendy Craik, and Robert Fitzgerald.
Contact: GPO Box 1671, Adelaide SA 5001.

Green Connections Workshops

✲ 19-21 September—Straw bale building.
Central Victoria
Will cover wall systems,bale characteristics, foundations, door and window openings, bale wall finishes and electrical. $110 per day, including lunch, morning and afternoon teas.
Contact: Straw Bale Australia on: ph(03)5470 6391.
✲ 1&2 Novenber—Seed saving
Castlemaine, VIC
Will cover biodiversity of food plants, origins of plants, chemical dependency, what seeds to save and many other topics.
Contact: Green Connections magazine on: ph:(03)5470 5040.

Roxstop

✲ 22 September-3 October, 1997
Roxby Downs, SA
This desert action and festival is a great chance to show your opposition to uranium mining in Australia.
Contact: Roxby Action Collective, PO Box 222, Fitzroy VIC 3065, ph:(03)9419 8700, fax:(03)9416 2081, www: http://www.vicnet.net.au/~seaus/roxstop.html, email: foefitzroy@peg.pegasus.oz.au

Degree Courses in the Netherlands

✲ September, 1997
Enschede, The Netherlands
Courses are available in 'Forest Survey' and 'Socio-Economic Information for Natural Resource Management'.
Contact: W E Klunne, ITC/LARUS, PO Box 6, 7500 AA Enschede, the Netherlands, fax:+31 53 4874 399, email: klunne@itc.nl

Solar Energy Workshop

✲ 1 October, 1997
Monash University, Melbourne
This one-day workshop will cover the latest PV developments, solar pumps, resource assessment, solar energy for buildings, storage, power electronics and installation.
Contact: Dr A Zahedi, Dept of Electrical and Computer Systems Engineering, Monash Uni, 900 Dandenong Rd, Caulfield East VIC 3145, ph:(03)9903 2095, fax:(03)9903 2906, email: zahedi@eng.monash.edu.au

Permaculture Convergence

✲ 11-18 October, 1997
Nimbin, NSW
Includes workshops, field trips, seminars Earth Festival, Designers' convergence and Permaculture Expo.
Contact: APC-7, PO Box 379, Nimbin NSW 2480, ph/fax:(066) 89 1755, email: permed@nor.com.au

Renewable Energy & Energy Efficiency

✲ 14-16 October, 1997
Jakarta Convention Center, Indonesia
A forum for dignitaries from Asia-Pacific, the US and the international financial community to advance renewable energy and energy efficiency.
Contact: Alternative Development Asia, 5/F, 3 Wood Rd, Wanchai, Hong Kong, fax:+852 2574 1997, email: altdev@hk.super.net

Ecologically sustainable Development Conference

✲ 27-28 October, 1997
Storey Hall, RMIT, Melbourne VIC
Architects will be shown how to build a sustainably. Guests include William Browning from RMI and green architects Professor Brenda and Dr Robert Vale.
Contact: Rupert Posner, ph:(02)9934 7372.

Ecosphere & Economy Conference

✲ 17-20 November, 1997
Melbourne, VIC
This conference discusses economies and how they are directly related to the ecosphere. The theme for the conference is 'Creating a Green Future'.
Contact: ANZSEE Conference Secretariat, Conference Plus, Level 5, 406 Lonsdale St, Melbourne VIC 3000, ph:(03)9602 3073, fax:(03)9642 5152.

1997 Energy Expo & RACV Energy Breakthrough

✲ 21-23 November, 1997
Maryborough, VIC
Incorporates science and technology, road safety awareness, alternative power applications and appliances.
Will be held in conjunction with the RACV Energy Breakthrough, a 24-hour endurance race using alternative energy sources.
Contact: PO Box 439, Maryborough VIC 3465, ph:(03)5460 4588, fax:(03)5460 4579.

Solar '97

✲ 1-3 December, 1997
The annual conference of ANZSES (Australia New Zealand Solar Energy Society).
Contact: George Hardy, ANZSES Administrator, PO Box 1140, Maroubra NSW 2035.

