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ReNew

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Sydney's solar Olympic village

Make your own house paint

Monitoring your power system

Greenspeed recumbent test ride

Green power in Australia

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Issue 64
Jul-Sep 98
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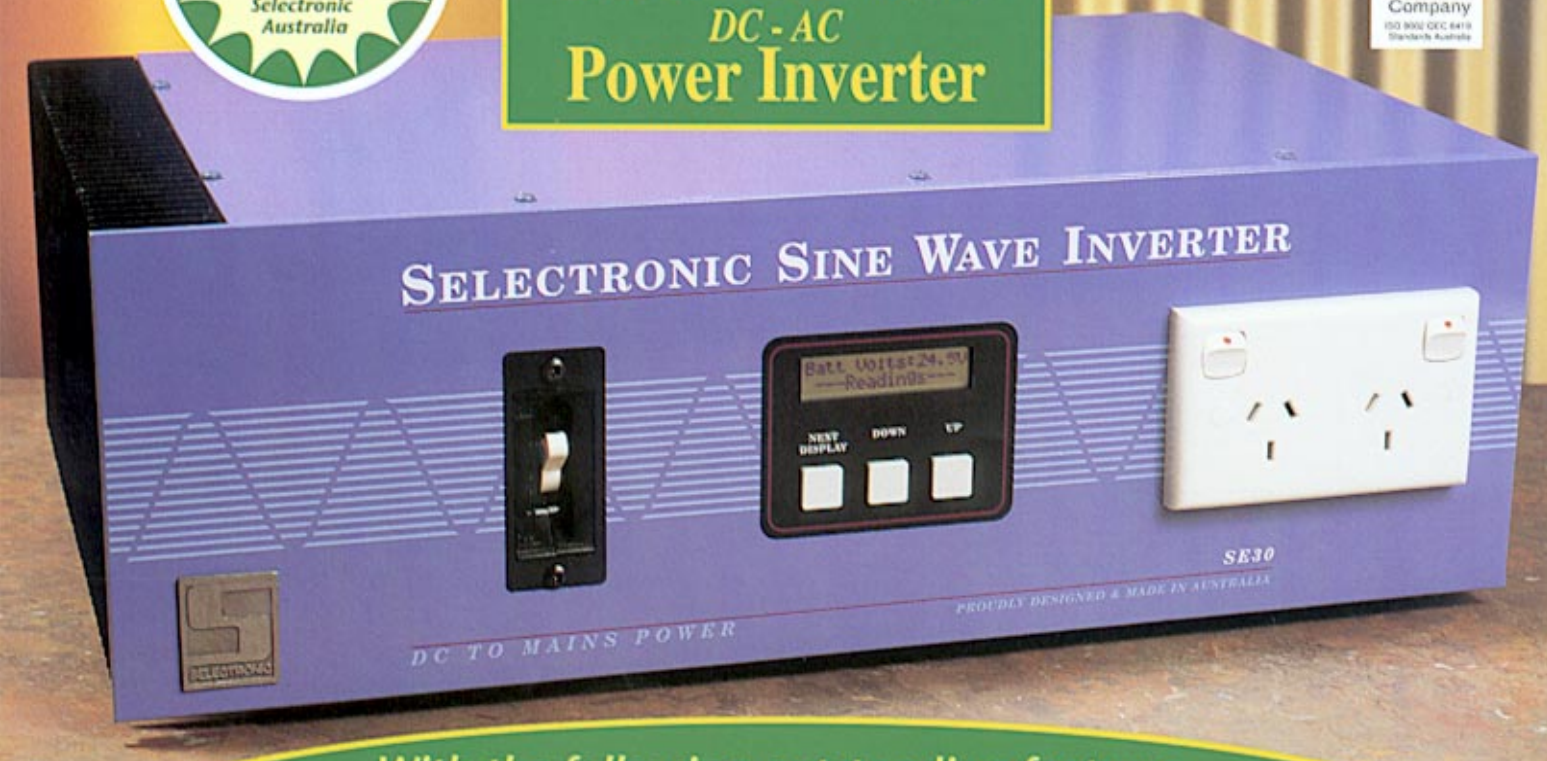

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SPECIFICATIONS

PART NO	VOLTS	AMP HR CAPACITIES* 20HR	100HR	APPROX WEIGHT KG	OVERALL DIMENSIONS MM LENGTH	WIDTH	HEIGHT
FLOODED							
7G	6	190	210	26.9	260	181	276
9G	6	215	239	28.8	260	181	276
8C6V	6	330	366	44.2	298	178	365
8L16	6	370	420	51.2	298	178	419
8KFS	12	135	150	35.8	346	171	292
9C12	12	228	253	57.5	394	178	362
GELTECH							
8G27	12	86.4	98	28.9	324	171	251
8G310T	12	97.6	108	32.0	329	171	240
8G4D	12	183	210	58.9	527	216	254
8G8D	12	225	265	72.9	527	279	254
8GGC2	6	180	198	31	260	181	276

* NOMINAL

FOR GELTECH ALL RATINGS ARE AFTER 15 CYCLES AND CONFORM TO B.C.I. SPECIFICATIONS.

IMPORTANT CHARGING INSTRUCTIONS: WARRANTY VOID IF OPENED OR IMPROPERLY CHARGED. Constant under or overcharging will damage any battery and shorten its life! Use a good constant potential, voltage-regulated charger. **For 12-volt, batteries, charge to at least 13.8 volts but no more than 14.1 volts at 68°F (20°C). For 6-volt batteries, charge to at least 6.9 volts but no more than 7.05 volts at 68°F (20°C).** Do not charge in a sealed container.

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features

Geoff Kilminster with the solar panels and wind turbine that provide electricity to his house in Warrnambool.
Story page 18

We test ride the ultimate eco-tourism vehicle, the Greenspeed Recumbent Trike...page 66

Photo: Courtesy energyAustralia

The cover: A 200kW photovoltaic array at Singleton in New South Wales. The array feeds electricity into the mains grid, which is sold to participants in electricity retailer Energy Australia's Greenpower scheme. New South Wales householders can opt to pay extra for their electricity to ensure that an equivalent amount is generated from renewable sources. For more information about subscribing to Greenpower, contact the Sustainable Energy Development Authority on (02) 9291 5260.
In this issue of *ReNew*, Alan Pears looks at the the future of sustainable energy in Australia and the role Greenpower will play in it. See The Pears Report on page 48.

regulars

About ReNew

Formerly titled *Soft Technology*, *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.
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editorial

A few issues back we ran an article by Bob Fuller about global energy equity. Bob's article included a pie chart of the average Australian's annual energy budget, which showed that 22 gigajoules are used for transport, 7 for electricity, 15 for gas, and 200 for 'indirect' uses that are outside our immediate control, such as infrastructure, agriculture and manufacturing. I think about the chart a lot, and by concentrating on different sections of it, find that it is a useful way to measure and reduce my personal contribution to global warming.

Each issue of *ReNew* looks at different sections of that chart, and how each of us can reduce our personal greenhouse gas contributions through decisions about how we live. In this issue there is another article from Bob Fuller (page 28) about one of the larger slices of the pie; transport. His *freedom diary* is a personal evaluation of life without a car, which anyone who is contemplating giving up their car will find inspiring. The transport theme is also followed in our review of the Greenspeed recumbent Touring Trike on page 66. I was lucky enough to ride the Greenspeed, and it has changed the way I think about cycling.

One of the items classed as 'indirect' in the chart is food production. Getting food to our tables is an incredibly costly exercise in terms of energy consumption. But a look at the statistics quickly reveals that a western meat-based diet is a far worse offender, in terms of energy and other resources consumed, than a diet based on vegetables and grain. When it comes down to it, all of us are solar powered, and animals simply aren't an efficient way of converting the sun's energy into food. At the time I became a vegetarian, around six years ago, I was persuaded by the arguments in a book called *Animal Liberation* by Australian ethicist, Peter Singer. For this issue I asked Peter Singer himself to address the issue of meat and sustainability, and he has obliged with a typically forthright analysis.

Introducing new ideas that challenge the way things are usually done is famously prone to resistance. The spread of renewable energy technologies across the globe has been meeting such resistance for decades now, and astonishingly the resistance continues in Australia today. It seems to come from institutions more than individuals, which is hardly surprising given the large number of Australians who are now aware of and support expanding the use of renewable energy. In this issue we look at a family who encountered institutional resistance to installing a renewable energy system for their home. The Kilminsters didn't exactly lose the battle against their electricity utility, but they were obstructed and compromised in reaching their objective (see page 18).

In his column, Alan Pears also looks at institutional barriers, but on a larger scale. Will Australia have a meaningful sustainable energy program in the near future?

There are many more articles that relate to each of our 'personal energy pies'. We look at what's new with sinewave inverters in our buyer's guide, check out an exciting new renewable energy project—the building of the Olympic athletes' village in Sydney, and look at investments that consider the environment as well as profit.

Happy reading.

Michael Linke

A fix for noisy wind turbines

I read that Michael of New Zealand (*ReNew* issue 63, page 44) is not pleased with the noise level from his Air 303. I would suggest to Michael to get in touch with the manufacturer in Arizona in the USA or his local agent and purchase the new blades marked with four dots near the boss end of the blade.

These blades are much stiffer and slightly heavier and exceptionally quiet. They don't trumpet like an elephant at high speeds.

My replacement blades were $US75 plus postage and handling 12 months ago.

Chris Harris, Coolbellup

The right angle for solar hot water panels

I have been following with interest your campaign for a Hot 100. Perhaps we could play on the Government's micro twinge of greenhouse guilt and get them to legislate for compulsory solar hot water for all new buildings—say 100 litres for each bedroom and 10 per cent of the total bedroom floor area of collector! Then perhaps we could start to talk about a Hot 2000 for that very significant year.

I would also like to make a small contribution to the discussion of mounting angle. Our household of two is on an exposed coastal site in southern Victoria. We knew that we would be dependent on solar hot water and took the best advice that we could find. We thus have a section of roof over the stairs that faces north and is angled at latitude plus ten—big mistake.

With 700 litres and twelve square metres of collector area we have oodles of hot water in summer with zero 'boosting'. With no reticulated power our alternative input is a slow combustion wood stove which does not switch itself on overnight, or by a thermostat—the trigger is a cold shower! The stove is not used in summer but we cook and heat the house with it in the winter and get plenty of hot water. The cold showers occur mainly in autumn, and occasionally in the spring. It is thus at that time of year that we need the best from the solar.

As a result of this experience I have moved half of the panels to another roof at a lower angle—a sort of bad compromise! We now seem to run for six to eight months without needing to light the stove to heat water (that is not to say that we do not light it occasionally for heating). For the rest of the year we generally light the stove for three to five hours each day.

A solar/wood setup works very well but the mounting angle should be as Ross Horman (*ReNew*—issue 63) recommends—latitude or a little less. One other tip: two tanks in parallel to increase the capacity works well.

Harold E. Ford,
Toora North 3962

Battery woes

I would like to congratulate the ATA for producing a very useful and informative publication. I have been an avid reader since its arrival in WA. I particularly enjoy the buyers' guides to renewable energy equipment. It is exciting to see all of the wonderful new products becoming available, however I am not completely confident that all manufacturers and suppliers realise the true application of their products.

In July 1997, we decided to update our tired ex-Telecom batteries. We spent over $2500 for a new GNB exide 670 amp-hour, 24 volt battery bank. After ordering the batteries, we were told to expect an eight week wait before delivery as the batteries are only manufactured when ordered, to save batteries sitting in the factory not being charged. We accepted this in the hope of receiving a good quality product.

It was an exciting event when the new batteries finally arrived. We have a second battery bank, comprising of flooded nicads, that is used for heavy loads, in theory extending the lifespan of the new (lead-acid) batteries.

The batteries performed well for two months of 'light duties'. Then disaster! One of the new battery cells died. It read zero volts when tested and would not accept a charge. I took the offending cell back to my supplier who informed me that there were no problems and that it would be replaced under warranty.

That was over five months ago and we still haven't received our replacement battery. I can't get any straight answers as to the whereabouts of the missing cell besides 'Don't worry, it's on the way'.

This has left me having to charge the remaining batteries, in two 12 volt banks—swapping a cell to make up 12 volts in each, via a battery charger powered by a petrol-driven generator. This is not how I imagined our solar powered system to become after an upgrade. We also added another 160 watts of solar panels to the system.

An independent power system is just that, independent. When a component fails in an IPS, the whole system fails. It is not just a hobby down in the back shed.

Unfortunately, this is not an isolated case. I know a family in this area with a large independent power system. The house is totally 240 volt powered through an inverter. When this locally (WA) made inverter broke down recently, they were left with no power for three weeks while it was repaired under warranty.

I have been involved in using renewable energy for over ten years now. I will continue to support the development and use of sustainable energy sources but if these types of power systems are to become mainstream instead of 'alternative', there has got to be better backup

and understanding from manufacturers and suppliers.

Keep up the good work.

James Duddles,
Kendenup 6323 RMB 416

Web site a hit

I think you have done a great job with your web pages. I was a bit disappointed when a search of the web using 'solar energy' and 'made in Australia' turned up no hits. But then, while searching through an energy contacts list on a US site, I found a link to your page.

Did you realise that by 'windowing' the sites (in frames) from all the links that you provide, you give the impression that the information on these sites is either yours or that you endorse all information and links from that page? Perhaps you should be a little more selective with the frames.

Your use of frames to leave a menu on the side of the screen is a great idea and you use it most effectively. Keep up the good work.

Graham Miller,
Kenilworth Qld, graham@gmcs.com.au

Thanks for the comment Graham. We have changed our web site so that clicking on a linked site opens it in its own window.

—ML.

Batteries and greywater

We've just discovered your magazine some two weeks ago and we find it very interesting reading. Lots of useful information.

We would like to know exactly what kind of problems to expect from a battery bank in a wind and solar system when you leave it unattended for some months (when going on an extensive holiday, for instance).

If you shut down the system the batteries will go flat; or leave it on with a minimum number of appliances going the batteries might either overcharge or go flat depending on the weather (a lot of wind or sun and a possible overcharge or little wind or sun and a possible discharge, if not both) and this will shorten their life.

Is there a good answer to this problem? We are in the process of designing our wind system at the moment with possibly some solar panels later if need be. We want to make sure that we get the right equipment from the word go and it is not all that easy with so much choice and every maker claiming their product is the best. How can you tell?

While I'm at it, I might as well ask question about another little (smelly) problem. We live on a large block of land, two thirds of which has to be regreened. We started planting some 360 trees last winter and since we only have rainwater we have to be very careful how we use it. We are using all our greywater, except that from the toilets, to water those trees. All the water goes through a grease trap and from there into a trough (about 500 litres). When that trough is full we pump it up the hill to a 1600 litre tank and from there onto the trees.

Is there a simple solution on how to clean both grease trap and trough? A lot of muck comes through and accumulates on the bottom. So far, my husband has cleaned this stinking mud by hand with a shovel. Is there a better, healthier way?

Evelyne Wagnon, Streaky Bay SA

You should not experience any problems with your battery bank when you are on holiday provided you have a good regulator in your system. The regulator should keep the batteries properly charged without overcharging them.

Water loss from the batteries should not be a big problem if the regulator is set to float charge

the batteries only and not give them an equalising charge while you are away. Definitely do not leave any appliances running while you are away, this is courting disaster. To be on the safe side, disconnect your inverter, if you have one.

As for which components you should be using, you will need to shop around, talk to different people, ask the suppliers for the names of a few of their customers that you can talk to.

The solution to your greasy sludge problem is basically to redesign the greywater system. There are a number of options available, including a reed-bed system. The ATA sells a good introductory book on the subject of designing systems called Not Just Down the Drain. Details can be found on page 60.

—LT.

Self installing—a right?

Whilst it is not my intention to use this magazine as a political forum I feel I must reply to Jeff Webb and his comments on my previous letter, (*ReNew* issue 62). My letter was not about standards per se, even though standards are the bottom line, but about rights of people to do their own work in relation to extra low voltage (ELV).

ELV presents no problem if the installer follows the guidelines, and these guidelines were set many years ago and ELV is still the same now as it was then, a volt is still a volt and an amp is still an amp. It is not a dedicated science to bring the two together, but some people have been blinded by the push of self interest by industry and others to regulate ELV installation and place it in the hands of the few.

Some of the biggest and most costly blunders I have seen in ELV installations have been made by so called qualified installers. Standards have a rightful place, but when standards become oppressive regulation it is just not on!

Many of us out there in ELV land have some knowledge or know where to look for it, so Mr Webb, don't condemn us for wanting to do our own thing, some day in the not too distant future you may find yourself restricted by standards that have become regulations.

J E Allott, Wolvi

12 volt computing

I run several computers in my home office as part of my occupation. I am currently investigating uninterruptible power supplies and am finding these to be quite expensive.

I have enquired on several occasions if it is possible to hook up a normal desktop computer to a 12 volt power supply. It would be nice then to connect this in turn to a solar panel and have uninterruptible power which was also coming from a renewable power source.

However, whenever I enquire about this from computer hardware 'experts' they tell me it is not possible. I find this a little hard to believe given that I know there is a transformer in my computer, putting out various voltages all well below 12 volts. I also have a notebook computer with a power pack which is rated at 16.9 volts and 2.7 amps. Is it true that 'it can't be done', or does it just reflect a lack of knowledge about alternative energy issues amongst computer hardware people?

I would be interested to hear if any of your readers have done this, or tried to do it and failed. Perhaps, if there was enough interest, it could even make a good 'how to' article for those of us who are not afraid to open up a computer and move bits around, but are a little weak in the volts/amps/ohms area.

Rob Hills, rhills@ozemail.com.au

The real oil supply problem

The letter in response to my article by petroleum geologist Ian McPherson states that 'oil', including what is known as non-economic reserves, is plentiful. I agree that oil will never be used up, simply because there is so much of it. The real problem is that a large proportion will be too costly to extract because it is too difficult to get at or too polluting.

continued p 12

can you afford not to buy a Bergey?

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Most people think that remote power system equipment is expensive. Not surprising really, when you consider that you are buying your own complete, if small, power station.

What is surprising then, is the way many people end up buying a system not once, but sometimes two or three times, because they buy unwisely in the first place.

It makes good financial sense then to buy wisely and buy once..... and much cheaper in the long run. Not only cheaper, but you have the power and convenience you've paid for..... from day one, without the frustrations.

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ALL DIMENSIONS IN MM (25.4mm= 1 inch)

BATTERY			Wgt	Length	Width	Height	Battery	Batt.	Term-
CAT No	V	20HR	Kgs			O/T	Top	Box	inals
A2200	6	215	28	264	181	284	MONO	PP	WNT
A2400	6	230	32	264	181	284	MONO	PP	WNT
AJ250	6	250	35	299	178	292	MONO	PP	UT
AJ305	6	305	47	308	178	356	MONO	PP	UT
AJL16	6	350	56	297	178	424	MONO	PP	LT
AJ185	12	185	50	394	178	362	MONO	PP	UT
AG33	12	33	10	197	132	184	MONO	PP	ST
AG72	12	72	19	286	172	248	MONO	PP	WNT
AG85	12	85	22	286	172	235	MONO	PP	WNT
AG85	12	85	22	305	172	248	MONO	PP	WNT
AG105	12	105	24	305	172	248	MONO	PP	WNT
AG115	12	115	25	305	172	248	MONO	PP	WNT
AG130	12	130	28	337	173	235	MONO	PP	WNT

Letter of the month

The staff at *ReNew* award a solar battery charger to the letter judged most interesting in each issue. Send your letters to *ReNew*, 247 Flinders Lane, Melbourne 3000.

Wind power co-ops?

Many years ago I won a tender to purchase a second-hand Dunlite 48 volt, 800 watt wind generator from Telecom. When I got around to finding a suitable site for it, I discovered that there weren't any in my vicinity (Mildura—NW Vic). There just isn't enough wind in this area to make any sort of wind generator competitive except on the very odd occasion when a reasonable breeze is blowing, which isn't very often.

I got to thinking recently, would it be a good idea to move to the coast where there's heaps more wind? No, quite settled and happy where we are. Alternatives? Install a generator somewhere where it's very windy, feed the power into the 'grid' and take it out here where we need it. Not very feasible on a small scale.

Question. Are there enough people who would like their own wind generated electricity but don't have the wind? What is the possibility of a large number of like-minded people pooling their money and skills and installing a reasonably large (in the hundreds of kilowatt range) unit at a suitable site? The various state governments seem very reticent in this area.

Would it be feasible to:

a. Swap the power generated with a large power generating company, by putting in when the wind blows, and taking out as and when needed, with probably some charge by the power company concerned.

b. Paying the company who owns the power lines a fee to 'transport' the power to where we need it. (I can see heaps of problems here but nothing's impossible if you have the will).

How could either of these ideas work. There would be countless people 'out there' who would be keen to make money from a scheme such as this. But, whilst the base cost of coal-fired power stations is so artificially low for whatever reasons, making money from wind generators can only be a dream of the demented. However, when it comes to making electricity not for profit, but as a step in the right direction for world pollution, and a spoke in the wheel of self sufficiency, then surely there just might be enough concerned people out there to get a scheme like this up and running, here and now, with electricity prices rumoured to double or so in the not-too-distant future.