Catalyst '97

✲ 5-8 December, 1997
University of Canberra, ACT
Intended to facilitate a shift in environmental design to bring about the transformation to an ecologically sustainable society.
Contact: Janis Birkeland, PO Box 1, Belconnen, ACT 2616, fax:(06)201 2279, email: jlb@design.canberra.edu.au

Sunrace '98

✲ January 1998
Adelaide to Melbourne
Featuring solar and electric cars racing over six legs for six days, and will run via Elizabeth, Peterborough, Broken Hill, Mildura, Swan Hill and Bendigo. Feature a 200hp electric Porsche and the three million dollar Aurora solar car.
Contact: Alison Waters on ph:(03)9820 1723 or fax:(03)9820 2027, or John Hoerner on ph:(03)9820 9032, fax:(03)9820 2027, email: sunrace@netlink.com.au, or web site at: http://www.sunrace.netlink.com.au

Environmental Management Conference

✲ 10-13 February, 1998
University of Woolongong
The second international conference on environmental management, with a focus on environmental engineering, geotechnology and mining engineering.
Contact: James Cook, Conference Manager, ICEM2, University Union, University of Woolongong, Woolongong NSW 2522, ph:(042)29 7833, fax:(042)26 4250, email: j.cook@ouw.edu.au

World Renewable Energy Congress

✲ 20-25 September, 1998
Florence, Italy
Contact: Professor A. A. M. Sayigh, Chairman, 147 Hilmanton, Lower Earley, Reading RG6 4HN, UK, fax:+44 118 961 1365, www: http://www.netcom.net.uk/~asayigh/wren.html

World Solar Challenge

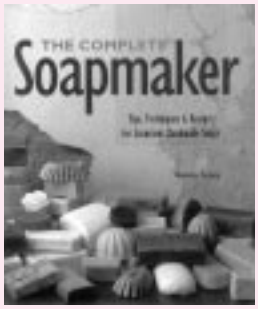
✲ 18-27 October, 1998
Darwin, NT to Adelaide, SA
This world renowned international solar car race will now be held biennially to cater for increased interest in the event.
Contact: Cathie Holdich, Adelaide Event Office, ph:(08)8303 2021, email: wsc@saugov.sa.gov.au

Alternative Christmas Gifts

Give a gift of knowledge this year. Buy a friend or loved one a book that will help them live with greater comfort, more cheaply and planet friendly. The ATA is offering a range of books that have been reviewed in either *renew* or *soft technology*. ATA members and subscribers receive a 10% discount off the listed prices.

WARM HOUSE, COOL HOUSE
Author: Nick Hollow
Price: $27.50 Softcover, 172ppg
Reviewed in *Soft Technology* #54
An easy to read introduction to the principles of energy-efficient housing design. Covers a broad range of topics, and contains an abundance of drawings, plans and photographs. The author is an architect well versed in the field of low energy design and teaches at the University of Sydney.
Item code: WHCH

REMOTE AREA POWER SUPPLY SYSTEMS: An Introduction
Price: $30.00 Softcover, 100ppg
Reviewed in *Soft Technology* #53
Enables the average person to gain a good grasp of what RAPS systems are all about. Covers individual system components, correct sizing and safe installation and maintenance. A must-have if you are looking at installing, or wish to know more about your own RAPS system.
Item code: RAPSS



THE COMPLETE SOAPMAKER
Author: Norma Coney
Price: $24.95 Softcover, 128ppg
'The politics of soap making' in *ReNew* #60
Whether you want to make a political statement or just want a quality home-made product, this book will provide you with step-by-step instructions and yummy recipes for making your own soap.
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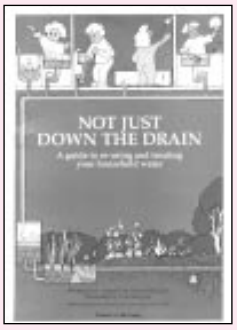

NOT JUST DOWN THE DRAIN: A Guide To Re-using And Treating Your Household Water
Author: Stuart McQuire
Price: $11.60 Softcover, 59 pp
Reviewed in *ReNew* #57
Whether you live in a house, a flat, in the suburbs or the country, this book will help you cut your water costs while conserving Australia's most scarce natural resource.
Item code: NJDTD

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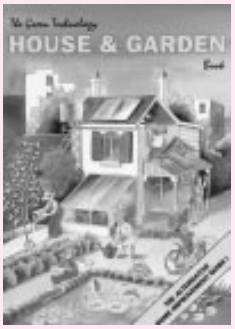

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issue 61

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Low power clothes iron

If your inverter can't handle those 1200 watt monsters, then you need a low power iron

One of the most power hungry tasks that a solar power system can be asked to perform is that of ironing. With the typical iron consuming around 1200 watts or more, they place a very heavy load on batteries and inverter.

We recently decided to investigate the market place for an iron with a smaller appetite for those valuable watts. Although a gas iron is available, from what people have said to me, it seems that most would rather use an electric iron.