If the ATA could get together with groups like Greenpeace, and the ABC radio programs *The Science Show* and *Earthbeat*, then who knows where a scheme like this might go? Perhaps with the experience gained with the Breamlea unit, someone down there might be in a position to comment on this idea.

Now my expertise is in procrastinating, and organising something like this would be well out of my league (I've already been thinking about some scheme like this for over twelve months now and doesn't time fly.) What I would see is a committee that would have to decide how much money would be needed, and if it could be raised in a reasonable time. Would a mechanism be desirable where people could trade their 'shares' or have some other way of getting their money back if the need arose? Would there be an opportunity for people to donate their time and expertise or alternatively to 'buy' their way into the scheme for services rendered in some way or another. These and a thousand other questions would need to be addressed.

It would seem to me that if the base cost of coal powered electricity is around two cents per kilowatt-hour, and yet domestic customers are paying in excess of ten cents per kilowatt-hour, then a scheme such as this may at the very least, reduce that ten cents by some small amount to the contributors, and if that's not possible, then the handsome dividends to be gained in the pollution war should still be sufficient incentive for the growing number of people who hold concerns for their children and grand children. What thinks you?

I am a mid-fifties aged electronic technician living with my wife in a comfortable active solar heated house with no summer cooling, other than that which the occasional night time breeze affords. I am a frustrated self sufficiency dreamer and am greatly concerned at what we are bequeathing to our grandchildren. I await your reply with baited breath.

Maurice Wedlake, Buronga, NSW

Maurice, I must have had half a dozen people propose the idea of Danish-style wind energy co-operatives in Australia in the past few months. Although the Danes are better served by encouraging government legislation, I believe the conditions for this kind of co-operative will improve in Australia as more commercial wind energy ventures get off the ground. Some states, particularly NSW, would have less barriers than others because of legisation that encourages renewable energy. Getting a long term price guarantee for electricity from a wind farm without such legislation is extremely difficult. This has been one of the barriers to the proposed windfarms in the Portland area. Going ahead with a multi-million dollar investment without a price guarantee of several years is quite risky.

We will run an article on the prospect of wind energy co-operatives in an upcoming issue of ReNew.

—M.L.

The information I used on reserves comes from a group of petroleum geologists and other oil industry experts around C J Campbell. His book *The coming oil crisis* published by Multi-Science publishing (1997) is my bible on the topic. The Australian author of the book *The Decline of the Age of Oil*, Brian Fleay, keeps me up to date with oil journal articles.

I have on file fifty or so papers on oil production and consumption in the developed world but there is very little written about the future needs of some of the most populous poor countries who have not got any oil of their own. My article was about what happens when we run out of easily extracted 'cheap oil', as billions of people depend on 'cheap oil' to power assist their labour intensive food production. My concern is the long term human consequences in a world with 80 million more mouths to feed every year for the next 20 years.

The age of cheap oil is rapidly coming to an end simply because cheap oil is now being used up nearly four times faster than it is being discovered. I remain to be convinced that the remaining reserves of 'cheap oil' will not be wasted by increased and unnecessary motorisation in the developed world and that hundreds on millions will not starve as a consequence. Most important of all, our attitude to oil resources needs to change so that we can empower ourselves to use oil in a much more sustainable way to create a new 'solar civilisation'.

Alan A Parker, Footscray Vic,
alanpar@ozemail.com.au

Washing stones

I noticed in the most recent copy of *ReNew* (issue 63) an advertisement for some 'ceramic washing stones' in which it was claimed that they contained 'ceramic beads' which 'react with water to remove dirt'. The main reason I noticed this was that I had just finished reading a review of detergents in the ACA magazine *Choice* (I don't know which edition).

In the Choice article, they also reviewed a number of 'environmentally friendly' products like the one mentioned above and found that they were no better at removing dirt than fresh water.

You may like to do your own tests on such products to help provide *ReNew* readers with objective information about them. I am as keen as anybody to reduce the impact my grey water has on the environment, but I would prefer not to be separated from my hard-earned pennies by peddlers of products which simply don't perform.

Please don't interpret this as criticism of *ReNew* for running the ad. I realise that you guys can't check every product that is advertised in your publication.

Rob Hills, Waikiki, WA

Rob, I have been using the washing disks advertised in ReNew for the past six months, and liked them so much that I bought a set for my mother, whose greywater goes directly on to her top paddock. While I don't claim to have run the same mass spectrometer tests that Choice did in their tests, something has been cleaning my clothes for the past six months. It is true that the Cleantec disks don't get out tough stains or get whites extremely white, and on a few occasions I have added detergent to the wash. But our household has avoided using several kilos of detergent in that time by substituting the Cleantec disks. It is worth noting that the Cleantec disks were not included in the Choice test, which measured the brightness of fabric samples before and after washing. I use my nose, which is quite adept at differentiating between clean and dirty socks! To date the Cleantec disks have performed well in my odour removal tests. If you contact them directly, Cleantec will also supply you with copies of tests that they claim were performed by an independent laboratory.

We are giving away three sets of the disks in our limerick competition (details on this page), so sharpen your pencil and you can test them for yourself.

—M.L.

Write a laundry limerick and win a set of washing stones

We are giving three lucky readers the chance to try the Cleantec ceramic washing stones, which use a sack of alkaline ceramic beads encased in plastic to clean clothes.

To win a set, all you have to do is write a limerick that involves sustainable technology, though a greywater theme will be looked upon favourably. A limerick is a five line verse where lines one, two and five rhyme with each other, and lines three and four (which are shorter) also rhyme. Below is a simple one we came up with to get the ball rolling.

There is a magazine called *ReNew*
That's full of good things to do
So, go on, subscribe
If you've got a good vibe
And we'll post it straight out to you!

Send your entries to *ReNew* Greywater Comp., 247 Flinders Lane, Melbourne 3000 by July 30 to be in the running.

Whitecliffs revisited

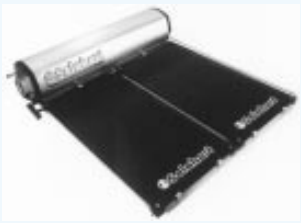
There hasn't been an issue of *ReNew* in recent times without a new Greenpower renewable energy project to announce, and this issue is no exception. The latest one is at Whitecliffs in NSW, known for its 25 kilowatt solar thermal dish concentrators. The dishes have been inoperative for several years, but have been refurbished with photovoltaic concentrator technology, and will be feeding electricity into the grid soon.

Victoria's first wind farm on hold, for now

The fate of a 20MW wind farm proposal for Cape Bridgewater and Cape Nelson on Victoria's coast now depends on the outcome of a hearing at the Administrative Appeals Tribunal. The Tribunal will meet in June to assess objections to the project, with a ruling not expected until September or October.

Coming to a town near you... Greenpeace's Solar Kitchen is an impressive display of solar electricity in a domestic application. It is currently touring Australia, and is pictured here in Swanston Street, Melbourne as part of the Moomba festival.

The lucky winner of our Solahart Black Chrome XII competition is Andrew Bock from Ferntree Gully in Victoria. Andrew's nine year old hot water service is just about due to break down, so he was over the moon about winning the Solahart. Andrew got the news just before Mother's Day, and he said that he and his daughter would be giving his wife, Kerri, the best Mother's Day present ever. Our thanks to Solahart for supplying the prize, which is valued at $4,200.



The proposed wind farm will have around 30 turbines, each 600kW, and is expected to generate 70 gigawatt-hours per year. It would be the largest single renewable energy project in Australia, and would triple Australia's wind energy capacity. A successful tenderer to supply the turbines will be announced in June, and purchasing contracts for the electricity are still being negotiated.

International Solar News, April 1998

EnergyCard no more

The EnergyCard program, which allowed participants to purchase insulation and solar hot water systems at low interest rates is no longer being funded. The Federal government came under attack from the Sustainable Energy Industries Council of Australia in 1996 when it ceased promotion of the Energy Card with $1 to 2 million left in the annual promotion budget. This may well may be a small amount compared with the money still in the EnergyCard's current budget. No doubt the Howard government will spend it wisely!

The ultimate solar hot water booster?

Gas is arguably the cleanest and most greenhouse-friendly boosting fuel for solar water heating systems. Electric boosting often creates more greenhouse gas than a standard gas water heater *without* any solar input. Up until now, the only gas boosting option has been storage gas boosting, where the solar heated water is boosted in the main storage tank.

Storage water heating presents an efficiency problem, in that a lot of energy is wasted just keeping the water at a set temperature. A more efficient way of boosting is to use instantaneous, or on-demand heating, where the solar heated water is brought up to a pre-set temperature by a gas booster. In Australia there is currently no commercially available domestic solar water heater with instantaneous gas boosting (although large commercial units are available). That could change soon though, as Beasley Industries in South Australia have obtained a grant from the State Energy Research Advisory Centre for $37,500 to develop just such a unit. Beasley are being tight-lipped about the project, but we'll keep you posted with developments.

Sydney to Melbourne in three hours...by train?

A new inter-city high speed train proposal has been announced for Australia, and this one has the potential to overcome the environmental concerns created by previous projects. The 'Transrapid' system involves the train levitating on a magnetic 'cushion', so there is no contact between the train and

its track. According to the consortium promoting Transrapid, this means far less noise and vibrations than conventional high speed trains. Because the track is elevated, it also means that wildlife can safely travel beneath it.

The Transrapid proposal is currently being evaluated by the NSW, ACT and Federal governments, and the first stages would include links between Paramatta, Sydney's CBD, Wollongong and Canberra. The proposal suggests greenhouse gas savings of 83,000 tonnes per annum from a reduction of 9,000 vehicle trips per morning on the proposed routes. Travelling at speeds up to 550km/h, the Sydney to Paramatta trip is estimated at 10 minutes, Sydney to Wollongong at 22 minutes, and Sydney to Canberra at 59 minutes. Future extensions to Melbourne and Brisbane are also proposed, each with estimated travel times of around 3 hours from Sydney. While we don't have any hard data on the energy required to build the steel and concrete track, or the electricity required to run the Transrapid, we would be willing to bet money that it is more greenhouse-friendly than air travel.

Transrapid media release, 14 April 1998

Another Australian solar efficiency record

The University of New South Wales has set two new world records for photovoltaic solar cell efficiency. A polycrystalline cell from the centre recorded a 19.8 per cent efficiency in converting sunlight to electricity, while a monocrystalline cell achieved 24.4 per cent efficiency.

The polycrystalline cell record is approaching the theoretical conversion efficiency of 20 per cent for this type of cell, and according to Martin Green, director of UNSW's Photovoltaic Special Research Centre, the laboratory achievement will mean greater efficiency in Pacific Solar's commercial cells. Pacific Solar is a joint venture between Pacific Power and UNSW's technology development company, Unisearch. Pacific Solar aims to have its first full scale production plant running by the end of the year 2000.

Australian Energy News, March 1998

Sustainable technology is everywhere! This Clivus Multrum composting toilet system is one of many that are cropping up in rest stops on the Hume Highway between Melbourne and Sydney. The roof collects rainwater in a tank for washing hands, while the solar panel charges a battery for lighting at night, as well as powering an exhaust fan. The main chamber faces north, and has a transparent lid to let the sun in and speed up the decomposition process.

Wood heaters and pollution

Melbourne's air is being filled with deadly small particle pollution from wood fires, which are catching up with cars as a major source of winter air pollution. The Australian Academy for Technological Sciences and Engineering recently released a report recommending that open fireplaces be banned from new urban buildings.

Victoria currently allows the sale of wood heaters that do not conform to the Australian design standard for smoke output, which means the problem is not likely to improve in the near future.

The Age, 29 April 1998

Green homes for NSW

New South Wales could soon have a uniform sustainable building code. The Energy Smart Homes Program has been on trial with 21 councils, and will now be open to the remaining 136. It offers councils an energy efficiency housing policy, which they modify to suit local conditions. Assistance and training is available to the councils in tailoring their policy, and both the framework and assistance is paid for by the State Government.

The program will cost $2 million, and is expected to avoid 250,000 tonnes of greenhouse gases each year. The program is being administered by the Sustainable Energy Development Authority. Residents in participating councils will be eligible for a $500 discount on the price of selected solar and heat pump water heaters.

NSW Govt. press release, April 1998

Straw bales and solar

Choosing the technology to make your house more resource-efficient can be a daunting process. Michael Linke introduces some of the choices he is facing for an upcoming retro-fit of his house

It has been a long time in the pipe line, but my partner Elenor and I have finally decided to finish renovating our house in inner-city Melbourne. Anyone who owns a house will probably find the idea of *finishing* renovations laughable, as there is always something that needs fixing or could be done better. But our plans have always involved extending the house, and now we're ready to do it.

Working at *ReNew*, I have been privileged to see some great working examples of energy efficient houses, and to talk with the many readers who have incorporated sustainable technologies into their homes. While I have used many of these ideas in and around the house already, there are some major projects that have been on my wish list for some time.

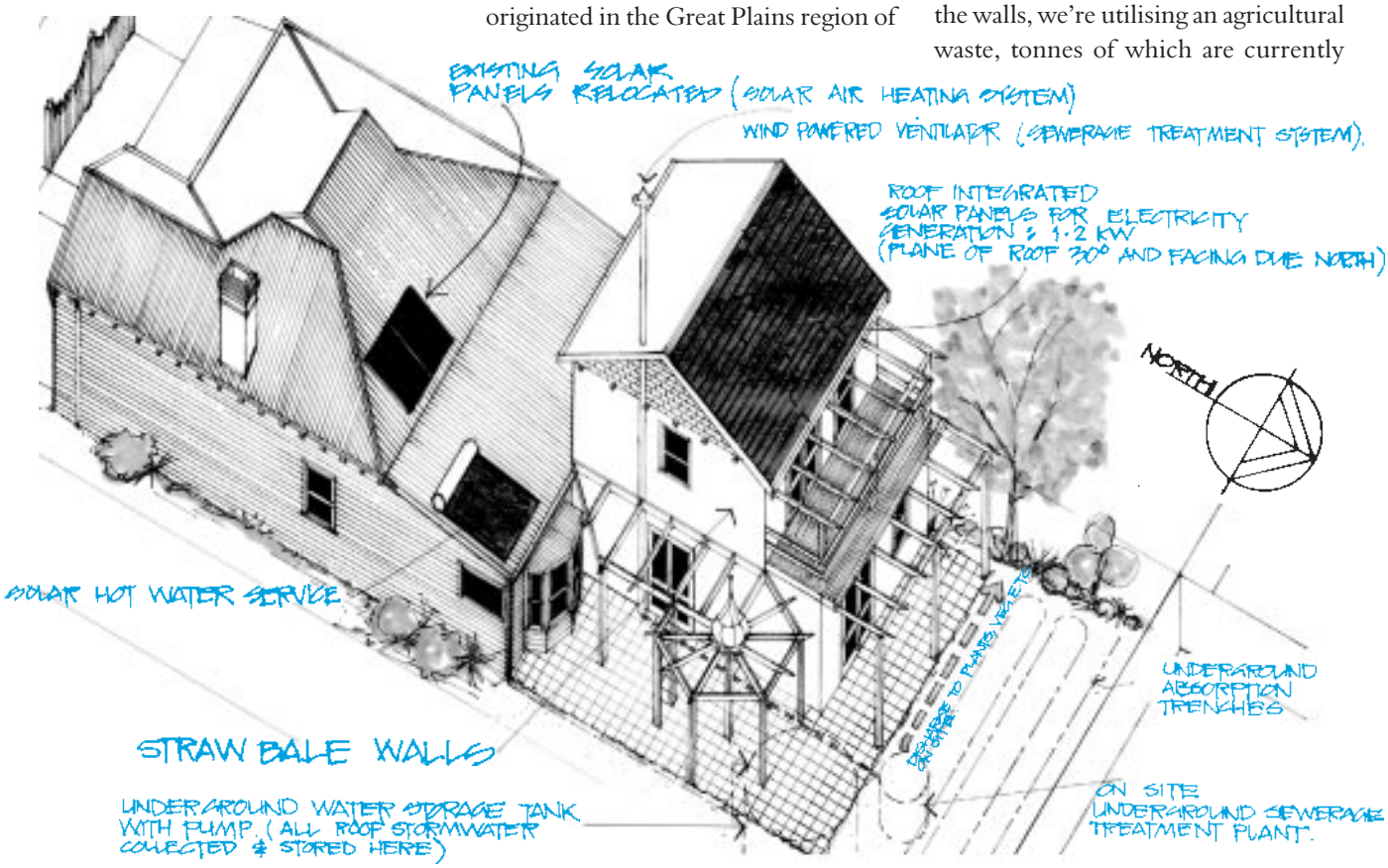
Realising that the whole process would take several years if we did it all ourselves, we enlisted the help of architect Trevor Scott, who has developed our plans to the stage where they are (almost) ready to submit to the local council for approval. The drawing below shows the existing house to the south, and the proposed two-storey extension to the north.

Building materials

We have chosen to build the extension with straw bales. Straw bale building originated in the Great Plains region of the US in the 1880s, where timber was scarce and straw was plentiful. It has become a popular idea in Australia in recent years, though to date there are not a lot of houses built in straw.

Basically, straw bale building involves laying the bales like giant bricks and rendering them inside and out with cement, lime or earth plaster. Straw buildings have many advantages, the main one being excellent insulation properties (an R5 rating or more in insulation jargon). Most of the walls in our extension will use timber framing and have the bales as infill, though on the first floor some of the bales will be load-bearing.

By choosing straw as the material for the walls, we're utilising an agricultural waste, tonnes of which are currently



burnt each year. This ties up the CO_2 that would be released when the straw is burnt, as well as avoiding the other pollution that burning straw creates. In California, for instance, it is estimated that around a million tonnes of straw are burned after harvest each year, which produces more particulate and carbon monoxide pollution than all the state's electricity generation. Of course, in a system of sustainable agriculture the straw would ideally be returned to the earth, but building is better than burning, and enough straw to build a house takes a year to grow compared with several years for timber. Recycled glass and timber, and PVC-free electrical and plumbing fittings will also be utilised.

Grid interactive solar

We have opted for a grid-interactive solar electric system, which will provide at least half of our electricity requirements. The solar panels will replace roofing material on the north facing roof of the extension, thus defraying their overall cost.

Solar hot water

I am getting tired of waiting for the old storage gas-fired water heater to kick the bucket, and I figure that while everything else in the house is in turmoil we may as well upgrade to a solar water heater. Positioning the panels is the biggest challenge, as the photovoltaic array takes up most of the premium north-facing roof space. On the drawings at the moment it is on the roof of the existing house, but we're yet to establish at what time of the day it will become shaded by the extension.

Space heating

Settling on space heating is proving to be one of the biggest challenges. Given the north-south axis of the block, we have limitations on the amount of north-facing area for passive solar heating. The existing north-facing wall is not a good passive solar design, but the extension will be, and we don't expect that any heating in addition to that provided by the sun will be necessary.

More insulation will reduce the need for heating in the rest of the house, but it will still get unpleasantly cold in the southern bedrooms. Some kind of natural gas heating would seem to be the best option, but there are several options to choose from.

A Stirling engine system that is being developed in New Zealand looks promising. It is an 800 watt combined heat and power unit, meaning that it will generate electricity, and the heat that is a by-product of the electricity generation will be available for space or water heating. The electricity generated by the engine would be more greenhouse friendly than that from a coal fired power station. The problem is that this technology is not yet available in Australia, and I want to have the heating system running this year. I also have a limited budget, and even model Stirling engines aren't cheap.

The next best option is probably an instantaneous gas-fired hydronic heating system. I have heard that an instantaneous hydronic heating system will heat a three bedroom house for a year with around the same amount of gas that a storage gas hot water service wastes in stand-by mode: that is, keeping the water in the tank up to the thermostat temperature when not in use.

I currently have a solar box heater on the existing roof (see *ReNew* issue 60), but this will most likely be shaded out by the new roof. The roof cavity may still be warmed in the mornings and afternoons though: if so I would like to get this heat into the house.

Cooling

The extension will have eaves designed to block out summer sun, and the high Victorian ceilings in the rest of the house should ensure that summer continues to be pleasant indoors.

Rain water collection

Based on Melbourne's annual rainfall and the roof area of the house after the renovation, I estimate that our house roof spills around 100,000 litres of water into storm water drains each year. This is roughly equivalent to the amount of water that four of us living in the house will use each year. Putting two and two together, it makes sense for us to collect and use rainwater in the house. Although water collected from inner-city roofs can be cleaner than mains supply, filtration and monitoring will still be necessary—there's a lot of pollution in Melbourne's air!

Composting toilet and waste water treatment

While Melbourne's sewage treatment plant at Werribee might be generating enough electricity from methane to keep itself going, there is still a lot of energy, water and infrastructure required to get our gastronomic processing wastes there. There are also several fruit trees, grape vines, an almond tree and an olive tree in the back yard that would probably appreciate some extra nutrients. So once again, there are two problems that can be played off against each other.

The solution is to install a composting toilet and greywater system, which will provide water and nutrients for our garden.

The future

While we're optimistic that our plans will be achievable, there is still a long way to go in terms of obtaining various approvals, and possibly hidden costs that we haven't allowed for in the budget. We'll keep you updated with our progress in upcoming issues of *ReNew*.

Solar struggle in Warrnambool

The Kilminster family left the city in the hope of building the grid interactive system of their dreams. Little did they know their new energy retailer was not in the habit of making environmental dreams come true

by Cable Daniel-Dreyfus

Any visitor who walked through the Kilminster's house would not be able to tell that the renewable energy system that provides it with electricity took months of planning, frustrating negotiations, re-planning and compromises. Geoff, partner Monique, and their two children left Melbourne for Warrnambool on Victoria's southern coast in the hope of living a less resource-intensive lifestyle. But instead of receiving cooperation from their local electricity retailer, Powercor, the battle was all uphill, and the end result was less then ideal.

The Kilminster's energy system is at the back of their quarter acre block. Complete with a wind turbine and solar panels, the system currently saves the family roughly 75 per cent on electricity bills annually. Although they are happy with their system, their first choice would have been to install a grid interactive system. Unfortunately, when Geoff started calling Powercor to set his plans in motion, it took him weeks just to 'climb up through the layers of bureaucracy,' to be able to speak to anyone in the company who was at all knowledgeable about renewable energy systems. He was finally put through to a marketing manager who was familiar with grid systems, but was flatly told that it would be at least six months before anyone would be able to get back to him on a formal request.

Fight the power

Powercor had two main reasons for not accommodating the Kilminster family. The first was that the company did not

Geoff, and son Max, in front of the family's sixteen solar panels and their twenty-four volt wind turbine. While the turbines 10 metre tower is not an ideal height, it is a compromise for their location in suburban Warnambool on Victoria's coast.

have a budget for installing the transformer necessary for grid connection. Their other reason was that they believed their technicians could be electrocuted while working on 'dead' mains power lines if the home system was 'live'. Yet, as Geoff points out, grid-interactive inverters are designed to automatically switch off when they detect the mains supply has gone off, thereby avoiding the risk to technicians working on 'dead' wires. In fact, in Geoff's opinion, 'interactive inverter technology is miles ahead of typical energy companies' systems, so much so that it seems the employees at Powercor are unwilling or incapable of learning about it.' Geoff describes Powercor as being 'totally uncooperative' when it comes to grid interactive renewable energy systems, which is unfortunate considering the fact that by his estimation there are at least fifty people in the Warrnambool area who would switch to a grid interactive system if Powercor would permit their installation. At a time when other electricity companies around Australia are encouraging grid interactive systems, Powercor's stance is a surprisingly backward one. (See box on page 20 to see whether your electricity utility permits grid interactive systems).

New beginnings

The Kilminsters knew that if they wanted to have a renewable energy system they were going to have to do it themselves. And so they did. Instead of a grid interactive system, the Kilminsters installed a 1100 amp-hour capacity battery storage renewable energy system which is comprised of sixteen solar panels at eighty-five watts each, as well as a twenty-four volt wind generator. Both panels and the generator are attached to the shed, in which the batteries and control equipment are located. The wind generator is attached to a seven metre aluminium pole with a three metre extension. The solar panels and the wind turbine are attached to twelve, two volt SunCycle batteries. The system supports four people: two adults and two children. A remote control attached to a low voltage wire runs from the kitchen into the main inverter to measure how many amps the solar and wind system are generating and expending. Geoff likes to keep the charge in the batteries at 85 per cent of capacity or more to prolong their useful life. When the charge drops below the 85 per cent mark, the batteries can be recharged from the electricity mains via a battery charger.

The Kilminsters chose a Beasley solar water heater because of its durable stainless steel tank. Geoff thought that because Warrnambool's water supply has a high level of dissolved minerals, a stainless steel tank would be least likely to corrode.

Improving the system

When the Kilminsters started designing the system, one of the first things they did was to estimate the energy used by each appliance in the house. Geoff believes that he was right on target with the exception of his old, power hungry refrigerator. He underestimated the daily running time of the fridge, which uses more electricity than any other appliance. Now aware of this fact, the Kilminsters have placed an order for a twenty-four volt Sun Frost fridge from Davey Industries in Barnawartha, which will bypass the inverter and run directly from the battery bank. The Kilminsters would also like to swap their electric oven for a gas one and add a composting toilet.

While the panels on the shed are angled to optimise solar input and face north, they would be substantially more efficient if they were placed on a tracker and could rotate so that they were always facing the sun. Geoff would probably invest in sun trackers before buying more panels.

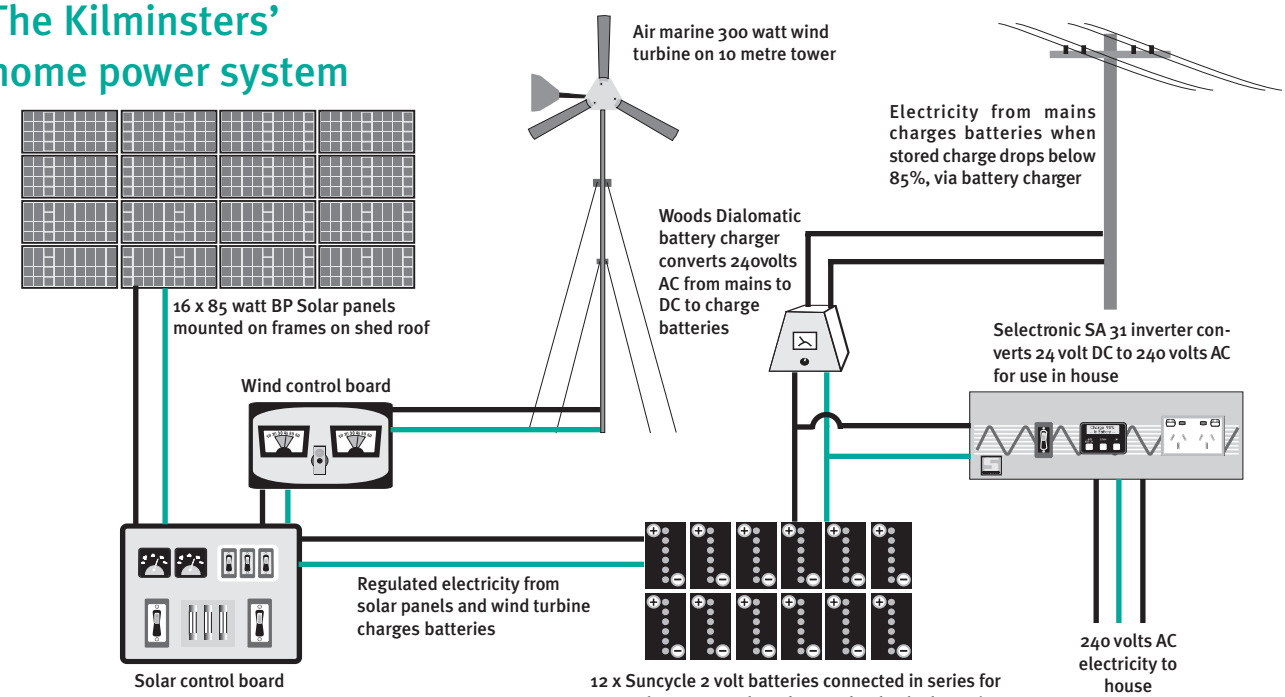
Their hot water is supplied by a solar water heater manufactured by Beasley —chosen because it offered a stainless steel tank, which they thought would be best for Warnambool's poor water quality. The family also supplement their food supply with a small vegie garden, fruit trees, and eggs from a few well-fed chooks. To help out with waste

Electricity retailers around Australia. What do they offer?

ReNew called Australia's electricity retailers to find out which ones offer grid-interactive connection, net metering and green power schemes. Net metering is a service that allows residential customers with renewable energy generators to sell the excess electricity they produce back to the utility. In effect, the meter runs in both directions. Most retailers buy the electricity back at a much lower rate. At present, Intergral Energy is the only utility that buys and sells electricity at the same rate. In this table, 'Individual Grid-connect' refers to whether or not power utilities will allow individual house connections as opposed to large scale grid interactive installations.

Retailer	Grid Interactive	Individual Grid-connection	Contact	Net Metering	Green power Scheme
Advance(NSW)	yes	yes	132795	no	yes
Aus.Inland(NSW)	building	yes	(08)8080 2444	no	yes
Australian Inland is opening a solar power station that will be grid connected at White Cliff Farm in NSW later this year.					
CitiPower(Vic)	yes	yes	(03)9297 8682	yes	yes
About to announce a scheme to encourage greater uptake of small, domestic grid-connected solar systems.					
Eastern Energy (Vic)	no	no	none	no	not yet
Eastern Energy has plans to build a wind farm, hydro electric farm, and us methene gas created from tips.					
Energy Aus.(NSW)	yes	yes	1800 807107	no	yes
Energex(Qld)	yes	yes	131253	no	yes
Energex is in the process of having their proposal for a green power scheme assessed by SEDA.					
Ergon (Qld)	no	no	(07)3228 7661	no	no
ETSA (SA)	yes	yes	none	no	no
Great Sthern (NSW)	no	no	132356	no	yes
Integral (NSW)	yes	yes	131081	yes	yes
Not only does Integral offer net metering, but also has three different green power schemes which are approved by SEDA.					
NorthPower(NSW)	probably	probably	132066	no	yes
North Power would probably allow a grid interactive system, but have yet to be approached by a prospective customer.					
Powercor (Vic)	no	no	(03)9412 5666	no	commercial only
Solaris (Vic)	no	not yet	none	no	commercial only
Solaris buys methane gas from the old Broadmeadow tip in Victoria, and offers that to commercial customers.					
The Hydro (Tas)	hydro	possibly	(03)6233 3879	possibly	hydro
Prospective customers should call the Office of Energy and Planning in Hobart before they are connected.					
United (Vic)	building	no	(03)9265 7868	no	not yet
United Energy is currently installing a grid connected solar panel system in a residential house. Details will be releasesd upon completion.					
Western Power(WA)	yes	yes	(08)9326 6095	yes	no

The Kilminsters' home power system



control, there is a worm farm in the back yard where scraps can be dumped, composted, and eventually turned into a nutrient rich fertiliser. In terms of cost, Geoff estimates that he spent around thirty-three thousand dollars on the system, comprised of $8,000 for the battery bank; $3,000 for the inverter; $800 for the battery charger; $3,000 for the high voltage electrician's labour and control box; $3,000 for the system installer's labour; $3,000 on the solar water heater and installation; $11,000 on the solar panels; and $1,200 on the wind generator. If Geoff were to have installed the system himself he could have saved money on labour, but he knew that it would have taken longer, and the results would not have been as professional. Although money is not the Kilminster's greatest concern when it comes to their energy system, Geoff is looking forward to the day when he can call Powercor and tell them, 'I'm not going to pay your bills any more!' Yet before he does this, the house is going to run one full season with Powercor on reserve just in case.

Reasons to resist

The Kilminster's reasons for switching to a renewable energy system are varied. Although cutting down on green house gas emissions was a motive, it was by no means the only factor. Geoff's view of self-sufficiency is that independence and self-reliance are among the most important virtues to cultivate. Yet, perhaps the most compelling reason is politically influenced. The Kilminster family did not agree with the privatisation of the State Electricity Commission. When Powercor went private, they were purchased by an American company. Not only was their money going off shore, but Powercor's focus was purely on supply rather than demand control. Instead of helping customers to chose wise alternatives through the power company, they are only in charge of supplying the electricity and have little interest in the method of generation. The end result was dirty electricity and no Australian profit, a reality Geoff refused to endorse.

While his son, Max, sits on his shoulders and happily taps a plastic clothes peg on his head, Geoff explains that despite the problems the family faced with Powercor, they were adamant about not supporting the power industry at present. Patient, Geoff is not only content to continue letting Max bang the peg, but has also persevered in his desire to utilise renewable energy. Geoff believes that if more and more people demand grid-interactive connections from uncooperative electricity utilities, they might make a slice of their marketing budgets available to accommodate them. Until then, the family is pleased with the system they have at present and will continue to encourage others. ⚹

Building Australia's biggest solar suburb

Preparations are well under way for the 2000 Olympic Games. The Sydney suburb of Newington will host the athletes during their stay, in what will be an impressive, high-profile display of renewable energy in a suburban setting

Story by Jane Clement

A milestone for the Australian renewable energy industry will soon be reached when the first houses and units go on sale in the world's largest solar suburb, Newington in Sydney.

Up to 665 permanent solar equipped houses will be built at Newington as part of a staged development being built

Installing solar electric panels on a rooftop of the Olympic athlete's village at Newington in Sydney. The panels to the right are for solar water heating.

All this could be yours! Around 660 houses and units will be built at Newington in Sydney for the Olympic athlete's village, and sold to the public between now and 2006. Here a new rooftop with special framing is ready for the installation of solar panels. The main stadium at Homebush Bay is in the background.

and sold to the public progressively between 1998 and 2006.

One kilometre from Sydney's Homebush Bay, Newington is the site for the Olympic athletes' village. The homes will form part of the mixture of temporary and permanent housing which will house athletes and officials in 2000. After the Sydney 2000 Olympic and Paralympic Games, the temporary dwellings will be removed, while the permanent dwellings inside the Olympic village will be occupied by owners. The remaining areas will be developed in accordance with market demand.

The first stage of the development, which lies outside the Olympic village, will allow residents to remain in their homes before and during the Games.

The $470 million Olympic village is being developed by Mirvac Lend Lease Village Consortium (MLLVC). An agreement between the Consortium, Pacific Power and the Sustainable Energy Development Authority (SEDA) provides for the installation of photovoltaic (PV) solar power systems on each permanent home built by September 2000, and for the homes to incorporate energy efficiency features.

The Olympic village is just one of several 'green' power projects being undertaken in NSW with the support of SEDA, a NSW State Government body whose mission is to reduce greenhouse gas emissions from the production and use of energy in the state.

'An important part of our role is to commercialise existing clean energy technologies, such as solar, which are struggling to increase their market share,' said the Authority's executive director, Cathy Zoi. 'Newington is a perfect international showcase for the viability of such technologies in a large-scale domestic housing environment which will set new standards in residential development in Australia, the rest of Asia and, hopefully, around the world.'

One million kilowatt hours

Pacific Power will supply, install, own, operate and maintain the PV systems, which have the potential to produce a total of one million kWh annually. This

Newington—energy smart housing

- shading and glazing for north facing windows
- size of windows facing south, east or west minimised
- solar north orientation for 90 per cent of all housing lots
- gas boosted solar hot water systems
- R1.5 insulation in roofs/ceilings (metal roofs); R2.5 insulation in tile roofs
- main living areas north-facing
- gas cooking appliances and heating outlets
- cross ventilation between doors and windows maximised
- floors finished in materials which maximise heat absorption in winter eg concrete
- skylights and wind powered ventilators for natural ventilation/ lighting
- 5-star rated electrical appliances
- no mechanical air conditioning
- light coloured external finishes
- doors and windows weatherstripped
- space for outdoor clothes drying
- landscaping to maximise solar penetration in winter and minimise in summer

solar electricity will be generated by grid-connected solar panels on the permanent houses built before the Olympic Games, which will each have approximately eight square metres of high efficiency rooftop PV cells, rated at 1kW of peak DC power. The power will feed into a high efficiency inverter located in the house, where it will be converted directly into 240V AC electricity.

The rooftop PV panels have been designed to generate about as much solar energy over the year as each permanent house in the Olympic village uses. Peaks and troughs in demand are allowed for by including the connection of each home's inverter output to EnergyAustralia's distribution grid.

The houses will be models of energy efficiency. The new suburb's layout allows the majority of the housing lots to be orientated with living areas between 20 degrees west of and 30 degrees east of north, while all the permanent houses are designed to achieve a 50 per cent reduction in energy requirements compared to a standard home. This will be achieved by incorporating features such as thermal insulation, gas boosted solar hot water heating, maximising orientation and solar control, high efficiency lighting and 5 star energy rated appliances (see separate box for details).

The outcome should be a suburb which is more environmentally friendly than any other in Australia. It will result in a total reduction of carbon dioxide emissions by 7000 tonnes per annum when the whole development is completed.

The high profile of Newington means that strict environmental checks must be built in at every stage. For instance, as the housing designs come off the drawing boards of the several teams of architects involved, they are assessed by the Nationwide House Energy Rating Scheme (NatHERS), a detailed computerised software tool which is used for assessing the energy efficiency rating of medium density developments and multi-unit residential buildings.

Future impact

Apart from energy efficiency and renewable energy usage, Sydney's newest suburb will also be a showcase for other aspects of ecologically sustainable development (ESD), including water efficiency and protecting the natural environment. Newington will also include a retail complex and a business park.

As a model project, Newington could well affect the way all new suburbs in Australia are designed and built. Maria Atkinson, MLLVC's ESD manager, predicts that it will act as a catalyst for permanent change in the housing industry.

'It's raising the benchmark for residential property development. Future developments will be judged against it and we are already seeing the momentum gathering as other developers learn from our experience,' she said. 'We're demonstrating that the largescale application of ecologically sustainable principles can mean the creation of a practical, attractive, comfortable and cost-efficient domestic environment in which people want to live.'

Newington is also exciting from a research and development point of view.

'The project's sheer scale means that we are able to work closely with a number of small and large building material manufacturers and suppliers to encourage the development of environmentally responsible 'fringe' technologies and manufacturing processes to such an extent that they will become available to a wider market,' Maria commented.

'The response has been phenomenal. Manufacturers are collaborating within and across industries to develop solutions, products and technologies specifically for Newington in many areas, including paint finishes, electrical cabling and pipe materials.

'Industry benchmarks are being raised and there should be a flow on effect to the housing industry in general.'

New mounting system

One example of industry rising to the challenge is the development by BP Solar Australia of the solar arrays for the Olympic village's permanent houses.

The company is supplying and installing the first 500 PV systems under contract to Pacific Power. A unique feature of the systems is the mounting system for the solar panels, which the company has developed specifically for Newington, and which it plans to incorporate into future solar developments.

The mounting system enables the solar panels to be integrated into the surrounding roofing material rather than being set on top of the existing roof structure. This will enhance the appearance of the house without compromising the system's technical performance.

A specially shaped colourbond subtray is the core of the mounting mechanism. The tray displaces roof tiles and acts as a moisture barrier between the system and the roof, allowing ventilation into the bottom and the top of the array and letting water flow behind the solar laminates.

The impetus for the new mounting system came from the village's architects, who wished to preserve the flush roof lines of the houses to make them aesthetically appealing.

Design factors also drove BP Solar to develop two different interfaces between the mount and the roof to suit the two roof coverings involved at Newington—tiles and corrugated iron.

The result, says BP Solar's distribution sales manager, Richard Collins, is a rooftop solar system which blends in far better with the house's design than the standard rooftop solar array.

'In addition to design considerations, we sought to take the lowest installed cost route for these systems,' Richard added. 'We wanted to make them easy to manufacture and, as so many installations will be required, easily deployed.'

In order to achieve this, BP Solar consulted relevant industries extensively when designing the new mounting system. They worked with roof plumbers, tilers, sheet metal workers and other relevant trades, progressively modifying the design to incorporate their comments.

'The resulting interface is very easy for roof plumbers to install,' commented Richard. 'It doesn't require the tremendous accuracy of a standard mounting so it can be quickly mounted with a simple set of screws, ready for the 'top hat' section and solar panels to be added.'

'The whole thing shows how easily and quickly multiple PV systems can be integrated into a residential development and should have a positive impact on future developments of this type.'

A close-up of a BP solar panel integrated into a roof.

Largescale system management

In another first for a whole suburb in Australia, Newington will also set new standards in residential PV system management, with the PV systems' sophisticated inverters having the ability to communicate with a centrally located personal computer for overall plant monitoring, data acquisition and remote diagnosis.

As well as providing more efficient system management for residents, the computer system will enable Pacific Power to gather detailed performance data from a number of the systems for use in future developments. The balance of the systems will also be monitored via remote electronic energy metering. In addition, testing will be conducted in conjunction with the Photovoltaics Special Research Institute and EnergyAustralia to verify grid connection performance.