A quick visit to a number of local electrical shops produced a couple of travel irons made by Korjo and a very nice little steam iron made by Kenwood. This iron had a footprint approximately half the size of a standard iron, with the power consumption stated on the label being between 670 and 800 watts. We decided to purchase this model, the Discovery ST50, for further tests.

After a quick perusal of the instruction manual the main point to note was the correct position for the voltage switch, ie the 240 volt position must be selected. Failure to observe this precaution would result in a non repairable failure of the iron.

After checking the switch was correct, The iron was plugged into our SA21 inverter (connected to a 12 volt battery) with the thermostat set to the first position. The inverter's DC amp meter displayed 80.4 amps immediately and the base of the iron rapidly got very hot. In fact, the heat was almost instantaneous, which would allow virtually immediate use.

After a short period, the iron's thermostat operated, which of course resulted in a power consumption of zero amps. We were pleasantly surprised at the duty cycle (period on to period off) of this unit (about 50 percent), which would probably allow it to operate off much smaller inverters, perhaps as small as 600 watt.

The Kenwood Discovery ST50 travel iron has a lower power consumption than most conventional irons—great for independent power systems!

The overall construction of the iron is quite good, and it features a non-stick base, a fold down handle (which contains the water for steam) and a lengthy cord for connection. The continuously variable thermostat allows for various garment types and the push button steam option is available for those stubborn wrinkles. It is supplied with a well written instruction manual and a 12 month guarantee with dealers Australia wide.

On the down side, the iron was a bit on the light side for some garments, such as jeans and other heavy materials. However, overall we found the iron to be a good compromise between full size performance and low power consumption.

Just in case those with smaller inverters feel left out KORJO, which states it is an Australian owned company, make a very basic no-steam model with a power consumption rating of just 270 watts. Although we have not tried out this model, it may suit those unable to operate the larger units.

Distributor/manufacturer contact:

The test iron came from Retravision, but contact Breville P/L (the Victorian Kenwood distributors) on ph:(03)9349 1555 for other dealers.

Price: $42.50

Review by Brian and Helen Bartlett

Noel's treasures from trash

fun things for clever kids to make

To make this

Cartesian diver

you will need:

- a long glass bottle with a wide mouth—a spaghetti jar is good
- a large balloon to fit over the top of the jar
- a couple of strong rubber bands
- a some paper clips
- a small plastic bottle—a film canister is ideal
- some small weights—nuts and washers work well
- a balance or set of scales
- a pair of pliers

Learn about air pressure with this cartesian diver.

This toy is simple to make and enjoy, and you can learn a lot of physics explaining it.

To make the cartesian diver you will need a set of scales. If you don't have these, you can make a simple balance by suspending a wooden ruler by a hole drilled exactly in its centre, then hanging a tin or other suitable container from each end.

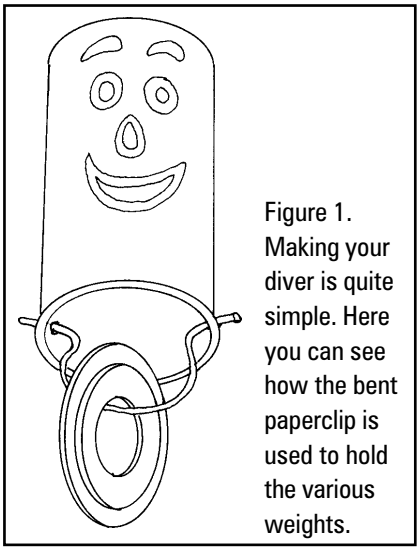


Figure 1. Making your diver is quite simple. Here you can see how the bent paperclip is used to hold the various weights.

The small plastic film canister will become the body of your diver, so you need to know how much water it displaces (in grams). To do this, fill it full to the brim with water and pour this into one side of your scales. Then put the empty canister in the other side and add small weights until the scales balance.

What we are aiming for is a diver that just floats. Archimedes, a Greek scientist, showed that the weight of water displaced by an object equals the weight of that floating object.

We also need to allow for the water displaced by the weights (nuts and washers) so add a small amount of extra water to the scales, and another weight or two until it balances.

Making the diver

Now poke a hole through each side of the plastic film canister, very close to the mouth of the canister. Straighten out a paperclip and bend it to shape as in figure 1. Pass one end through one of the holes in the canister from the inside of the canister mouth, place all of your weights from the scale over the paperclip and pass the other end through the other hole in the canister. When you have finished, your weights should be hanging from the paperclip underneath your canister when it is turned upside-down.