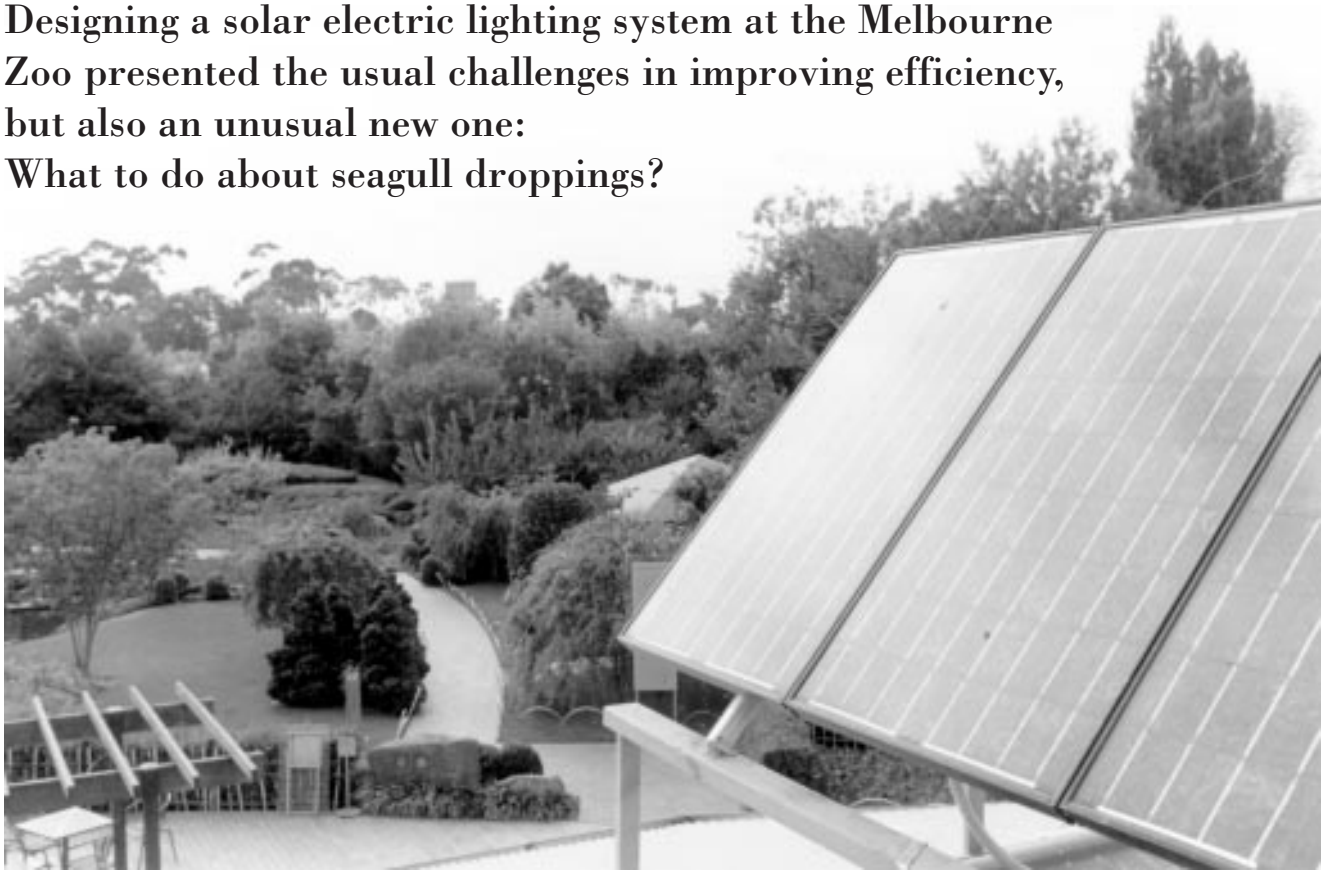
For the world's largest solar suburb, such monitoring is essential. It will ensure that the highest industry standards are maintained, that any issues which arise are resolved quickly, and will provide useful information for future developments in Australia and elsewhere.

'The proven solar technologies being showcased at Newington will pave the way for mainstream PV systems to be competitive with electricity generated from conventional fuels,' said Cathy Zoi. 'They will demonstrate that from every perspective—performance, aesthetics, long term financial and maintenance—such systems are a viable alternative.'

For further information about the Newington development, contact SEDA on (02) 9291 5260, BP Solar on (02) 9938 5111 or Pacific Power on (02) 9268 8111.

Solar at the Zoo

Designing a solar electric lighting system at the Melbourne Zoo presented the usual challenges in improving efficiency, but also an unusual new one: What to do about seagull droppings?



Three of the six solar panels that provide electricity for lighting in the Melbourne Zoo's outdoor kiosk area and Japanese garden.

The sound of gibbons whooping fills the air. They jump around, gesturing in their primordial monkey way. You can see them quite clearly from the Japanese garden at the Melbourne Zoo. It's a strange part of the Zoo, with the gibbons on their island, the stylised garden, and a few metres away a khaki kiosk like the kind they have in national parks. But a keen observer will notice something unusual on the roof of the kiosk: solar panels.

The system was installed by Melbourne company Solar Charge in 1995, with funding obtained by the Zoo from the Federal Government Department of Primary Industries and Energy.

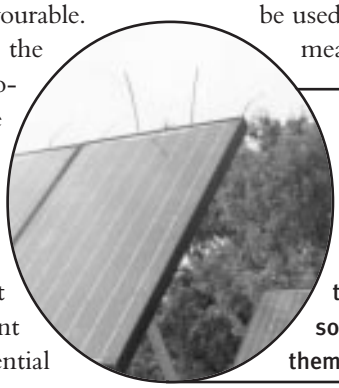
There are six Solarex MSX 77 watt modules on the roof, which charge a bank of deep cycle batteries. A 400 watt CSA Challenger inverter converts this from 24 volts DC to 240 volts AC for downlights in a nearby gazebo and pathway lights in the Japanese garden.

Grid interactive inverter technology was relatively new for small renewable energy systems when the Zoo's system was installed, so a battery storage system was used instead. Backup battery charging is supplied from the electricity grid. An auto changeover switch turns on the mains when the batteries' charge drops below a certain level, and a backup Woods battery charger converts the AC electricity from the mains to DC suitable for charging the batteries.

Like any good renewable energy system, the efficiency of the load was taken into consideration. Two 50 watt mercury vapour floodlights replaced 150 watt halogens for area lighting. Ten 9 watt halogen lights were installed along the pathway, and four 11 watt compact fluorescent lamps replaced higher wattage halogens in the gazebo.

When it comes to improving the energy efficiency of lighting, the economics are almost always favourable. Using electricity from the mains, a compact fluorescent globe will save more than its cost in electricity when compared with incandescent globes of similar brightness. When it comes to an independent power system, the potential financial savings are even greater.

The efficiency measures in the Zoo's Japanese garden lighting system mean that less solar panels are needed to run the system, which is a substantial cost saving. Depending on how much the efficiency measures lower the load, it can also mean that a smaller inverter can be used to run the system, which means more savings.



***The problem*: seagull droppings on the solar arrays.**
***The solution*: plastic cable ties attached to the tops of the panels, spaced so the seagulls' wings touch them when they try to land.**

The Zoo attracts many non-human visitors, and this caused some problems in the early days of the system. The solar panels provided ideal perches for seagulls, and they became thoroughly 'fertilised' within a few weeks of being installed. A cheap solution was suggested by Solar Charge, and declared humane by the zoo's bird experts. Holes were drilled at around 20cm spacings along the top of the panel frames, and cable ties attached so that they point upwards. This means that seagulls landing on the panels hit their wings against the cable ties, and can't comfortably land, so the panels stay clean.

The Zoo also used the grant to install a similar system with six MSX 77 watt panels mounted on the main entrance building, which provides electricity for pathway lighting elsewhere in the Zoo.

-Michael Linke

Large scale solar at Western Plains Zoo

A 50kW solar farm is planned for Dubbo's Western Plains Zoo. Eighty three watt Solarex panels will be used for the array, which will provide power to the centre of the Zoo and the kiosk. Surplus power will feed into the local electricity grid.

The farm is a joint project between the Zoo and NSW electricity retailer, Advance Energy. It will be marketed by the Zoo as an additional attraction, and the surplus electricity will be used by Advance Energy as part of its Greenpower program. At the time *ReNew* was going to print, there was also rumoured to be an extension planned for the project, though this is yet to be announced. Our money is on a pachiderm-poo methane digester.

An artist's impression of the Western Plains Zoo solar array

Living without a car
a freedom diary

Bob Fuller's ethical leap of faith from his car to the tramstop is one that many people think about making. Here he describes life after the gas-guzzler

It's exactly one year to the day that I waved good-bye to my car, a 1985 Toyota Hiace campervan. There it stood, spruced up for the sale, in the car dealer's yard. I had speculated on and off for over a year about this moment. Freedom at last or a stupid idealistic mistake? Would I regret this moment two weeks down the track?

But now I had finally made the step. My partner dropped me off at the nearest railway station and away I went to try to live out my life without a car. How would I cope? More precisely, would I cope? What would I miss out on and what would the benefits be? One year on, all can now be revealed. Hopefully my experiences may help those teetering on the edge of the same decision to take the plunge. Life still goes on without a car in your life, in fact it gets better!

But before I detail my experiences and thoughts, I must give you a personal profile of my regular personal travel needs, so that you can judge them against your own, and assess my 'degree of difficulty', if any, in living without a car.

I have an unusual living situation, in that I live in two places, 40 kms apart. For one week I live in a flat in a bayside suburb, and the next week, I live in the Dandenongs, east of Melbourne, 25 minutes walk from Belgrave railway station. I do not have a regular 9 to 5 job, but instead work on a casual basis at Melbourne University. Once a month, I have to travel to Queenscliff, and other than that I do the usual amount of socialising that a person without the responsibility of children at home can do.

So what are the advantages and disadvantages of living a car-free life?

Life slows down

The first thing to be said is that life slows down. Although the car can sometimes transport you more quickly between points A and B, it also increases your expectations of what you can fit into a day. You know the scenario. It's Saturday morning, and over breakfast you plan your day. First the market, then across town to that particular store that may have what you are looking for, and perhaps just calling in on a friend who lives nearby the store. Then, it's a quick run home, only to discover that you have forgotten something for that day in the garden tomorrow. So it's back into the car, and down to the nursery. Back home for a while and a friend rings. Can you come round and help him move a bed? Sure, I'II be over in 15 minutes. Back home again, and there's just time for a shower before meeting some friends for dinner, again just 20 minutes away by car.

When you don't have a car, you don't have days like this. If any distances are involved, then usually one thing only can be fitted into the morning, and one thing only in the afternoon. Usually you only feel like going out on the bike or travelling by public transport once a day, so you tend to space your travelling accordingly. You start to shop locally more often, plan and combine trips more carefully and generally find creative ways to solve needs. For example, using hardware and grocery stores that deliver. Sure, it may sometimes appear to cost a bit more, but wait until you see what you save on personal and automotive 'wear and tear'.

More reading and resting

The next thing you notice is that your reading and resting levels increase enormously. I now read the paper from cover

to cover on most days, and my marking and lecture preparation gets done on time at reasonable times, rather than last thing the night before. Extra naps are taken on my hour long trips to and from Belgrave, and, of course, stress levels go down. I have also decided that while motorists may compete with other motorists, they do not see cyclists as such a great threat. So if you are careful and thoughtful, then as a cyclist you avoid the constant potential to be involved in road rage incidents.

More walking and cycling

Now, I am by nature a pretty active sort of 50 year old, still jogging and swimming a bit. One of the promises I had made to myself when I sold the car was to buy a new bicycle. The old one, which I used to use regularly was beginning to show its 18 years. So I lashed out $750 on a new machine which rides like a dream. It's like riding on butter compared to my 'old faithful' which has been semi-retired.

So I now find that distances of 10-12 km are comfortably and regularly undertaken on the new 'dream machine', and with two good panniers, quite a bit of luggage can be accommodated too! All this means, I am getting fitter. I am sure this a better strategy than paying for health insurance.

Money in the bank

Over the past year, I have kept a record of how much I have spent on all forms of transport—trains, trams, buses, taxis and even the odd contribution of petrol money to friends giving me a long distance lift. In total over the year, I have spent $1015—about 50 per cent of which has gone on train travel. My estimation of the expenses incurred from owning a car are about three times this amount annually—about $3000. This includes $20 a week on petrol, registration, insurance, RACV membership, servicing and repairs, and depreciation. By anyone's reckoning, this is an impressive saving!

A better environment

Australians are near the top of the table when it comes to greenhouse gas producers. Each of us is responsible for about 16 tonnes of carbon dioxide going into the atmosphere each year. One of the big contributors to this is our motor vehicles. The average car produces 3.5 tonnes of $C0_2$ each year, so not owning a car has cut my personal contribution to this global problem by over 20%. Cars are also one of the main culprits when it comes to urban air pollution, so one less of them on the road, just makes my air a touch healthier to breathe.

The down sides

Are there any down sides, I hear you asking? What about all those wet, cold and windy days waiting at tram stops and deserted trains stations? Well, there are ocassionally some of those, but not as many as one would suspect, so their memory does not linger for long. Melbourne's weather is actually much maligned, and its unpredictability overexaggerated.

But without a car, you do have to become a good planner. You do have to learn to think ahead. Where will I be, what do I need to have with me? And

finally, you do have to start to learn what public transport is available. I now have quite a collection of train and bus timetables for my most frequently used routes. I have even learned to understand them!

Would I get another car? My partner has been surprised by my continued and strong enthusiasm for being 'carless'. She thought that a few months into this personal experiment, that I would weaken, renege and rejoin the car brigade. Not so, and while I cannot say that I will never, ever own another vehicle, the urge and need to do so seems remote. I suspect that owning a car is a bit like giving up smoking. The longer you abstain, the less the craving and the easier is gets.

Bob Fuller is compiling a booklet on 'Giving up your car,' and is looking to interview people who have consciously and deliberately chosen life without a car. People from nuclear families, retired couples and single parents are particularly sought after. You can contact Bob through *ReNew*.

Bob's life without a car

Financial savings

Cost of running car for 12 months	$3000
less Cost of transport without car	$1015
Total savings for one year	$1985

Environmental savings

3.5 tonnes of greenhouse gas emissions avoided

Reduced contribution to noise pollution

Health benefits

Avoid harming others—various studies have linked increased deaths from respiratory complications, around 1,000 per year in Australia, with raised air pollution levels. Cars are the major cause of air pollution in Australian cities.

Cycling and walking increases fitness. Heart disease is big killer of Australians, and a major contributing factor is our sedentary lifestyle.

20 years of Going Solar

In April this year, sustainable living retailer Going Solar celebrated 20 years in business. Peter Hunt spoke with owner and industry pioneer Stephen Ingrouille about Going Solar's early days, starting the Alternative Technology Association and the future of renewables

A land of milk and honey: the early Going Solar sold everything from crafts to mud-brick rams

If you look back to the early days of the alternative energy and self-sufficiency industry in Australia, you cannot help but come across Stephen Ingrouille's name.

For over two decades Stephen has been promoting sustainable technology with his business Going Solar and through a variety of community and educational groups. To appreciate Stephen's involvement we need to wind back the clock to where it all began.

In the late 1970's, with the Australian economy beginning to recover from the oil crisis and the public outcry against uranium mining nearing its peak, Friends of the Earth (FoE) was among the major groups proactively demonstrating against uranium mining.

After moving to Melbourne from Sydney, Stephen became more actively involved in the FoE anti-uranium movement. In early 1977, at the suggestion of a senior FoE member, Stephen organised a public meeting on alternative energy.

'We advertised the event in *The Age* and put up countless posters calling people to "A public meeting to discuss alternative energy options"', Stephen recalled. 'I had booked a room for 40 people in the Church of All Nations hall in Carlton but on the night I arrived to find hundreds of people huddled around the entrance trying to get in. Fortunately there was a room across the corridor where we managed to squeeze in the 300 or so people that turned up. That's how the Alternative Energy Co-operative (ATC) started.'

With the infectious enthusiasm generated by the public meeting the first ATC committee formed and met on the same night. Later to be renamed Alternative Technology Association, ATC's committee resolved to produce a newsletter and later a magazine *(Soft Technology*, now known as *ReNew)*, conduct regular public meetings, build a workshop at Collingwood (a new one was later built at CERES in East Brunswick), have a regular radio segment on public radio station 3CR, and investigate the need for a retail outlet focussing on alternative technology.

One of those also attending the public meeting was Tony Stevenson, Stephen's future business partner. 'I remember meeting Tony for the first time at the public meeting. We were both young and excited by the prospects for alternative technology. We clicked right away', he said.

And so it was that in April 1978 the first Going Solar shop opened its doors to the public near the Victoria Market. The new shop was crammed with a range of energy, agriculture and self-sufficiency supplies.

With many of the educated middle-class looking to 'escape the rat race' and do-it-yourselfers aplenty, Going Solar flourished. 'At the time there was a big back-to-the-land movement with many people trying to escape the city. We sold thousands of mud brick moulds, and books like *5 Acres and Independence* were very popular. Permaculture was also beginning to take off and we found a ready market for our organic nursery plants', Stephen said.

In a manner typical of Going Solar's democratic style, a future customer came up with the shop's name. 'I remember standing outside the shop with Tony', Stephen explained. 'We were scratching our heads trying to think of a name when we overheard someone in a nearby group of friends say "I'm thinking of going solar soon". We both looked at one another and instantly knew that we'd found ourselves a name.'

When Going Solar first started there were no other retail businesses like it in Victoria. As time progressed Stephen became aware of other like-minded retail businesses operating interstate and so a gathering was organised. This was to grow to become the Appropriate Technology Retailers Association of Australia (ATRAA)—a national industry body for retailers within the renewable energy industry.

Several years after opening for business in Franklin Street, Melbourne, the shop was relocated closer to the Victoria Market and later to the current Victoria Street address in North Melbourne. By this stage the original business partnership had dissolved, and

Everyone and their dog was at Going Solar's 20th birthday celebration in April. Stephen's the one standing in front of the bicycle.

with the major equity in the business Stephen continued on his own.

A visit to the shop reveals the depth of the product range—solar hot water systems, wood heaters, solar and electric dehydrators, small washing machines, hemp products, soaps, massage oils, bulk detergents, non-toxic paints, solar electrical equipment, composting toilets, beekeeping equipment, gas and DC refrigeration, garden seeds and a room full of wonderful books. 'We consistently have people visit the shop from interstate, overseas and right across country Victoria. I am constantly amazed by how much time these people spend in the shop. Some have to go off for a lunch break and come back.', Stephen said.

Going Solar later expanded to include a wholesale division, catering for the increasing number of trade enquires. 'We believe very strongly in working through a network of local dealers', Stephen explained. 'Every day we receive calls from all over Victoria. If our customers require more than just general information, we can refer them to their closest appropriate dealer. In this way customers benefit from the local knowledge and service provided by our dealers.'

Over the last 20 years there have been numerous changes in the sustainable technology arena. Apart from the name changes—'alternative energy' to 'renewable energy' and 'self-sufficiency' to 'sustainable living'—trends have come and gone and technology, in some cases, has leapt forward. But how far have we really come in educating people and applying alternative technologies?

'It seems to me that we have yet to take the big step', Stephen explained, 'the general public at large still lacks an appreciation of the real benefits of renewable energy and sustainable technology options. Often decisions become purely economic and oriented towards the short-term. Living in a fossil-fuel driven economy and with the federal government's current stance we seem to be going backwards rather than forwards.'

What might the future hold then? 'I am the eternal optimist', he said. 'If the greenhouse issue becomes more serious, international political pressure may be brought to bear on the Australian government. In the meantime though, we are beginning to see public demand drive a number of renewable energy initiatives with a rise in projects to provide power for "green power" schemes.

As individuals we ultimately vote with our spending dollar. If you buy electricity from a coal-fired power source you are effectively saying "I want coal-fired power."'

Education of the public plays a vital role in ensuring that sustainable technology becomes recognised as a viable alternative. For nearly a decade now Stephen has been teaching CAE and TAFE courses on renewable energy. 'It's very satisfying to see the genuine interest from people attending the courses and then later on seeing the same faces starting their own renewable energy businesses', he said.

In recent times the rising interest in renewable energy from the commercial and industrial sector has brought about a new business called Allied Solar, of which Stephen is a member. Allied Solar is a consortium of companies consisting of manufacturers, installers and renewable energy specialists aiming to service the needs of electricity utilities and the commercial sector. 'By offering renewable energy systems on a larger scale we hope to move renewables into the mainstream marketplace,' said Stephen

Going Solar's 20th birthday year still has a lot in store, with a renewable energy fair in November and a new web site with a copy of their full retail catalogue expected soon.

Ethical investing

Many people are forced to invest in superannuation or the traditional banking system, and without even knowing could be contributing to environmental degradation. Penelope Sell looks at how you can have a direct role in making a profit from your principles.

Money makes the world go round, yet many of us have no idea where our money goes once it's put in the bank. Through superannuation we could unwittingly have shares in companies such as Western Mining Corporation, Coles Myer, or the National Bank. But there are alternatives. Ethical Investment not only avoids social and environmental irresponsibility, it also actively pursues sustainable, 'green' industries with a view to establishing a sustainable, socially just society.

In the long term it will be the sustainable enterprises which will profit our society as the unsustainable ones, by their very nature, will no longer exist. But even in the short term, ethical investment can pay substantial returns. Australian Ethical Investments, the only public company in Australia which is wholly concerned with ethical investment, had a return of 9.7 per cent for its Balanced Trust to the year 30 September 1997, while its higher risk Equities Trust returned 17 per cent in the same year. A new trust established by Australian Ethical Investments, called the Income Trust, available for short term, low risk investments has expected returns at five to six per cent per annum. This is a higher return than the rate offered by commercial banking term deposits which fluctuated under the 5 per cent mark in 1997. The minimum amount you need to invest in any trust in Australian Ethical Investments is $1000.