Now you have to test your diver. Place it in a container of water so that air is trapped in the upside-down film canister. It should just float on the surface of the water. If it sinks, remove a small weight, but if it floats too high, add some extra weight—a paperclip or two will probably do it.

Fill your large glass jar with water, leaving about 30mm of air at the top. Place your diver into the jar, making sure the air is trapped underneath.

Stretch the balloon across the mouth of the jar, and hold it in place with a strong rubber band or two. You may need an assistant for this.

Your diver should be now ready to go. Just press on the balloon, and the diver should sink. Release the balloon, and it should rise again.

How your diver works

When the diver is floating, its weight is slightly less than the water it is displacing—just like a ship. When you press on the balloon, you increase the air pressure inside the jar, but as water is virtually incompressible, it pushes on the air inside the diver. This causes the air in the diver to compress, so it takes up less space and therefore displaces less water, making the diver too heavy for the water it now displaces. This is why it sinks.

When you release the balloon, the air pressure decreases, causing the air in the diver to expand again. This allows it to displace more water, and so the diver now floats again.

The Dome Home

If the traditional brick-veneer box is not the home for you, then why not try living under a dome?

The dome company uses the simple yet versatile form of geodesic domes to create buildings that not only have an interesting and unusual look, but are functional and cost-effective as well.

The unit shown is the Home Dome, but the Dome Company have other ideas as well, including the Garden Dome, and the Shade Dome, a variation on the traditional shadehouse.

For further information, contact The Dome Company, 47 Edwards St, Sylvania Heights NSW 2224, ph/fax:(02)9522 6283, email: domeco@wr.com.au, www: http://www.wr.com.au/domeco

Split-level hot water

There is no doubt that solar hot water heaters are a great thing, but the size of their water storage tank can make them a problem to install on some buildings.

Solahart have now released their Streamline model, which is a split level solar hot water system. The system uses the familiar hot water panels mounted on the roof of the building, but the water storage tank is mounted at ground level. This eliminates most of the heater's bulk from the roofline, and also allows for easier maintenance of the tank.

The Streamline unit is is electrically boosted, for those days when the sun doesn't shine, and is available in 250 and 300 litre sizes. The units also feature thicker than standard polyurethane insulation to reduce heat loss, and the cylinder is coated with two coats of ceramic lining, instead of the usual one.

The Streamline comes with a five year warranty.

For more information, contact Solahart, 112 Pilbara St, Welshpool WA 6106, ph:(08)9458 6211, fax:(08)9351 8034, email: solahart@solahart.com.au, web site: http://www.solahart.com.au

A smart pergola

Pergolas are a great idea if you have to entertain outdoors, but those large vertical beams that most pergolas are made from have the drawbacks of providing insufficient shade in summer, and blocking out the light in winter.

Sun-gola, as its name suggests, is a pergola that makes much better use of the sun in winter, but blocks it in summer, allowing you to use your outdoor areas all year round. It does this by the use of angled louvres that allow the winter sun to pass between them, but not summer sun, which is much higher in the sky.

The Sun-gola is made from Colorbond steel and powdercoated galvanised steel tubing, and is available in any of the standard Colorbond colours. You can also have an existing pergola fitted with the Sun-gola panels.

rrp from $120 per square metre. The Sun-gola is presently only available in Western Australia.

For further information, contact Solar Option, ph/fax:(08(9313 5630.

A lot of worms!

It is a sad and unfortunate fact that much of the waste that goes into landfill is organic waste that could just as easily be composted and turned into fertiliser. And one of the biggest culprits when it comes to organic waste matter is the food industry.

However, many forms of conventional composting are both slow and difficult to implement for commercial scale disposal.

The Eco Logical Organic Waste (ELOW) bin is an alternative form of organic waste disposal system. What it amounts to is a large version of a home worm farm, and each two-metre diameter bin can dispose of around a tonne of organic waste per week. Just think how much waste could be saved if every restaurant had one of these out the back!

Because the bins seal properly and are lockable, they do not attract flying insects and vermin such as mice and rats.

For further information, contact: Debra Stone, Steinmark Pty Ltd, 20 Arthur St, Eltham VIC 3095, ph:(03)9431 2909, fax:(03)9439 1407.

Simple sinewaves

If you have a smaller RAPS system, but don't want the limitations of a modified square wave inverter, then the PowerSine sinewave inverter range from Power Conversion Devices may be ideal for your system.