The problem with profit

Traditionally, profits are calculated as income minus expenses. The problem with this simplistic method is that expenses do not take account of production's contribution to environmental degradation or social malaise. Commonly termed 'externalities' by economists, these costs are harder to quantify and easier to ignore altogether. Even the word 'external' has a removed sense, they are 'external' to the company, beyond their responsibility. In the end, as inhabitants of the earth we all have to pay these 'external' costs, yet we receive none of the profits. If Shell Oil took responsibility and compensated for all of its 'externalities' you could be sure their profit dividends would be lower.

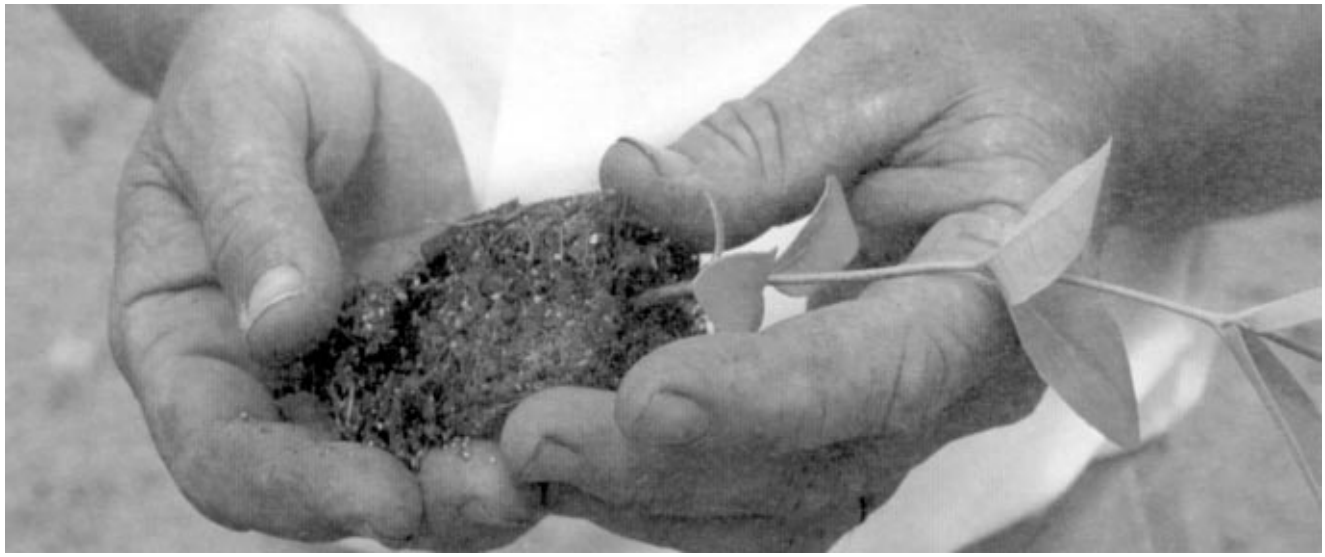
A traditional argument many businessmen and economists take is that business should operate by the 'invisible hand' of the market. A hand which is essentially amoral, where social and environmental issues play no part in determining what is produced, how it is produced, or the effects that production has. There is an inherent flaw in the 'invisible hand' argument in that for the principle of free market to operate, you must also have the principle of free choice.

In the perfect competition model it is assumed that all consumers and investors have full information of the market place in order to make 'rational' decisions. But information is not freely available, and many deals are struck in secrecy. Every now and then a scandal breaks out, and it becomes apparent how much information is withheld, and how corrupt many of our industries and governments are. By keeping information hidden from their investors and the public, the free market model is essentially archaic, false and unable to effectively operate. Free choice is also forgone when we are forced to contribute to a superannuation trust we have little or no information about, or even forced to open a bank account in order to get paid.

Slowly, yet only through necessity, some attitudes towards environmental and social responsibility are changing as the detrimental effects of unchecked production become more visible. For example, it wasn't until the ozone hole was literally burning us all through radiation that serious action was undertaken, even though scientists were warning governments of the effects years earlier. Obviously we shouldn't wait around for any directives from the government!

Taking control

While some companies have moved away from the 'greed is good' mentality,



The saying goes that money doesn't grow on trees, but ethical investors know better. Ethical investment choices include sustainable forestry and sawmilling that uses timber more efficiently.

many have not. The huge amount of pollution emitted by large multinational corporations, and the geographical distances of some communities directly affected by unethical practices, can often make us feel helpless to stop the tide of destruction. However, besides boycotting unethical businesses' products, there is a more direct way of gaining control, and giving power back to the caring individual. That is by putting our money where our mouths are and hitting them where they feel it most—in the hip pocket. Even if you have little or no money to invest, at some stage most people will begin to save for a house deposit, or perhaps be left an inheritance by a parent or relative. Don't put it in the bank where you have no control over what it will be used for. Invest ethically and do the planet a favour!

Knowledge is the key to control. Ethical companies and organisations typically aim to fully inform their clients about their production processes, and where they re-invest your money. They are often more democratic in that they seek comment from investors as well. With a caring attitude towards the environment and a belief in justice for all people and animals, ethical investors are typically anti-exploitative and humanitarian-oriented. While money matters, it is more than money that counts.

How green is green?

The criteria which determines whether investments are ethical or not varies. Australian Ethical Investment Ltd. has a policy where they not only avoid socially and environmentally damaging activities, but also actively support new 'green' industries. On page three of their prospectus they state, 'The Manager selects investments for the Trusts that contribute to a just and sustainable human society and the protection of the natural environment.'

The Australian Ethical Charter, also in the prospectus, details these criteria. Other investments may put their emphasis on avoiding damaging activities, and be less active in seeking out beneficial investments. Generally, ethical investment avoids industries directly involved or associated with: defence and armaments, uranium mining, gambling, alcohol and tobacco production,

Australia's ethical investment bible

Tracking down ethical investment company can be hard work. *Ethical Investment* makes the job a lot easier, with a comprehensive listing and star rating of the organisations involved in ethical investment. It also highlights trusts that use 'ethical' in their title rather freely, and provides general background information about making ethical investment decisions.

Some interesting alternative investments are also suggested. A chapter on improving the resource efficiency of your house demonstrates that 'investment' doesn't have to mean a direct financial return. Items like insulation, water saving devices and passive solar housing design are all good for the environment, and will often repay more than they cost in resource savings.

Ethical Investment is available from Choice Books.

inadequate and detrimental environmental policies (including energy efficiency), cruelty to animals, poor labour relations and exploitation of indigenous or foreign labour. Once these factors have been eliminated, it is up to the company or organisation as to how far they will go in promoting sustainable, humanitarian enterprises.

Ethical investment opportunities in Australia

Many of you will have already invested ethically without being aware of it. Cycling to work or taking public transport are forms of ethical investment in that pollution is minimised, and savings are made on petrol and car wear and tear. Investing in solar panels, planting an organic vegetable patch or practising water conservation are other common forms of investing ethically in your own home. But for those of you who have savings and wish to contribute more directly to a socially and environmentally responsible society, the major ethical investment avenues in Australia are listed below. For those of you who don't know, a trust is a collection of holdings (usually money or property obtained from individuals such as you and me), which is managed according to criteria, guidelines and regulations, for the benefit of the original investors (you and me).

• **Australian Ethical Investment.** This public company is devoted to ethical investment, and offers four different trusts that investors can pool their resources into. They range from the long term, higher risk and higher returns 'equities' trust, to the shorter term, low risk yet return competitive 'income' trust. They provide full information and disclosure on investments in their prospectus, and take a strong role in supporting positive ethical enterprises which beneficially contribute to society. Of the many companies and enterprises in which they have invested, some include: Australian Gaslight Company (natural gas distribution), Environmental Recovery Services (provides a collection and recycling service for industrial solvents), and Earth Sanctuaries (native animal sanctuaries for tourism and education). They also have a savings plan where individuals can save a minimum of $200 per month in any trust. Superannuation opportunities are also available through master trusts and personal self-managed trusts. Ph (02) 6242 1988 or freecall 1800 021 227 for a prospectus, or see their web site: http://www.austethical.com.au

• **Equitilink Greenlink Trust.** This trust invests only in environmentally positive or neutral public companies listed on the Australian Stock Exchange which exhibit good medium term growth prospects. Companies they have invested in include: ForBio Ltd (uses its plant biotechnology for high quality tree plantations) and Simsmetal Ltd (metal recycler). Ph EquitiLink Australia Ltd on (02) 9950 2888 or 1300 362 888

• **ANA Ethical Superannuation Fund and Friendly Society Bond.** Their super fund is only available to Queensland residents, however the friendly society bond is available to all residents of Australia. An ethical charter sets out their criteria whereby they invest only in projects which care for the earth, its people and communities. ANA have invested in housing cooperatives and welfare services, along with share purchases in companies such as Blackmores Ltd and Energy Developments Ltd (this company taps land fill gas from rubbish tips for electricity generation). Ph: (07) 3260 5075

• **Superannuation Master Funds** Master Funds give the superannuation investor a wider choice in where their money goes by taking care of statutory and reporting requirements and enabling employer sponsored superannuation and personal superannuation contributions. Some superannuation funds you can invest in which have an ethical strategy are: Freedom of Choice Master Fund (Ph: (03) 9621 1644), Lifetime Asset Management Programme (LAMP) Ph: (08) 9481 6088, 1800 626 323, and Credit Union Superannuation Fund Ph: (03) 9639 0100. Australian Ethical Investment Ltd superannuation dealings operate through these funds.

• **Community Based Funds** These include local community credit cooperatives as well as funds like the Community Aid Abroad Ethical Investment Trust which invests only in socially and environmentally beneficial projects. Ph: (03) 9289 9444.

So the avenues are there for the conscientious investor to contribute to the healing of our planet—and to make money in the process. Of course, it is still big business that causes the most damage, but if enough people withdraw from or refuse to back them, even they will have to act on the concerns and opinions of the majority. It is not only us, but the whole world who will profit from our ethical decisions.

Penelope Sell is a freelance writer who studied economics for four years at Auckland and Melboume Universities.

Make your own paint

With cheap, non-toxic ingredients

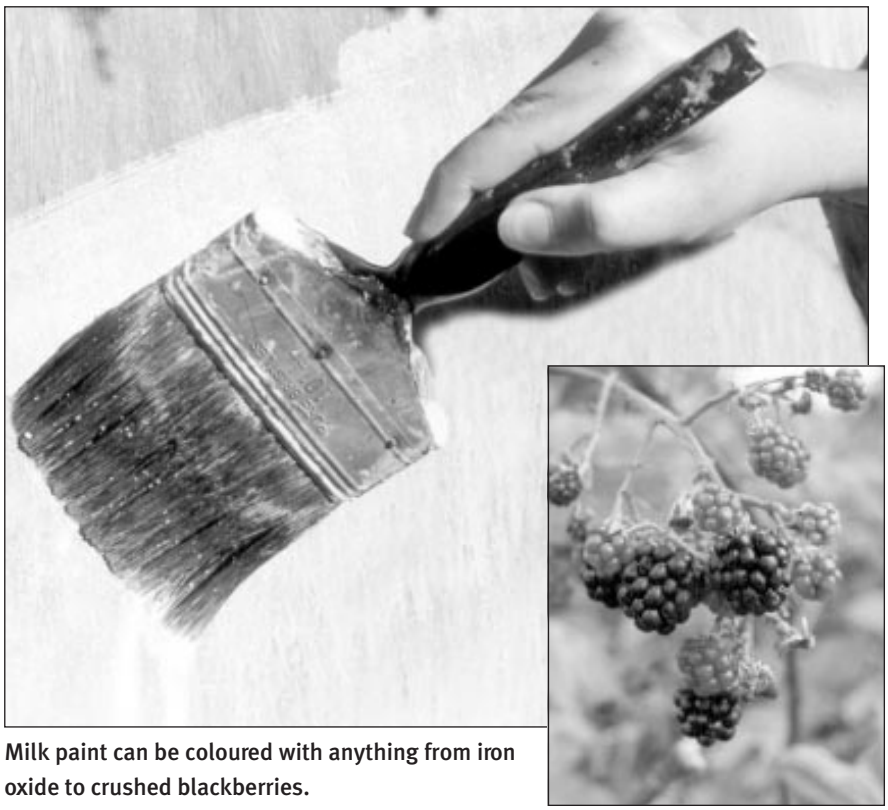
The average tin of paint from the hardware store is a cocktail of chemicals with names that only a chemist could love. While some are benign, many are definitely best avoided. The toxins in common housepaints include cadmium, mercury, phenols, chlorine, sulphur, formaldehyde and other volatile organic compounds. These can all cause illness for both the painters and the people who live with the painted surfaces—ranging in severity from headaches and nausea through to cancer.

ReNew and *Soft Technology* have run articles on non-toxic paint alternatives, but many people are put off by the extra cost of non-toxic paints (even though the avoided health costs may make up the difference). Paint also has a high energy cost. Today's conventional paints are, by weight, among the most energy intensive building products. Many of the non-toxic alternatives available in Australia are made in Europe, which means they must be shipped here, adding to their associated greenhouse gas emissions and other pollutants.

So where to get the least costly, non-toxic, low-energy paint?

The answer lies in a trip to the milk-bar. A couple of litres of skim milk will form the base for enough paint to begin experimenting. The next stop is the hardware store for some builder's lime (also called slaked or hydrated lime) and plaster of Paris. Apart from some water and your choice of pigment, these are all the ingredients you will need.

There are several variations on what is usually referred to as 'milk paint'. One involves mixing lime into a thick paste with a little water, then gradually adding milk until it reaches a paint-like consistency. I was told about this method by a friend of mine, Salvatore, who had used it while growing up in Italy in the 1930's and 40's. Both ingredients were widely available, and used with various pigments, milk paint is attractive and durable. I tried the recipe using bottled skim milk, though Salvatore recommends milk directly from the cow, with the cream skimmed from the top.



Milk paint can be coloured with anything from iron oxide to crushed blackberries.

I sieved the lime before mixing it with the milk, and let it sit for several hours, though found that it was still quite lumpy. Straining the mixture through muslin makes it much smoother. I used the paint on old unpainted weatherboards, and got good coverage—once it dried it actually looked like paint!

An internet search revealed some other paint recipes. One that I tried consists of plaster of Paris as the main solid ingredient, mixed with a little lime and skim milk. Again, filtering through muslin cloth to remove lumps is a good idea. This paint was similar to the lime paint, but where the lime-only paint was powdery when dry, the plaster of Paris set a lot harder.

Creating colours

There are many options for colouring milk paint. For a straight white, zinc oxide or titanium dioxide are good. Calcium carbonate or chalk will make the paint more opaque. Iron oxide (rust) is easy to manufacture at home from steel wool or iron filings, and gives the

paint a nice ochre colour. Many traditional paints used wild berries for colouring. Again, the muslin cloth comes in handy for removing pips. If you're concerned about being able to replicate your colours, you could compromise and buy some ready-made pigment from an art supplies shop.

Cleaning up

Besides the obvious advantage of not having to inhale pungent vapours, cleaning up these paints with water was dead simple. I didn't have to worry too much about tipping the cleaning-up water on the garden, although too much lime can be a bad thing for soil. Lime and milk paint also comes off hands and clothes much more readily than other paint. While lime is alkaline and can cause skin to dry out and feel 'burnt' after prolonged contact, it is easy to dip your hands in a bucket while you paint, or wear gloves. If you get lime in your eyes flush them with cold water immediately.

Finishing the surface

One disadvantage of milk paint is that it can be marked by water. Sealing will eliminate this problem, and will make the finish generally easier to clean in 'high splash' areas like the kitchen. A range of finishes can be used, including linseed oil and Danish oil. The roughness of the surface caused by particles of lime can be smoothed with steel wool or sandpaper before applying the finish.

What the ingredients do

Why milk and lime? The first reason is that they are cheap and readily available, which is why milk and lime mixes were the most commonly used paint until the mid-1800's. Most importantly, though, they have a synergistic effect that makes great paint. Milk contains a salt called casein, which reacts with calcium in lime to form calcium caseinate, a resin that binds itself with pigments in the paint and the surface the paint is applied to. Many people complain of the great difficulty in removing the bottom layer of paint on old doors and window frames—in many cases, that's well-cured milk paint. The combination also means that once cured, milk paint will no longer be alkaline.

Commercial milk paints

While looking for more paint recipes, we stumbled across an Australian company specialising in natural paints. Porters Paints, based in Sydney, were also inspired to make paint by a recipe from the past, when founder Peter Lewis discovered some paint recipes with his Grandfather's diaries. Porters range includes a cement paint called Boncote, interior and exterior lime wash, cement render and milk paint. (see their listing in 'products' in this issue).

Soft Technology Issue 55 has a feature article on the contents of commercially available paints and non-toxic alternatives. It lists non-toxic paints available in Australia, and is available for $5 from ReNew, 247 Flinders Lane, Melbourne 3000. (Soft Technology is the former title of ReNew).

-Michael Linke

Home-made paint recipes

Basic lime and milk paint

•Mix in one part of lime with twelve parts of skim milk (you can measure by either weight or volume). Add pigment until desired colour is acheived.

Lime, milk and plaster of Paris paint

Ingredients:

Skim milk	1.5 cups
Lime	30 g
Plaster of Paris	240 g
Pigment	

•Mix skim milk with lime while stirring briskly until the lime is thouroughly dispersed.

•Add plaster of Paris and pigment until desired colour is acheived

Notes:

Allow the mixture to sit for an hour or until it stops bubbling.

When painting, stir the mixture every five minutes to prevent the solid ingredients settling.

Washing up

Use water, and a little soap. Unlike commercial synthetic paints, the residue can safely be poured onto the garden, though be careful not to tip too much lime on one area.

Sinewave inverter buyers' guide

There have been a lot of new models since our last inverter buyers' guide. Lance Turner takes a look at what is available

To many people, providing 240 volt AC power from a 12 volt (or other extra-low voltage) battery bank may seem like a bit of a black art. The conversion process is done by a amazing box of tricks called an inverter, which magically transforms one form of electricity into the other.

But not all inverters are the same. There are two broad catagories of inverter: modified square wave and sine wave. Modified square wave (sometime referred to as modified sine wave) are the cheaper of the two, but have the disadvantage that many appliances (such as VCRs, TVs and computers) may dislike the type of power they provide. As a consequence, they may run less efficiently, or in extreme cases, not at all.

Sinewave inverters, on the other hand, provide the same type of power that comes from the mains grid. The difference between the two types can be seen in figure 1. Indeed, the power from a good quality inverter will often exceed the grid in terms of quality and voltage stability.

Stand alone or grid interactive?

More often than not the choice is made for you by circumstance—ie, lack of grid availability, but if you already have the grid connected, then you need to decide whether to have a stand-alone (independent) power system or have it grid interactive. The latter allows you to use the mains grid as a battery bank—excess power is fed into the grid, while power is drawn from the grid when the renewable energy sources are insufficient.

The first table on pages 42 and 43 describes inverters designed to supply power to independent power systems, such as those used for remote homes, while the second table describes grid-interactive inverters.

The OK4-100 inverter is designed to be connected directly to a solar panel and the mains grid. These are modular units, and you can connect as many of these as you like to the grid in the same installation. This gives the system greater reliability—if one inverter fails, the rest keep working.

The Trace inverters are multi-purpose and can be used for either grid-interactive or stand-alone systems. They contain inbuilt battery charging and many other features, making them virtually a power centre in a box, but their price reflects this.

There are a greater variety of stand-alone inverters than grid-interactive ones, in power outputs from 150 watts up to 10 kilowatts or more. Some have very few features and may only be suitable for weekenders or automotive use. Others have every bell and whistle you could imagine and can easily run an entire house or small business.

Many of the larger inverters have energy monitoring facilities, with such things as battery voltage and current, AC output voltage and watt-hours used displayed on a digital display. Some also have the ability to be controlled remotely, allowing you to change settings or shut down the inverter from inside the house.

What size do you need?

The inverter you will need will depend on your power requirements. If you only have small appliances, up to 500 watts per appliance, then you should be able to get by with a 600 watt inverter with few problems. However, if you have a large washing machine and use a lot of power tools, then you will need a bigger unit, say with a 2500 watts continuous rating, such as the SE30 from Selectronic Components, or the M D O'Brien unit.

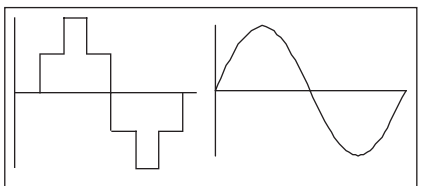


Figure 1. On the left is a modified square wave, while the on the right is a sine wave.

Many of the inverters now have LCD displays and are programmable, such as the SE30 from Selectronic Components.

This 600 watt Power Conversions inverter is one of a number of new smaller units now available.

This Trace 4kW inverter can be used as both a grid interactive or stand alone inverter.

It is just a matter of looking at the power rating of your appliances, taking into account how many appliances are likely to be running at one time, and choosing an inverter in that power range with the options and features you want.

Inverter lingo

There are a lot of different specifications and terms used to describe sinewave inverters. We will look at a few now and attempt to clarify any areas of uncertainty.

Power output:
There are three figures that may be considered here: continuous power, the half-hour rating, and the surge capacity. The first is the maximum power that the inverter can supply to appliances continuously.

The half-hour rating is the power the inverter can supply for half an hour without overloading.