There are three inverters in the PowerSine range; a 600 watt (2400 watt surge) 12 or 24 volt unit, a 1000 watt (2800 watt surge) 12 volt unit, and a 1200 watt (3500 watt surge) 24 volt only machine.

The manufacturers say these inverters are capable of starting difficult loads such as induction motors, and have no power factor limitations. Other ratings include less than five percent THD (total harmonic distortion), output voltage regulation to within ±2 percent, and efficiencies of up to 94 percent.

Other features include 1kV input to output isolation, battery under and over voltage protection, output current limiting, short circuit and overload protection, and circuit breakers on both input and output. These inverters are also fully compliant with Australian standard AS3000.

rrp 600W model: $980, 1000W: $1695 and 1200W: $1495. All prices are plus sales tax.

For more information, contact: David Sharpe, Sharpe and Jephcott, ph:(03)9598 5775 or Richard Kluz, Power Conversion Devices, ph:(03)9761 1252.

A better refrigerant

With the phase-out of chloro-fluoro-carbons (CFCs) over the last few years, there has been a need to find an alternative to CFC refrigerants for airconditioning and refrigeration systems.

Victorian company Esanty have developed ER12 refrigerant, a direct replacement for CFCs that requires no modifications to existing systems or equipment at all. ER12 consists of two components found in natural gas—propane and iso-butane, along with an additive that makes the gas smell like rotten cabbages for easy identification of leaks.

Despite being made from flammable gases, the refrigerant has been proven safe for all systems, and is widely used in many other countries. According to the manufacturers, ER12 is a more efficient refrigerant than conventional refrigerants, and one 10kg cylinder has around the same charging capacity as a 30kg cylinder of other refrigerant types.

For further information, contact Esanty Pty Ltd, 7 Thornton Crs, Mitcham VIC 3132, ph:(03) 9872 3043, fax:(03) 9873 5925, email: info@esanty.com.au, www: http://www.esanty.com.au/

Turgo turbine

If you have a permanent or semi-permanent creek or small river with a reasonable fall on your property, then you have the perfect opportunity to use that excess water to power your home.

Mainland micro-hydro generators are made in New Zealand, and are capable of producing up to 500 watts of continuous power, depending on the water flow and head available.

The turbines consist of a Turgo wheel turbine connected to a brushless permanent magnet generator. The standard model has a 24 volt output, but it is also available with 12, 48 and 96 volt outputs. Another feature of these turbines is that each unit has its generator windings wound specifically to match the head and water flow of each individual site, helping to provide the maximum power from the water available.

The mainland micro-hydro turbines have a 520mm square base, are 375mm high, and weigh around 35kg.

For further information, contact Stuart Walker Electrical Ltd, 3 Boyes Place, Stoke Nelson, NZ, ph:+64 3 548 0888, fax:+64 3 547 6305.

Dishlex Global 500 Dishwasher

If you're in the market for a new dishwasher, the Dishlex Global 500 could be just what you are looking for.

The machine was designed in conjunction with the Centre for Design at RMIT and has been given both a six-star energy rating and an AAA water rating, which are both the highest possible.

The Dishlex has eight wash programs, plus an economy and half-load option. Other features are a four-stage filter system and fold-down lower dish racks to allow for large items like pots and pans.

According to Dishlex, if every dishwasher in use in Australia were replaced by the Global 500, approximately 10.5 billion litres (10.5 million tonnes) of water would be saved and carbon dioxide production reduced by 700,000 tonnes each year.

The Global 500 is available in a range of colours, including all black and all white, and is available in freestanding and built-in models.

rrp $999 to $1500

For more information, contact: Clinton Graham, Southcorp Appliances, PO Box 552, Bayswater VIC 3153, ph:(03)9721 1222, fax:(03)9720 5080.

Recycled pallets

Put simply, hardwood pallets are a terrible waste of trees! Most of them are never recycled because they are poorly made from low-quality wood, and are suitable for only one use.

The Vicfam Hygiene Pallet is not only fully reusable, it is made from recycled HDPE (high density polyethylene), making it extremely durable and totally corrosion and rot proof. This pallet is specifically made for the food and pharmaceutical industries, and can be steam cleaned or chemically sterilised without damage.

The Vicfam pallet has a static payload rating of up to 8000kg, and has four-way forklift and two-way pallet jack entry points. The pallet has a standard size of 1165 x 1165 x 150mm, and comes with a full three-year replacement warranty.

rrp $135, or can be rented or purchased over an extended period.