Most inverters have a high surge capacity, typically two to four times their continuous rating, in order to start difficult loads such as fridges and other motor-powered appliances. The surge capacity is usually rated for between one and five seconds.

For grid interactive inverters, there is also the startup power. This is the power level from the renewable power source at which the inverter starts feeding power into the mains grid.

Autostart:
Many inverters have the ability to consume very little power when no appliances are being used in the house, and will start themselves when they sense that an appliance has been switched on. They generally do this in a fraction of a second, so the autostart, or standby mode, is almost invisible to the homeowner. The minimum load that needs to be switched on for the inverter to sense is usually below 20 watts. For some inverters this figure is adjustable to suit the loads in the house.

Total Harmonic Distortion:
The waveform from a sinewave inverter is never perfect, but contains what is known as harmonic distortion.

The Total Harmonic Distortion (THD) figures of all of the inverters listed are below five per cent. This is considered a good figure, so this is not really a problem with any of the units.

Power factor:
This is a much misunderstood area, not surprisingly, as it can be hard to understand how current can be flowing through a device and yet no power is being used. All you need to understand is that an inverter should be able to handle all power factors that it is likely to encounter. Again, with all the models listed, this doesn't seem to be a problem, at least from the specifications given by the suppliers.

Efficiency:
The efficiency of an inverter is the ratio of the power output compared to the power input. If an inverter uses 250 watts from the battery to provide 200 watts to an appliance, then it has an efficiency of 80 per cent at this load.

This is a group of Solar Energy Australia 250 watt inverters.

The 500 watt unit from Altronics has a built in 6 amp battery charger.

The efficiency will vary at differing loads, usually being lower at very low load levels (below 10 per cent). You must consider this when buying an inverter. Don't buy a 2500 watt inverter if you will be only running 100 watts worth of lighting most of the time and have few large appliances. A smaller inverter with a decent half-hour rating could do the job more efficiently.

It should be remembered that all of the figures given only apply when the inverter is being run inside a specific temperature range. This is usually 0 to 40°C, but some manufacturers use other ranges. Beware of any inverter only rated to 25°C, as it is likely to be subjected to temperatures way above this during summer.

Idle power:
This is the power the inverter uses while it is on but with no load connected. This is effectively wasted power, so if your inverter is likely to be left on for long periods, look for a unit with a low idle power figure.

Standby power:
This refers to the power used by the inverter when it is in standby mode and waiting for an appliance to be switched on. It is generally much lower than the idle power used.

Safety

All grid interactive and stand-alone 240 volt systems must be wired by a qualified installer. You must never attempt to connect up such a system yourself, as you may cause serious damage to your equipment and possible personal injury.

Table 1. General purpose sinewave inverters

Manufacturer/ Supplier (Country made)	Model	Input voltages available	Operating voltage range	Power Output			Efficiency (at % of full load)	Power factor range	Total harmonic distortion	Idle power (watts)	Standby power (watts)	Autostart	Minimum start load (watts)	Output isolatio
				Cont	1/2 hr	Surge								
Advanced Energy Systems (Australia)	500/IC	12, 24	—	500	—	1,000	90%	all	3-5%	—	—	—	—	—
	850/IC	24		850		1,700								
	1000/IC	24		1000		2000								
	1500/IC	24, 48		1,500		3,000								
	2000/IC	24, 48		2,000		4,000								
	2500/IC	24, 48		2,500		5,000								
	4500/IC	48		4,500		9,000								
	5000/IC	110		5,000		10,000								
	5500/IC	48		5,500		11,000								
	10000/IC	110		10,000		20,000								
	15000/IC	110		15,000		30,000								
Altronics	M8100	24	22-28	500	—	—	85%	—	—	—	—	—	—	—
Baintech (France)	600s	12, 24	—	600	—	1500	85%	all	—	—	—	—	—	—
	1000s			1,000		—	90%							
Latronics (Australia)	47-BKZ-12	12	10.5-17	700	950	2,400	90%	all	<4%	5	0.42	yes	0-20 adj	yes (350
	48-BKZ-24	24	21-34	800	1,050	2,800	92%			7	0.6			
	412-BKZ-12	12	10.5-17	1,200	1,500	3,600	91%			8	0.48			
	415-BKZ-24	24	21-34	1,600	2,100	5,000	94%			10	0.72			
	525-BKZ-24	24	21-34	2,500	3,100	7,500	94%			12	1			
	530-BKZ-48	48	42-68	3,000	3,700	9,000	95%			17	1.7			
M D O'Brien (Australia)	2400W	24, 32, 36, 48	—	2,400	3000	7,200	89 at 10% 95% at 100%	all	<3%	20	—	no	—	yes
Power Conversions (Australia)	300	12, 24	10.5-16 21-32	300	—	1000	>85%	all	<3%	10	—	no	—	yes (100
	PS 600	12, 24		600		2,400	94% peak, 80% at 10%	±0.5	<5%	6 8		no	—	
	PS 1000	12	10.5-16	1,000		3,200				17				
	PS 1200	24	21-32	1,200		4,000				15				
Selectronic (Australia)	SE10	12, 24	10-17, 20-34	350	450	1,000	90%, 91%	all	<4%		0.6, 1.2	yes	4-16 adj	yes
	SA21	12, 24	10-17, 20-34	1,200	1,500	3,600	90%, 86%			8, 18	0.9, 1.44		3-20 adj	
	SE30	24	20-34	2,200	3,500	6,500	>90%			17	1.6			
	SA31	24	20-34	2,200	3,500	6,500				17	1.6			
	SA41	48	40-68	3,000	4,700	8,500				32	2.7			
Solar Energy Australia (Australia)	150/12	12	10.5-16	150	—	525	87% at 10% 87% at 100%	all	<1.2%	2	—	no	—	yes
	250/24	24	21-32	250	—	875				2.5	—			
	450/12	12	10.5-16	450	600	1,350	88% at 10% 88% at 100%			3	0.5	yes	4-40 adj	
	500/24	24	21-32	500	750	2,000				3	1			
	1300/12	12	10.5-16	1,300	1,900	3,900	90% at 10% 91% at 100%			10	1			
	1500/24	24	21-32	1,500	2,100	4,500				10	1			
	2200/24	24	21-32	2,200	2,800	6,500	90% at 10% 92% at 100%			10	1			
	2400/48	48	42-65	2,400	3,000	7,200				12	1			
	3800/48	48	42-65	3,800	5,000	11,400				14	1			
Statpower (Canada)	PROsine 1000i	12, 24	10-16 20-32	1,000	—	1,500	77% at 10% 86% at 100%	all	<5%	22	1.5	yes	10	yes
	PROsine 1800i			1,800	—	2,900	84% at 10% 88% at 100%						20	

Table 2. Grid interactive sinewave inverters

Manufacturer/ Supplier (Country made)	Model	Solar input voltages available	Operating voltage range	Power Output			Peak efficiency (at % of full load)	Power factor range	Total harmonic distortion	Idle power (watts)	Standby power (watts)	Autostart	Minimum start load (watts)	Output isolatio
				Cont	Surge	Activation								
Fronius Sunrise (Australia)	Micro	170	120-300	700	800		92%		<5%	—	0 at night	yes		yes
	Mini			1000	1050		93%		<3%					
	Midi	250	185-360	1500	1600		93%		<5%					
	Midi Plus	170	120-300	1500	1600		93%		<5%					
	Maxi	170	120-280	2000	2200		93%		<3%					
Integral Energy	OK4-100	24	24-50	100	—	0.15	94% at 40%		<3%	—	0.003W	—	0.15	—
Trace (USA)	SW2612E	12	11.8-16.5	2,600	7,200	—	90%	all	<5%	12	1	yes	16 to 240	—
	SW3024E	24	22-33	3,300	8,000		94%			16	1			
	SW3048E	48	44-66	3,300	8,000		95%			16	1			
	SW4548E	48	44-66	4,200	8,000		96%			20	1			
Solar Energy Australia (Australia)	2500/6	—	72-145	2,250	—	20	95%	all	<1%	—	15 in day 0 at night	yes	—	yes
	4000/6	—		3,500	—	25								
	1500 grid		75-276	1,350	—	13	93% at 60%		—		9 in day 0 at night			

	Indicators	Output current limit	Protection	Size (mm) W x H x D	Weight (kg)	Cooling	Comments	RRP $ (excluding tax)	Warranty
	—	—		250 x 225 x 330	22		Have battery charging ability, and can synchronise with a generator to provide extra power.	—	—
					25			—	
				550 x 575 x 280	35			—	
					40			—	
				585 x 685 x 292	45			—	
								—	
				695 x 852 x 427	125			—	
					135			—	
					135			—	
					200			—	
				750 x 900 x 495	250			—	
	P L H	—	O V	355 x 125 x 265	9.5	convection	Designed as a UPS. In built 6 amp battery charger and auto mains changeover	799 including sales tax	—
	P + LED bargraphs	yes	O T V C	346 x 90 x 218	3.3	—	Optional remote display	—	—
0V)	P S L H O T	yes	O T V C	310 x 145 x 260	10	fan	1.5 metre battery leads	1250	3 years
					10			1295	
					13			1990	
					14			2190	
				380 x 180 x 400	22			2690	
					24			2990	
	P H L T	input limited	O T V C	355 x 210 x 325	27	fan optional	1.6 metre battery leads, also 3000 watt unit avail.	2395	1 year
	P H L O	yes	O C R	252 x 95 x 225	3	convection	uses double conversion	655	2 years
0V)	P L H O	yes	O T V C	320 x 270 x 360	16		1 metre battery leads	980	
					28			1695	
					27			1495	
	P S L H O T	yes	O V T C R	176 x 122 x 260	4.6	convection	1.6 metre battery leads	790	2 years
	Plain English LCD			428 x 170 x 370	17.5		alarm inputs and outputs	2350	lifetime
				498 x 170 x 370	22		1.2 metre battery leads	2950	5 years
				498 x 170 x 370	22		1.6 metre battery leads alarm inputs and outputs	3360	lifetime
				545 x 170 x 370	32			3960	lifetime
	LCD or LED displays	yes	O T V R	110 x 75 x 190	1.8		1.2 metre battery leads	320	2 years
					2.5			460	
				255 x 135 x 135	5		1.3 metre battery leads	850	
								850	
				360 x 200 x 175	12		Battery charger model available	1890	
				456 x 320 x 211	19.5			2290	
								2750	
					30		1.5 metre battery leads	2970	
								3980	
	LCD	yes	O V T R	390 x 280 x 115	6.5	Fan		POA	2 years
					7.5				

	Indicators	Output current limit	Protection	Size (mm) W x H x D	Weight (kg)	Comments	RRP $ (excluding tax)	Warranty
	Standby/on	yes	O Is	360 x 180 x 335	15	Aimed at low cost systems	1,650	2 years
					17		2,100	
				320 x 180 x 430	25		2,500	
							2,850	
							3,375	
	—		O T V Is	90 x 120 x 30	0.55	Direct attachment to rear of solar panels	370 (trade)	1 year
	LCD plus assorted indicators	yes	O T V Is	570 x 380 x 230	42	Stand alone, grid interactive, battery charger modes	4,900	—
					50		5,900	
					50		5,900	
					65		6,900	
	LCD		O T V Is	308 x 450 x 235	22		POA	—
					28			
				260 x 181 x 375	18	Step-up converter at input, RS232 interface, power point tracking		

Indicators

P: Power on
L: Low battery voltage
H: High battery voltage
O: Overload
S: Standby mode
T: Over temperature
LCD: Liquid Crystal Display

Protection

R: Reverse battery connection
O: Overload
T: Over temperature
V: Over or under voltage
C: Circuit breaker protected
Is: Islanding protection

Suppliers' Details

Advanced Energy Systems: Prime Power Systems, PO Box 375, Como WA 6152, ph:(08) 9470 4633, fax:(08) 9470 4504.

Altronics: Yager Electronics, PO Box Q43, Sydney NSW 1230, ph/fax:(02) 9979 9672.

Baintech: Bainbridge Technologies, ph:(07) 3821 3333, fax:(07) 3821 3977, email: baintech@powerup.com.au.

Fronius: Echnida Technologies Pty Ltd, 8 Blackwood Terrace, Holder ACT 2611, ph:(02) 6287 3165, fax:(02) 6288 5638.

Latronics: Latronic Sunpower, PO Box 73, Moffat Beach QLD 4551, ph:(07) 5491 6988, fax:(07) 5491 6792, email: latronic@closer.brisnet.org.au.

M D O'Brien: M D O'Brien Electronics, PO Box 639, Port Lincoln, SA 5606, ph:(08) 8682 4131, fax:(08) 8683 4097.

OK4-100: Integral Environmental Energies, Locked Bag 8849, South Coast Mail Centre, NSW 2521, ph:(02) 4228 2999, fax:(02) 4228 2890, email: iee@integral.com.au

Power Conversions: Power Conversions, PO Box 274, Bayswater VIC 3153, ph:(03) 9761 1252, fax:(03) 9761 1911; Sharpe and Jephcott, ph:(03) 9598 5775.

Selectronic: Selectronic Australia, ph:(03) 9762 4822, fax:(03) 9762 9646; Yager Electronics, PO Box Q43, Sydney NSW 1230, ph/fax:(02) 9979 9672.

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Should an environmentalist eat meat?

Peter Singer examines the ecological problems with sustaining a meat-based diet

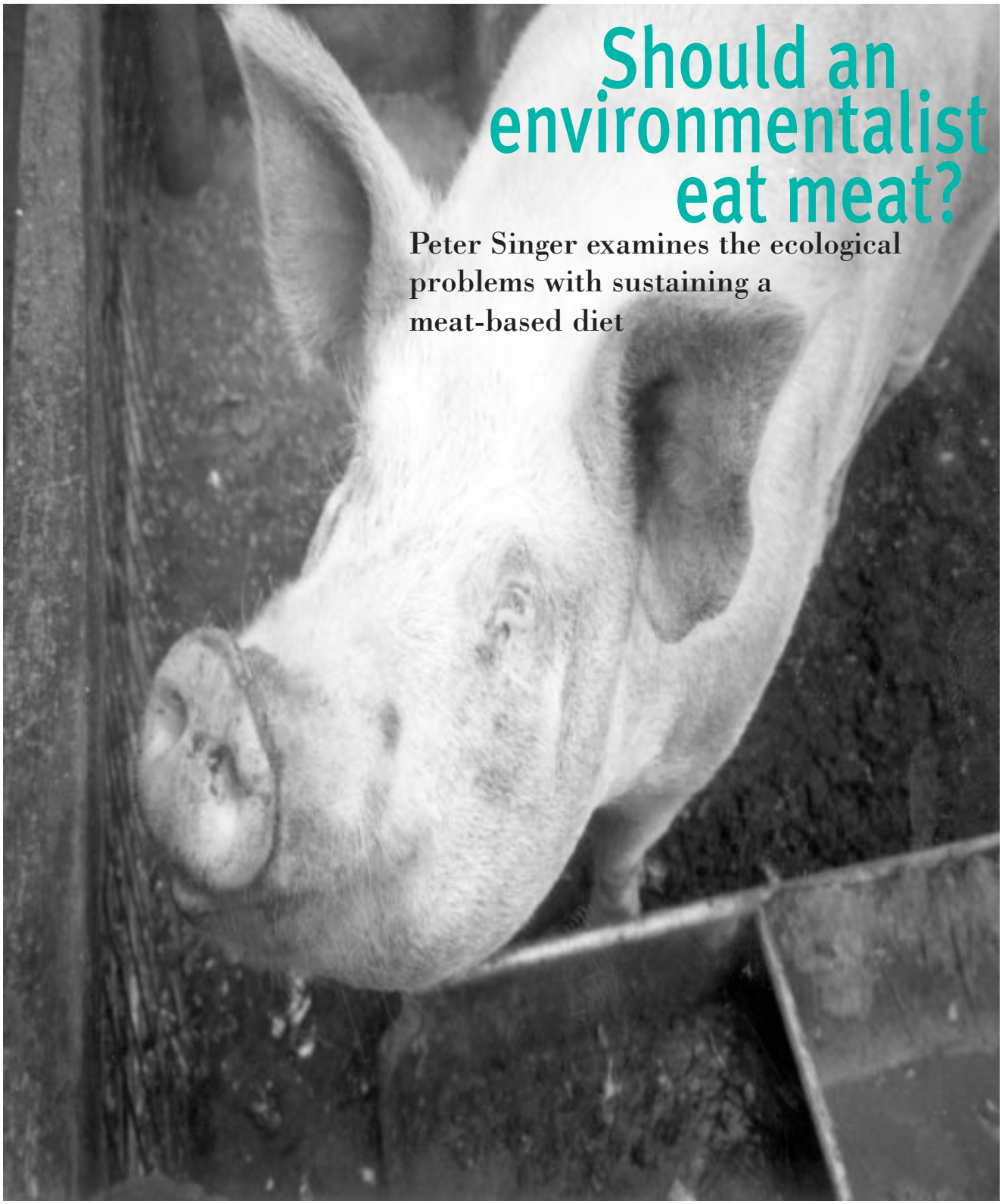


Photo: Cable Daniel-Dreyfus

A few years ago a number of environmental organisations ran a campaign against the packaging used by McDonald's. They wanted something more environmentally friendly. Eventually McDonald's yielded to the pressure and redesigned the containers for its hamburgers. The environmental groups went away happy with their success. Any progress is welcome, I suppose, but perhaps the environmentalists would have been less satisfied if they had thought for a moment about what was inside the packaging.

At a recent conference on 'Equity, Health and the Earth's Resources' at the Centre for a Livable Future at Johns Hopkins University, in Baltimore, Maryland, I listened as some of America's most distinguished scientists pointed to the growing health and en-

vironmental problems associated with their fellow-citizens' heavily animal-based diet.

Since the Centre for a Livable Future is part of Johns Hopkins University's internationally renowned School of Public Health, health aspects of the American diet were prominent. It is now well-established, the authorities agreed, that a diet high in animal protein and fat is correlated with an increased incidence of cardiovascular disease and cancer—the two biggest killers in most affluent societies. But the environment also affects public health, in many ways, and the environmental problems of factory farming were also a subject of concern, on several grounds.

Inefficient food source

The well-known inefficiency of intensive meat production as a means of producing food was again confirmed. Animals raised in sheds or on feedlots eat grains or soybeans, and they use most of the food value of these products simply in order to maintain basic functions and develop unpalatable parts of the body like bones and skin. Hence seven tons of grain are required to produce a ton of beef, five to produce one of pork, and four to produce one of poultry. This is the reason why the average American is responsible for the consumption of about 800 kilos of grain annually, most of it fed to animals closely confined indoors or in feedlots. In contrast Italians, who are hardly known for culinary privation, consume only 400 kilos of grain while in Taiwan and China people consume in the range of 250-300 kilos. On a crowded planet with a growing human population, the standard Anglo-American diet is a luxury that we are becoming increasingly unable to afford.

The immense demand for grain created by the production of vast quantities of animal products means that more energy and water are used, and more pesticides and chemical fertilisers are produced and spread onto the land. The energy use adds to the greenhouse effect and the agricultural demand for water is draining underground aquifers that took tens of thousands of years to fill. Beef eaters are 'future-eaters' in a very literal sense—they are eating resources that they have received from past generations, and which, because of their diet, future generations will never again be able to enjoy.

The sheer number of animals is also a problem. There are now one billion cattle on this planet—not as many as humans, but because cattle are so much larger, the biomass of all the cattle on this planet equals that of all the humans on it. Cattle release large quantities of methane and other greenhouse gases into the atmosphere, contributing significantly to climate change. We are risking unpredictable changes to the climate of our planet—which means, ultimately, the lives of billions of people, not to mention the extinction of untold thousands of species of plants and animals unable to cope with changing conditions—for the sake of more hamburgers.

Dangerous waste

Then there is the problem of shit. The spread of gigantic factory farms in the United States means defecation in mind-boggling proportions. A single pig factory farm now being developed in Utah will produce more shit and piss than the entire human and animal population of the City of Los Angeles. (Agricultural scientists use more polite language, but Shakespeare knew that another name doesn't make it smell any sweeter.) The dairy industry of California's Central Valley creates more shit than 21 million humans. Such vast quantities of turds are environmental

Meat and sustainability: the things your butcher isn't telling you

Fossil fuel and greenhouse gas

• One calorie of fossil fuel energy input returns in excess of 80 calories in corn, and 2.5 calories in wheat and soybeans. However, the same amount of energy input only returns 0.3 calories in rangeland beef, and less still in feedlot beef, with just over 0.03 calories.

• A hectare of crop land emits no methane while growing, while each head of sheep emits over seven kilos, and each head of cattle almost 50 kilos. Methane is a powerful greenhouse gas.

Land degradation

• In Australia, 90 per cent of soil erosion is linked to overgrazing and crop production. The majority of crop production in developed countries is used to feed livestock.

Waste

• Livestock release two billion tonnes of manure every year (approximately 10 times that of the human population). A 60,000 bird egg factory releases 82 tonnes of manure each week, while a farm of 2,000 pigs generates 27 tonnes of urine.