For more information, contact Specialised Pallets – Sales & Rental P/L, 187 Allambie Rd, Allambie Heights NSW 2100, ph:(02)9975 7758, fax:(02)9975 7759.

SolarShed

The SolarShed is a metal shed designed specifically for housing the components of an independent power system.

The shed is made from zincalum steel, and features a specially sloped roof suitable for mounting solar panels to allow them to take best advantage of the sun. Each shed has a polycarbonate window, two lockable doors, and two separate internal compartments, allowing the batteries and other equipment to be housed separately. By substituting the roofing sheets with clear polycarbonate, the SolarShed can be used as a greenhouse.

According to the manufacturers, the SolarShed is suitable for use in most parts of Australia—covering latitudes from 13° to 45°—except for the very northern most parts of the country. The SolaShed is 2522 x 3645 x 2640mm high, and weighs around 250kg.

rrp $1800

For further information, contact SolarShed, PO Box 156, St Albans VIC 3021, ph:(03)9390 2613.

What a chair!

If you have to sit in front of a computer or behind a desk all day, then having a chair that is comfortable is very important.

Looking like something from a Batman filmset, the Aeron Chair, by Herman Miller has been designed to fit exactly to each individuals body shape, greatly reducing fatigue and improving sitting posture.

There are three sizes available, to fit virtually anyone. They have many adjustments, including height, tilt tension, forward tilt, adjustable armrest positions and an adjustable lumbar support.

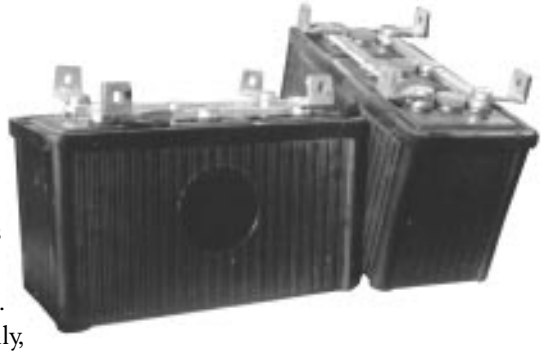
The seats are made from materials that breathe to increase comfort, and are available in 12 colours, while the base and frame are available in two colours.

To add ethics to style, the chairs also make use of recycled materials, with the bases being made from recycled aluminium, and the frames from recycled plastics.

rrp from around $700

For more information, contact Herman Miller Australia Pty Ltd, 33 Russell St, Melbourne VIC 3000, ph:(03)9654 5522, fax:(03)9654 5969.

Deep-cycle batteries



Ariel Batteries, of Clifton Hill in Victoria make a range of deep cycle batteries suitable for RAPS and other applications.

Their latest design is a 720 amp-hour, two-volt cell aimed specifically at the independent power supply market. The cells have such features as 1/8 inch thick, low antimony plates to reduce gassing, a large acid reservoir, and glass fibre separators between the plates to improve strength and cell life.

The unit actually consists of three 240 amp-hour cells connected in parallel. This allows the three cells in this unit to be removed and replaced individually, should the need arise.

The cells have an expected life in RAPS applications of around ten years, though this will depend on the depth and frequency of discharge. The cells are designed to be connected by bolting their terminals together, thus eliminating the need for cables between cells. Dimensions of the cell are 390L x 170W x 260H (including terminals), and they weigh around 35kg.

rrp $220

For more information, contact: Ariel Batteries, 660 Smith St, Clifton Hill VIC 3068, ph:(03)9482 1828.

New Selectronic sinewave inverter

It seems there are more small sinewave inverters entering the market all the time. Selectronic Australia, manufacturers of the SA series sinewave inverters, now have a much smaller unit available for those who just don't need 1200 watts or more of continuous inverter power.

The new inverter has been designated the SE10, and has a continuous output power of 350, with a maximum surge capacity of 1000 watts, which should be enough to start most appliances with smaller sized motors, including fridges. The SE10 is available in 12, 24 and 48 volt versions, which should cover the vast majority of independent power systems.

Other features of the inverter are adjustable demand start and reverse polarity protection, and it also has a DC volt meter. The SE10 weighs around 4.6kg, and comes with a two-year warranty.

rrp $720 plus sales tax

For further information, contact Selectronic Australia on ph:03)9762 4822, email: sales@selectronic.com.au

Solar water purifier

Many places in the world rely on groundwater for agriculture and domestic uses. The trouble is that this water is usually mineralised, and often too salty for use.

The Solarflow Solar Powered Brackish Water Purifier contains a reverse osmosis water filtration system, a 120 watt solar panel and optimiser power supply, and an optional ultra-violet light (UV) steriliser unit.