• Fat, offal, and nearly 12 million litres of blood (enough to fill 260 swimming pools) is washed down drains each year. A chicken processing plant uses five million litres of water each day to wash away blood and guts, which is the same amount consumed by 25,000 people in western countries each day.

• It takes around 600 litres of water to grow one kilo of wheat, around 2,500 litres for one kilo of rice, and a staggering 20,000-60,000 litres to produce one kilo of meat.

Side-bar researched by Erika Maksem

disasters waiting to happen—and they do happen. In North Carolina, in 1995, 35 million gallons of pig shit spilled from a containment dam into the river system, killing ten million fish. There were more than 40 shit spills in Iowa, Minnesota and Missouri in 1996, double the number in 1992. Excessive nutrients from intensive poultry units have caused an explosion in the growth of the microbe pfiesteria that has killed 30,000 fish in Chesapeake Bay, near Washington, DC. In the Gulf of Mexico, animal waste has helped to create a 'dead zone' of up to 7,000 square miles.

The BSE scare hurt the beef industry, not only because of the risk of contracting the disease itself, but because consumers learnt that today's cattle eat abattoir by-products along with their grain. Cattle raised in developing countries are more likely to eat grass, but this does not make them environmentally acceptable, since the grassland is often cleared rainforest, taken after tribal people have been pushed off their land. The meat industry as a whole is responsible for the loss of rainforest, and all the consequences of that, from global warming to the loss of some of the richest areas of biodiversity on this planet, and ultimately to the destruction of indigenous culture and the deaths of indigenous people fighting to defend their way of life.

A diet heavy on animal products, catered for by intensive animal production, is a disaster for animals, the environment, and the health of those who eat it. The scale of this disaster will be multiplied many times over if the trend for other countries to copy Western diets and methods of production continues. This is already happening in the more successful economies of East Asia, and it seems bound to spread further as the sphere of prosperity widens. One billion

Chinese, eating a Western diet produced by intensive farming methods, would dwarf the contribution to global warming and pollution now made by the agribusiness industries of the entire European Community. Yet how can we ask the Chinese not to go in this direction when we are doing it ourselves? The example we set will be more telling than the message we preach.

There was an extraordinary moment at another meeting last year, an international conference on 'Environmental Justice' at the University of Melbourne. Professor Tom Regan, a philosopher from North Carolina, put down his prepared text, and told the hundreds of assembled participants, from all over the world, that he had been amazed to see, at dinner the night before, people all around him eating meat! This was a conference so sensitive to the need to be good global citizens that which delegates were invited to contribute to a fund for planting trees, in proportion to the distance they had flown to attend the meeting, in order to compensate for the greenhouse gases their planes had emitted. What about the fossil fuels wasted in the production of that meat, Regan asked. What about the animal waste that needed to be disposed of? What about the surface of our planet needed to grow the grain to feed the animals? What about the arrogance of the human belief that other animals are here just to be treated as machines that convert grain into flesh for us to eat?

At the conference dinner after Regan's speech, the waiter interrogated me about my request for a vegetarian meal. Had I ordered it in advance? Yes, I had. OK, they said, I could have it; but they had to ask because a lot of people were asking for vegetarian meals now, and they hadn't ordered them beforehand. So Regan's powerful plea had some effect. I hoped that the delegates would heed it for longer than the duration of the conference. Perhaps more than any other single change we can make to our lifestyle, it is what the world needs.

Peter Singer is among Australia's best known ethicists. He is listed in the *Oxford Companion to Philosophy*, and is best known for his writings in the area of applied ethics, particularly his book *Animal Liberation* (1976). He has sat on various government committees, and currently works at the Centre for Human Bioethics at Monash University.

A sustainable energy future is in our hands

Recently, we have seen two very important innovations in renewable energy; Greenpower and a new generation of small, modular grid-interactive inverters. These innovations could play key roles in re-shaping our energy future. But their significance goes far beyond the obvious.

Greenpower schemes involve an electricity consumer paying a slightly higher price per unit of power in exchange for a commitment by the electricity supplier to produce a specified proportion of the power used by that consumer from renewable energy sources. The New South Wales government's Sustainable Energy Development Authority has introduced an accreditation scheme, and all NSW electricity suppliers now offer some kind of Greenpower scheme: within a few months of the program's launch, more than 15,000 customers have joined. In contrast, in Jeff's Victoria, the NSW Greenpower schemes are illegal until 2001 (green groups are challenging this and it looks as though the rules will be amended).

Greenpower schemes provide opportunities for individual electricity consumers to make a practical commitment to renewable electricity in a very convenient and cost-effective way. Their success should improve the economics of renewables by expanding markets, and help overcome the reluctance of the electricity industry to develop sustainable energy.

Electricity consumers in most developed countries, including Australia, have strongly supported moves towards an energy-efficient, renewable energy system for decades. Yet governments and electricity suppliers have, in most cases, done little to implement the wishes of the people who pay for the electricity and vote for governments. Australian politicians have built more fossil-fuelled power stations to win votes in marginal electorates and, especially since the emergence of pseudo-competitive electricity markets, most electricity suppliers have paid lip service to sustainable energy while cranking as much power from polluting coal-fired plant as they can.

...the existing subsidies for fossil fuel power (are) estimated by a NIEIR report for the Environment Department at well over $2 billion each year.

In this context, we might ask why our leaders and electricity industry have to be bribed with Greenpower revenue to do what the community wants. The reality is that both government processes and competitive markets have failed to deliver (with a small number of exceptions) on sustainable energy. Australians spend around $12 billion each year on electricity, so investment in a strong strategy supporting progressive introduction of sustainable energy options would be trivial in cost relative to this amount—and its cost would be recovered over time. In fact, it would really just be recovering some of the existing subsidies for fossil fuel power, estimated by a NIEIR (National Institute of Economic and Industry Research) report for the Environment Department at well over $2 billion each year.

The bias is blatant. In Victoria, the Kennett government withdrew support for the Toora windfarm while continuing to support a $100 million research and development program for 'efficient' brown coal-fired electricity. Later, that government 'wrote down' the value of rural electricity supply infrastructure by $400 million, so the new electricity companies could keep rural electricity prices lower. These and other actions have created enormous barriers to the development of sustainable energy in Victoria. The buyers of fossil fuel power stations have been prepared to borrow billions of dollars to invest in them, yet most refuse to invest even a few million dollars in sustainable energy: they claim it's too risky!

Some people are already suggesting the government's pre-Kyoto commitment to generation of just two per cent of electricity from new renewables by 2010 is too costly and difficult. In reality, just expanded cogeneration in the sugar industry (using bagasse, the waste fibre) could come close to this target at competitive costs. If fair credits were given for savings on transmission and distribution costs for electricity generation close to the source, wind, biomass and solar thermal could deliver enough electricity to easily exceed this modest target at competitive prices, while rebuilding rural economies. But most industry players and governments are too concerned with generating profits from existing coal-fired plant to think much about the future.

What is missing is commitment, will and positive vision. And, tragically, I can't see that appearing, despite the pressures created by the Kyoto outcomes—the aim will be to do the minimum that is necessary. So I reluctantly support the view that we should get out

there and support Greenpower, and deny the electricity industry an excuse to further delay introduction of renewables. Maybe one day our leaders and electricity suppliers will hear us.

This brings us to modular grid-interactive inverters, which are beginning to appear on the market. An Australian company, Pacific Solar, is developing a product, while an imported 'micro-inverter' with a capacity of 100 watts is being marketed by Integral Environmental Energy: these are two of the few new players in the electricity industry that seem genuinely interested in renewables. These products allow individual PV panels or other small scale renewable technologies to be connected to the grid via a standard power socket. This is a tremendous achievement. This innovation highlights the failure of the mainstream electricity industry to deliver on sustainable energy, while it provides electricity consumers with a useful tool to teach electricity suppliers a lesson.

The most cost-effective way to introduce renewables into an electricity grid is usually via reasonably large installations, such as 5MW biomass cogeneration systems, farms of 500kW wind generators or 100kW PV arrays. This takes advantage of economies of scale in both construction and operation. But to do this requires commitment from major energy suppliers, financiers and/or governments, which we clearly do not have (again, with a few exceptions).

However, the emergence of micro-inverters opens up new opportunities. It will now be possible to gain some economies of scale from mass production, so this technology can be applied to large PV installations designed in modular form. And the prospect of the $500 plug-in PV module as a Christmas present for the person who has everything is very close. Similarly, it is now possible to look at every lamp post as a potential tower for a small wind generator or PV panel.

Electricity retailer EnergyAustralia's 200kW photovoltaic solar array at Singleton in NSW would probably not have happened without the right legislation in place and the incentive of the Sustainable Energy Development Authority's Greenpower

Widespread adoption of dispersed micro-generation technologies could cause problems for the electricity industry, as tiny renewable generation systems pop up in all sorts of unexpected places, making orderly planning and management difficult. If so, this is unfortunate, but it is the inevitable outcome of decades of failure by governments and electricity suppliers to listen to the community. The pity is that, if they had been more responsive to the community in the past, the total cost and complexity of the shift to sustainable energy could have been much lower, and it could have happened much faster.

The message in all this is a sad one. The Australian community has been disappointed by the failure of its leaders and its electricity industry to confront the future and deliver on sustainable energy. This means we have to do it ourselves—although we should still maintain pressure on government and electricity suppliers. Greenpower and micro-inverters are two important tools in the struggle between the past and the future. The eventual outcome is almost inevitable. The uncertainties are how much time, money and emotional energy will be wasted as we move towards a sustainable energy future, and whether we will be too late.

Post script

For those who think the emerging competitive markets will create opportunities for sustainable energy, stormclouds are gathering. Recently, one electricity supplier admitted it is evaluating 30 services that could be bundled with electricity supply for households and small business, who use over half of Australian electricity. So the price of electricity could be lost in 'one easy monthly direct debit' that covers electricity, gas, home and car insurance, water and phone services—and offers loyalty points, too. So much for markets providing clear price signals!

Alan Pears

Australia set for a meltdown

Kakadu National Park is one of Australia's best known tourist attractions. It could also become a symbol of Australia's growing role in the nuclear power industry, writes Bruce Thompson

Wetlands inside Kakadu could be under threat from in-situ leachate mining of uranium at Jabiluka, but the Federal government is pushing the project ahead without a full environmental impact statement.

Australia has 30 to 40 per cent of the world's proven uranium reserves. Coupled with exponential growth in global energy consumption, we face a crucial test over our involvement in the nuclear fuel cycle. The election of the unashamedly pro-uranium Federal Coalition government just over two years ago has seen a flurry of uranium mine proposals. The abolition of the previous Labor government's so-called 'Three Mines Policy' has left no restrictions on the number of new uranium mines in Australia. Alongside this potential expansion of the uranium industry are plans for a permanent radioactive waste repository in South Australia, and a proposal for a new research reactor at Lucas Heights in suburban Sydney. If it comes to fruition, this combination will establish Australia as a serious player in the most toxic industry known to the planet—without sufficient public debate or consideration for the long term consequences it brings.

Jabiluka

One of the more prominent uranium proposals to receive Federal government approval is the Jabiluka project, located within Kakadu National Park. Government approval of the Jabiluka proposal is a serious indictment on the deficiencies of Australia's environmental safeguards. The proposed Jabiluka uranium mine is within the World Heritage listed Kakadu National Park, against the wishes of its legally recognised traditional owners, and would leave a radioactive waste legacy of several hundred thousand years. Project proponent Energy Resources of Australia (ERA), majority owned by resource giant North Ltd., continues its

push to open the controversial mine in the face of growing national and international opposition. Jabiluka's traditional owners, the Mirrar people, are continuing legal challenges to the mine. In partnership with national environment groups, the Mirrar are currently mounting direct action against construction of the mine, the scale of which has been compared to protests surrounding the Franklin Dam.

Jabiluka has been the subject of appeals to international treaties relating to its World Heritage status, as well as condemnation from both the European Parliament and the Australian Federal Senate. Jabiluka has also been receiving widespread media and public attention, both around Australia and internationally.

Other uranium mine proposals are also moving quickly through government processes designed to facilitate their rapid approval. The Beverley and Honeymoon proposals, in the north-east of South Australia, have set some concerning precedents about the level of environmental and social safeguards surrounding this most deadly industry.

Beverley and Honeymoon

Early this year, the South Australian government approved trial uranium mining to proceed for up to one year at the Beverley and Honeymoon sites. Neither proposal has as yet passed through the Commonwealth *Environment Impact Statement* (EIS) process. South Australia has a legislative framework designed to facilitate mining developments, and protect mining companies from full scrutiny of the environmental and social impacts of their operations. Under the state's *Radiation and Protection Control Act*, uranium mining is exempt from the *Environment Protection Act*. The company pushing for Beverley to open, Heathgate Resources, is 100 per cent owned by US utility General Atomics, who are heavily involved in the US nuclear industry. Honeymoon is owned by Canadian company, Southern Cross Resources.

Trial mining at Beverley and Honeymoon is being undertaken using a technique known as in situ leaching (ISL). ISL involves the injection of a leachate (sulphuric acid in this case) into the aquifer (or water table) containing the uranium deposit. This dissolves the uranium, which is then pumped back to the surface for extraction. Major concerns exist about the potental for groundwater contamination — both from the uranium solution, and the highly acidic leachate—during the mining process. It is also unlikely that mining companies are capable of undertaking groundwater rehabilitation to restore the quality of groundwater after mining operations are completed. These concerns are backed up by international experience with ISL. In Konigstein, Germany, for example, the contamination of groundwater by heavy metals from ISL poses a serious threat to the region's drinking water supplies. ISL poses similar risks to regional water supplies in Bulgaria, Czechslovakia and the Ukraine.

National radioactive waste repository

The Federal government has proposed the 67,000 square kilometre Billa Kalina region in South Australia as the site for a 2.5 hectare repository. If approved, the site would involve low-level and intermediate-level radioactive waste being buried less than 20 metres below ground in what is known as a near surface disposal facility. If all approvals are granted, the Federal government hopes to start construction in the year 2000. This is the third phase of a 'public consultation' process during which time the original proposal has remained completely unchanged despite indepth analysis and critique from environment and community organisations. The proposal flies in the face of the Senate Select Commitee on the Dangers of Radioactive Waste recommendation for a national above ground repository. However this would not solve all the problems, as any central waste repository represents dangers in transportation of radioactive waste. The removal of waste

Protests against the Jabiluka uranium mine proposal have been compared to protests against the Franklin Dam. The Mirrar people (left) have been supported by a blockade at the site, which has attracted many supporters.

from the site of production also encourages a culture of 'out of site, out of mind'.

Lucas Heights

The research reactor at Lucas Heights in suburban Sydney is to be decommissioned within the next four years, and will be replaced with a new reactor. The project would involve a considerable investment with minimal benefit and continued problems and risk.

The nuclear fuel spiral

Besides its use in nuclear arms, uranium is predominantly used for large scale electricity generation, with small quantities used in medical, research and testing equipment.

Australia's uranium supplies the nuclear power industry, an industry that is inextricably linked with the production of nuclear weapons. Australian government agencies are still unable to guarantee that our uranium is not being used in weapons of mass destruction. Even if it were possible to give such a guarantee, the use of Australian uranium for nuclear power still represents one of the greatest single long term threats to human health and the environment.

Nuclear power generation is the most dangerous industrial process on the planet. It has generated and continues to produce tonnes of highly radioactive wastes, for which there is still no known safe method of storage and disposal. Many of these wastes are lethal for hundreds of thousands of years and will therefore threaten the livelihood of generations to come.

Nuclear energy—the white knight in the greenhouse?

Amidst serious international concern over global warming, nuclear power is being promoted as a possible solution to carbon dioxide emissions from coal fired power generation. Such a view is based on the false premise that nuclear power represents a safe, clean, sustainable and economically viable alternative. Ignoring the history of nuclear issues and the problems of the nuclear fuel cycle, the nuclear option remains an ineffective solution to the problem of sustainable electricity generation.

Nuclear power is not greenhouse friendly

While nuclear electricity generation entails no direct emissions of CO_2 or other greenhouse gases, the total cycle does. Although these emissions are, at present, quite small in comparison with coal fired power stations (four per cent of equivalent size generation); they are considerably larger than other safe, viable options.

Nuclear power releases four to five times more CO_2 than equivalent power production from renewable sources. It also releases up to 20 times more CO_2 than saving the same amount of power with energy efficiency measures.

Considerable amounts of fossil fuels are used during the mining and enrichment of uranium, as well as during manufacture and plant construction. It might be argued that future nuclear power generation could achieve lower emissions, though as demand for uranium grew, CO_2 emissions would again rise as ore grades declined.

Nuclear power is unsustainable

Most publicity promoting nuclear power acknowledges that global uranium reserves are indeed quite limited when used in conventional thermal reactors.

> '...used in the type of reactors now in operation, the world's uranium supplies that are recoverable at a reasonable cost would be unlikely to last more than 50 years'
>
> *U.S. Dept. of Energy, 1989*

The Jabiluka mine proposal goes against the wishes of the Aboriginal custodians, the Mirrar people. There are sacred sites located close to the ore body, and the Mirrar people have had legal title to their land under the Northern Territory Aboriginal Land Rights Act since 1982.

However, without drawing attention to their fundamental technical problems and substantially higher economic costs, fast breeder reactors are usually cited, quite glibly, as a means of transforming severely limited uranium resources into a much larger potential source of energy. In theory, the use of fast breeder reactors could increase the energy available by a factor of 60. In practice, it is now not clear how this would be achieved on an expanded global scale without encountering basic plutonium shortages, not to mention serious problems with waste disposal, power plant decommissioning and nuclear weapons proliferation. In fact, use of fast breeder reactors is an essential component of the case for nuclear power. However, this case is built around a technology which the industry itself doesn't expect to be available for commercial introduction for another 20 years (UK Atomic Energy Authority).

Wasting time and money

Bill Keepin and Gregory Kats, research scholars at the Rocky Mountain Institute in the United States, undertook a detailed analysis, comparing the effectiveness of nuclear power with energy efficiency measures in reducing CO_2 emissions. Their principal findings were as follows:

- Even a massive worldwide nuclear power program sustained over a period of several decades could not 'solve' the greenhouse problem. Even if it could, the Third World cannot support a major expansion of nuclear power on the scale that would be required in an attempted nuclear solution to global warming.
- The key to ameliorating future climatic warming caused by the combustion of fossil fuels is to improve the efficiency of energy usage.
- Improving electrical efficiency is nearly 7 times more cost effective than nuclear power for abating CO_2 emissions in the US.

Keepin and Kats also highlight the problem of 'opportunity cost'. Spending money on an expensive, relatively ineffective option uses up money that could be spent on cheaper, more effective measures. This is especially relevant for cash-strapped developing nations.

Conclusion

Australia is at a critical juncture in terms of its role in the global energy conundrum. If the Federal Coaltion government is permitted to continue its push to open a myriad of new uranium mines, Australia will be firmly cemented in the nuclear fuel cycle. This fate, however, is not inevitable. The consolidation of the renewable energy sector will be a crucial element in Australia embracing a nuclear free future. The anti-uranium movement needs the support of all concerned with sustainable and appropriate energy sources—the active promotion of renewable energy is a potent and critical weapon in this fight.

Bruce Thompson campaigns with the Friends of the Earth anti-uranium collective and the Jabiluka Action Group. For further information and support contact Friends of the Earth on (03) 9419 8700 or the Jabiluka Action Group on (03) 9417 6660.

Regular transport to Kakadu and blockade training in major capital cities is being organised by the National Jabiluka Alliance—for more information phone (03) 9417 6660.

E Source Technology Atlas Series

E Source, 1033 Walnut Street, Boulder, Colorado 80302-5114 USA tel 303 440 8500, fax 303 440 8502, email esource@esource.com website: www.esource.com/atlas. The hard copy or CD ROM costs US$750, or US$950 for both plus US$45 shipping fee for hard copy. E Source have extended a $US100 discount to ReNew readers, and will also waive the $45 shipping fee.

Amory Lovins, an American energy efficiency guru, rewrote the science of energy forecasting in the 1970s and created a new vision of our energy future, when his book Soft Energy Paths outlined how society could stabilise, then reduce energy consumption instead of pursuing ongoing growth. The Rocky Mountain Institute (RMI), established by Lovins and his wife Hunter, has become a focus for the development of practical approaches to energy efficiency.

The E-Source Technology Atlas Series provides a summary of many years' work by teams at RMI. Its content covers lighting, cooling, heating, drivepower (motors and drive systems) and appliances in both the residential and non-residential sectors. The 1,700 pages of the hard copy version (also available on CD ROM) can only be described as encyclopedic. Anyone who worked through this material and absorbed it all would be among the most fully-informed energy-efficiency experts around.

The presentation of material is excellent, with plenty of clear diagrams and graphs, references to relevant research and experience, sources of equipment, and discussion of practical problems that might be encountered. For Australian readers, one limitation is the use of US units and terms. For example, cooling capacity is stated in tons, and insulation values look much more impressive than they really are: R8 duct insulation in this study is equivalent to R1.4 in our units! It would be helpful if there was a table of conversion factors.

As someone who works in the energy-efficiency field, I experienced occasional frustration where there was not quite enough detail to carry an argument with a reluctant heating and cooling engineer. And some Australian technologies were not addressed, because they are not common in the USA. But these are minor quibbles: very little of this information is available from any other source, anyway.