The system is capable of producing up to 400 litres of drinking water per day by removing both dissolved salts and water-borne particles. By reusing water flowing through the system to help drive the pump, dependence on solar power is reduced. This represents a significant cost saving.

Westwind say that the purifier has attracted a lot of interest from developing countries and rural Western Australia.

rrp $6188 for the purifier system, $1538 for the solar panel/optimiser, and $750 for the optional UV steriliser. (not including sales tax).

For more information, contact GP and GF Hill, 29 Owen Rd, Kelmscott WA 6153, ph:(08) 93995265, fax:(08) 9497 1335, email: venwest@iinet.net.au

Local Suppliers' Directory

National

Westwind

Wind Turbines

2.5kW $7,025
10kW $21,250

Charger/Controller

2.5kW $2,560
10kW $3,625

GP & GF Hill Pty Ltd
Manufacturer
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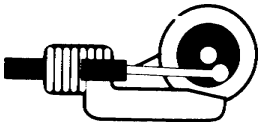

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PO Box 674 Moe 3825 Mobile: 019 932 444

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Mobile: 0417 736 737

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Classifieds

Classified advertising is available in ReNew. The cost is $30 for up to 30 words. Classified advertising is free to Alternative Technology Association members. Send Your adverts to: ReNew, 247 Flinders Lane, Melbourne VIC 3000, ph:(03)9650 7883, fax:(03)9650 8574.

For Sale: Selectronics Silver Series SPI 1500-SS 24 volt inverter (mod. sine wave). Excellent condition, with handbook. $1000. Ph:(03)5341 7807, 018 501 891.

Inverter: 24VDC to 240VAC. Selectronic SA30. True Sinewave, excellent condition. 12 months use. 3000W ½hr, 6000W maximum surge. $2,200 ono. Ph:(06)236 8385.

Battery Bank: Exide Energystore (6RP1000), 24 volt 500 amphour battery bank. Little use. Good condition. Large enough to run a house. Currently located in Melbourne. $1950. **Inverter:** 24 volt 1800 watt modified square wave, built by Butler Solar. Rugged and reliable. $500. Phone Mick on (03)9383 5775.

12 volt fluoros: 20 watt. Includes light fitting, inverter and tube. $25 ea. Also low voltage light bulbs, BC base, assorted wattages, 12 24, 32 and 110 volts. Cheap. Also **Electric scooter**, 12 volt. 3 wheels with seat. Forward and reverse Works well. $150. Ring (03)9386 9511.

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Advertisers' Directory

This new section has a number of purposes, the main one being to squeeze in items that didn't fit in anywhere else

Corrections from issue 60

In an effort to stay off the ABC's *Media Watch* program, we would like to point out some errors that appeared in the previous issue. Many were pointed out to us by astute readers, whom we thank for taking the time to write or call. We apologise to any individuals or organisations affected by these errors.

On page 12, a piece on BP Solar in the Phillippines was headed 'BP Solar in Indonesia'. It should have read 'BP Solar in the Phillippines'.

On page 17, the phone number for Leaf Eater water diverters was incorrect. The correct number is 1800 067 744.

On page 20, some of the red lines denoting positive wiring in the Watson's system diagram did not print. The missing cables can be traced through the bridges in the black, negative cable lines.

On page 27 the contact details for Nature Loo were incorrect. The correct details are: PO Box 1213 Milton Queensland, 4064. email: natloo@ozemail.com.au

In the introductory paragraph on page 30, Maureen Ford was incorrectly identified as 'Margaret'. We would like to make it clear that the mistake was made by us, not Maureen's husband, Harold.

On page 34 the photograph of the photovoltaic array should be credited to Western Power. The photo's caption on page 35 incorrectly states that each array produces 20 kilowatts of electricity for a total of 320 kilowatts. Each tracker supports 16 panels with an 85 watt nominal rating, and the whole system has a peak of 21.7 kilowatts.

On page 60, the advertisement for Battery Energy was missing the black plate. The advertisement appears in full in this issue.

On page 71, in the second paragraph of the first column, battery rating is given as 'about 500 cycles or more for a 10 percent depth of discharge'. This should have read 'about 5,000 cycles or more for a 10 percent depth of discharge'.

Glossary goes online

The glossary that appeared in the previous issue is not finished! It is now part of our web site (http://www.ata.org.au/glossary.htm to go there directly). Readers are invited to send in suggestions for new glossary items. Thanks to those of you who have already made contributions, they should appear on the web site soon.

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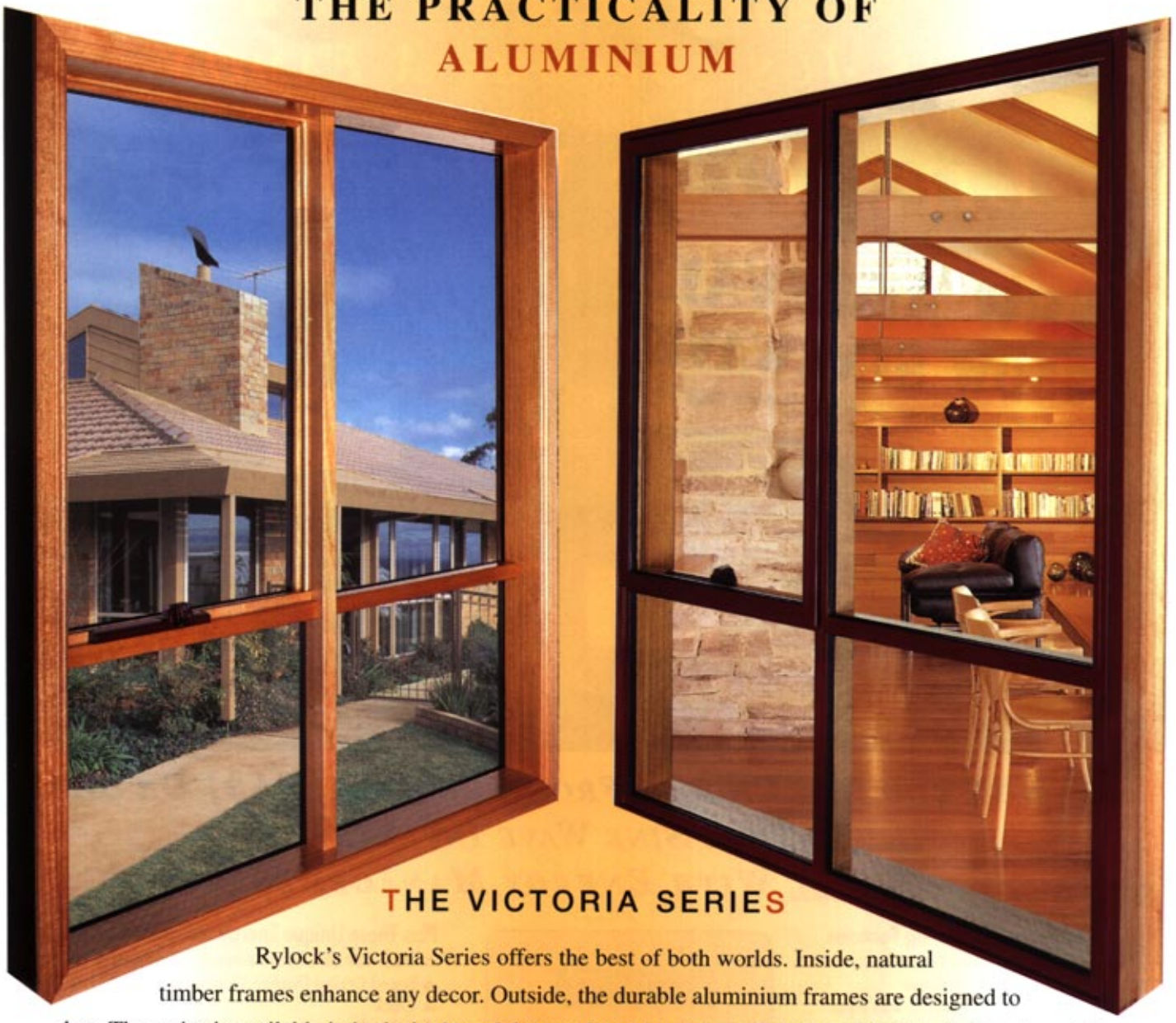

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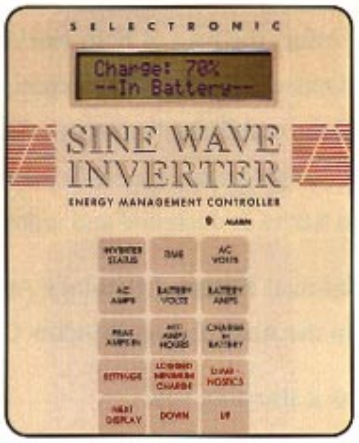

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