The power of the E-Source approach lies in the framework that is applied. Many people who try to improve energy efficiency look at individual components or items of equipment, and thereby miss most of the opportunities for savings. E-Source's approach involves a number of steps, including:

- looking at the situation in context, so that the real services being delivered can be recognised. For example, the real objective of office cooling is to provide a comfortable working environment.
- Understanding the whole system that is delivering the service. For example, can the local micro-climate be moderated? Can the building be designed or modified to minimise energy flows? Can internal heat loads (such as waste heat from lighting) be minimised? Can natural energy systems be used to minimise or avoid the need for cooling? And can the cooling system be designed for optimum performance and efficiency?
- Identify synergies (that is, beneficial interactions that multiply savings) between improvements, and consider them in design and costing. For example, investing in insulation, shading, improved glazing and energy-efficient

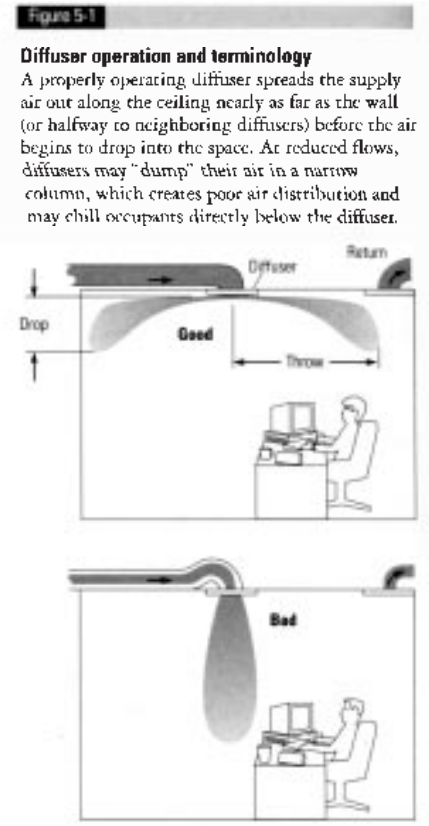
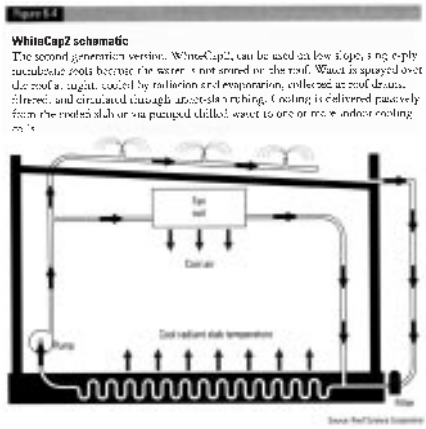


Figure 5-1

Diffuser operation and terminology

A properly operating diffuser spreads the supply air out along the ceiling nearly as far as the wall (or halfway to neighboring diffusers) before the air begins to drop into the space. At reduced flows, diffusers may "dump" their air in a narrow column, which creates poor air distribution and may chill occupants directly below the diffuser.


WhiteCap2 schematic

Examples of diagrams from the *Cooling* volume of the E-Source Technology Atlas series

lighting allows cooling system capacity (and capital cost) to be reduced, as well as cutting ongoing energy costs consider life-cycle costs, as long-term savings on operating costs often far exceed any additional capital cost. And the pleasant surprise is that, often, even overall capital costs can be reduced. Many analysts expect energy saving measures to repay their additional cost within a year or two: this tough criterion, combined with failure to consider overall system costs, means many cost-effective measures are routinely rejected.

When this integrated approach is adopted, savings of 50, 70 or even 90 per cent become feasible in many situations. Using E-Source's methods and information shows how it is possible to achieve the kinds of energy savings needed to achieve the large reductions in greenhouse gas emissions required to stabilise the concentration of greenhouse gases in the atmosphere—while helping the economy. For more examples of the kind of thinking needed, the book *Factor Four* by Weisacker and Amory and Hunter Lovins is also worth reading.

Reviewed by Alan Pears

Australian Solar Radiation Hand Book

ANZSES, PO Box 1140, Maroubra, NSW 2035. Fax (02) 9311 0004.
Package 1: $400/$320 for ANZSES members. Includes Main Report plus five state attachments in bound and disk formats (Mac and IBM compatible).
Package 2: $130/$100 for ANZSES members. Includes Main Report plus one state attachment of your choice in bound and disk format (Mac and IBM compatible).

The Australia and New Zealand Solar Energy Society (ANZSES) has made Australian solar radiation data more affordable and more reliable. Formerly distributed by the now defunct ERDC, the data has had a troublesome bug removed, and is now available as both a whole of Australia volume or as separate state volumes.

There are a total of 28 sites around Australia where data was collected or estimated for the Handbook, mainly in populous areas. Forty six data sets are presented for each site, including average daily irradiation on surfaces at various inclinations and orientations, average temperatures, heat gain through windows at various orientations and a range of climatic data including temperature and wind speed. The data is presented as averages for each month.

The Handbook data is available in disk and hard copy formats, and comes with a main report that outlines how to use it.

The disk version of the data is in '.tab' format, which means plain text with tabulation settings embedded in it. This means that it can be imported into word processing and desktop layout programs without the column formatting being messed up—a useful function for preparing reports. However, the real value of the electronic version comes when the data is imported into spreadsheet programs. We imported several tables into Microsoft Excel, and they formatted perfectly. It was extremely useful to be able to create complex graphs of the data in a few seconds and see trends at a glance. Once again, this would also be useful for preparing reports. Additional calculations based on the data are also much easier to perform in a spreadsheet.

There are a range of design tasks the Handbook could be applied to. Some

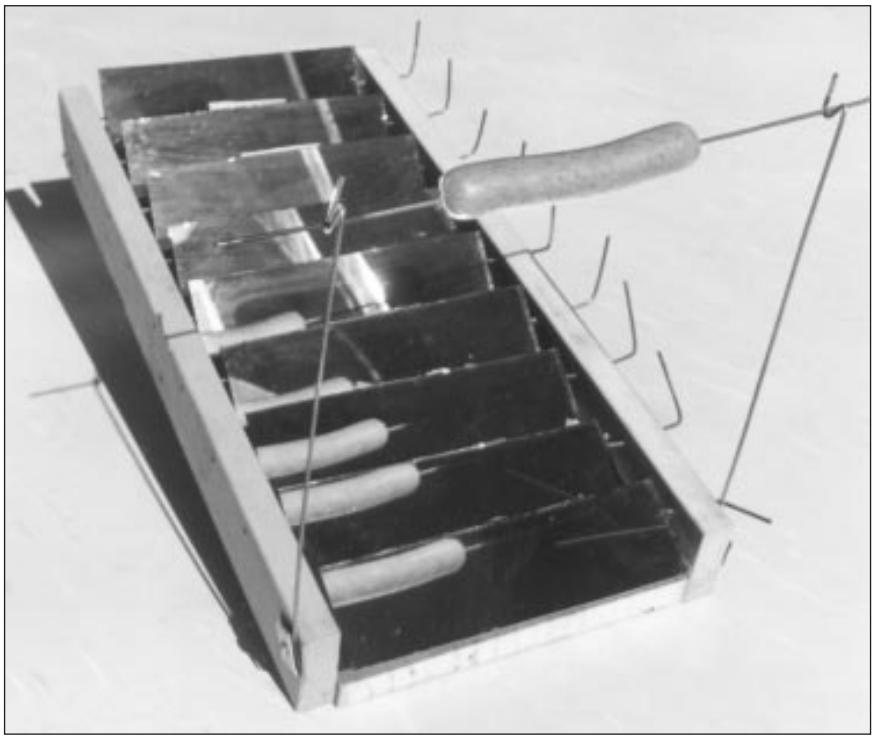
of those suggested in the main report include photovoltaic systems, passive solar buildings, greenhouses, daylighting in buildings, and solar hot water systems. While the Handbook is geared towards design professionals, it would still be a valuable tool for anyone designing their own passive solar house or looking to squeeze the optimum efficiency out of their home photovoltaic system.

[Kids' stuff]

Noel's Treasures from Trash

To Build this
solar sausage sizzler
you will need:

- 11 bike spokes 30cm long (a bike shop should be able to supply you with some old ones for little or no cost).
- 1 long stainless steel skewer
- 2 pieces of softwood 460 x 70 x 19mm
- 1 piece of softwood 460 x 190 x 19mm
- 9 pieces of mirror 180 x 45mm
- 6 x 50mm nails
- 2 x 10mm self tapping screws and washers
- strong packing tape
- a strong pair of pliers
- a drill and small drill bits
- a hammer
- a ruler



The solar cooker at work. Note the glow around the sausage where the sunlight is concentrated.

Continuing with our series on bending light, this time we will focus the sun's rays onto some food and try to cook it.

Making the base

Using only two nails or some strong sticky tape, join the two pieces of 70cm wide wood together face-to-face. You will need to be able to separate the two pieces later, so only use two nails.

Now mark a line, 10mm in from one edge, along the full length of one face of the wood. Put an 'X' on this line 25mm in from one end of the wood, and continue marking every 50mm. You should end up with nine marks across your line.

Next drill holes right through both pieces of wood where the 'X's are. You need to make sure that these holes go through at right angles, and that they are about the same diameter as the bike spokes. You can make a drill using a piece of spoke about 70mm long, and use a power drill to drill the holes with it.

Once you have drilled all nine holes, separate the two pieces of wood and nail one down each side of the larger piece of wood. The large piece of wood becomes the base, and the two rows of holes should be at the top.

Making the mirror holders

Cut off the small bend at each end of the spokes, and bend nine of them to the shape shown in figure 1. Make sure that the ends are in a straight line and that the bent spoke lies flat on the bench.

Carefully slide the long end of a spoke through one of the holes, then slide the short end through the matching

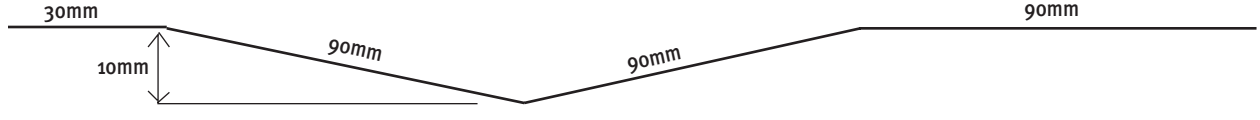


Figure 1. Bend nine of the spokes like this. These form the mirror holders.

hole in the other side. Repeat this with the other eight spokes.

Now tape one mirror to each of the bent spokes, and bend the long ends that protrude from the side of your cooker at right angles so that each spoke now has a handle that you can use to aim the mirror with. Make sure that the mirrors do not touch each other when rotated.

Making the food holder

Cut the small bent end off the two remaining spokes and bend one end of each one into a small circle just big enough for the screws to go through. At the other end of the spokes bend a small 'U' shape to hold the skewer. You can see the shapes in figure 2.

Now screw one spoke onto each side of the cooker, near one end. You might want to make a small hole for the screw first to make it easier. You can see how the finished cooker looks in the photo. Your cooker is now ready to test.

Get the food you want to cook, put the skewer through it, and rest the skewer on the 'U' shape at the end of each of the two spokes. We used a vegie sausage because they are pre-cooked and only need to be heated, and don't spit fat all over your nice clean mirrors like a meat one will.

Take the cooker outside and face it so that the food end is pointed towards the sun. Now rotate each mirror so that the sunlight is reflected onto the food. As you adjust each mirror in turn, the spot of light on the food should look brighter and brighter, and the food will start to cook, although it will take a while. Tilt the cooker up at the back if the mirrors are casting shadows on the ones behind them.

If you have used meat, make sure that it is properly cooked before eating it, or you could get food poisoning! If you are not sure, stick with vegies! You can also make kebabs, where you chop vegetables into pieces 3-4cm square and put them on the skewer.

Figure 2. How to bend the spokes for the food holder for your cooker.

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.

Dual battery banks

I am installing a second battery bank for winter in my country holiday cottage. I want a simple device that will switch the solar array over to the second battery bank once the main bank is charged and back again without user input.

Is there anyone who is using a micro-hydro system from seasonal run-off water? We have a 10 to 15 liter-per-second overflow from our dam in the wet months. I would like to hear from anyone with such a system in Victoria with the view to having a look at how well their system works.

Also, has anyone studied the increase in energy gained from using solar trackers? Are they worth the cost versus just adding extra solar panels?

David Holzgrefe,
Dtholt@nemesis.com.au

David, running two battery banks in parallel is certainly possible, and automatic changeover switches are available to do what you require. They are generally used for automotive use, and need to be used in conjunction with a good regulator. They are available from automotive and marine electrical stores.

Alternatively, you could connect the second bank to the load dump connection of a shunt regulator, but would need to have a second shunt regulator between the first regulator and the second battery bank. Some regulators will not be suitable for this connection, so I suggest you talk to the supplier if you want to do this. There may also be some regulators that allow for the connection of two battery banks, so look around.

The general concensus with solar trackers is that they can provide 30 to 40 per cent more power from your panels on most days, so they are certainly worth installing, especially if you have more than two or three good-sized panels. Trackers vary in price from $300 for a DIY kit to over $1000 for larger units. You may even want to go completely DIY and build the controller as well as the frames. A design for a suitable controller appeared in Soft Technology number 47.

– Lance Turner

Dual use solar panels

I have friends with a solar water pump which runs on 48 volts using four Solarex 50 watt modules. They have a solar house power system using a 12 volt battery and inverter.

During winter time they have no need for the solar pump and would like to have the four modules which are part of the pumping system adding to the power provided by the modules connected to the 12 volt battery for the house power system.

I have worked out the wiring system but need help with a switching device. I believe that I need an 8-pole switch to effect changeover for the four modules from 48 volt pumping mode to 12 volt battery charging mode. My suggested wiring is shown below.

An electrical wholesaler was able to offer me two 12 volt, 4 pole, 12 amp relays which would require electricty to hold them in one way. I do not want to have power constantly being used to hold the relay in, and thereby wasting power that could be available for the battery charging.

How much power would such a relay require? Would it be significant? What switching alternatives can you come up with?

Andrew Blair, Ringwood VIC

The wiring diagram you have supplied seems like the best way to go, but I would not bother using relays, they just add unecessary complication. A pair of four-pole, double-throw switches would do the trick. Electronics stores such as Jaycar Electronics and Dick Smiths have three amp versions of these for about $7 each. These are rated for 240 volt AC or 24 volt DC, and as there are eight sets of contacts in series when in the 48 volt mode, their ratings should be adequate.

A pair of these mounted side-by-side would be fine, but make sure that no reverse current can flow from the battery, as flipping one switch before the other may cause a temporary short circuit. If in doubt, use an isolation switch or a blocking diode just before the battery.

While you could use the suggested relays, they will draw from 0.25 to about four watts, depending on their design. They are also a bit over-rated (making them over priced, most likely), as each pole will only be carrying the current of one solar panel, which is about three amps for a 50 watt module. I would go with the switches.

– Lance Turner

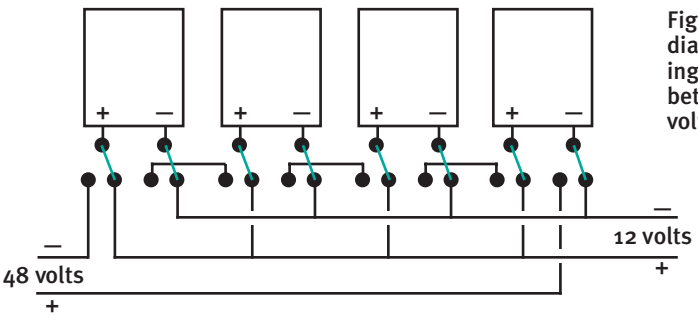


Figure 1. The wiring diagram for switching four solar panels between 48 and 12 volts.

Solar plant propagation

I would like to set up a very small (approximately 1m² area) hothouse with a bottom heat bed for propagating plant cuttings. Is there a way of heating the propagation bed using solar power but without the need for storage batteries?

Perhaps rocks beneath the bed could be solar heated during the day for night time heat emission? Being a complete novice at these things I'd appreciate referral to detailed plans or instructions if anyone knows of such.

Heather Gill, Margate TAS

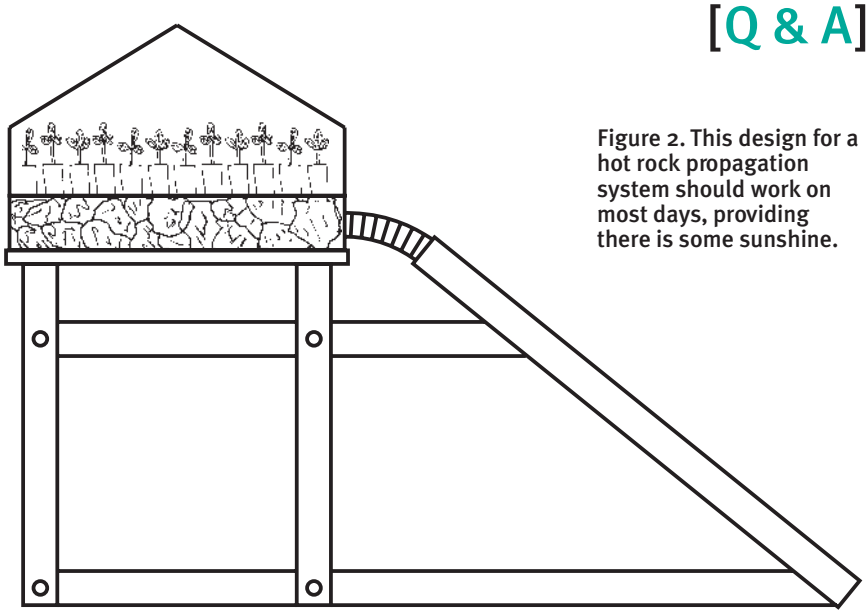


Figure 2. This design for a hot rock propagation system should work on most days, providing there is some sunshine.

I would suggest using a simple hot air panel to warm up a bed of rocks or other material with a high thermal mass which would then provide the required warmth at night. A design for a suitable panel can be found in the ATA's book, 'Build Your Own Green Technology'.

The solar heating panel warms the air which then flows through the rocks, heating them, then out through a vent at the back of the rock bed. Cool air flows into vents at the bottom of the panel.

Alternatively, a flat tank of water heated by a solar collector could be used. The water tank would be mounted about a metre from the ground with the solar panel below it and angled toward the sun.

– Lance Turner

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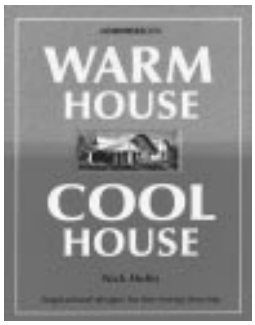

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Author: Nick Hollow
Price: $27.50 Softcover, 172ppg
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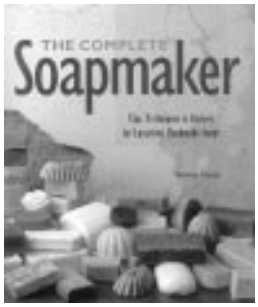

THE COMPLETE SOAPMAKER

Author: Norma Coney
Price: $24.95 Softcover, 128ppg
'The politics of soap making' in *ReNew* #60
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Reviewed in ReNew #61
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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.
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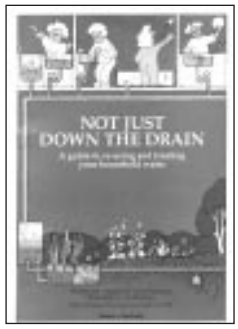

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Monitoring your system

All independent power systems need some sort of monitoring, whether it be a couple of indicator lights or a full set of meters. Lance Turner takes a look at the basics of watching your system

Even the smallest of independent power systems should have some way of telling the operator how it is performing. Without some sort of monitoring, there is no way to tell just how much charge is left in the battery bank, how much power is coming from the solar panels, wind generator or other power source, or if there is a problem with the system.

Monitors can take many forms, including simple light-emitting diodes (LEDs) that switch on and off, analogue or digital meters, and microprocessor controlled units that can provide just about every bit of information about your system you could ask for.

The simplest type of monitor is the indicator, which usually consists of a LED light or other small light that turns on or off when a preset condition occurs, such as when the batteries are fully charged or the inverter is running. Indicators are usually included in other devices like charging regulators, because they are simple and cheap to implement and provide the basic information required to operate that device.

The next type of monitoring device is the meter. These are either analogue or digital, with the latter being the more accurate of the two.

Analogue monitoring

An analogue meter usually uses a mechanically operated needle that travels across a graduated scale to indicate the value of whatever is being measured. Analogue meters are electrically actuated—current passes through a coil inside the meter which is attached to the needle, producing a magnetic field which reacts against a small magnet, deflecting the needle.

Analogue meters are limited to about five per cent accuracy, due mostly to the friction of the needle mechanism. However, they do have an excellent relative indication, so a quick glance can often give you all the information that you need.

Reading the numbers

A digital meter displays the measurement on a calculator-like display. This can be either a liquid crystal display (LCD) or LED.

Although analogue meters have been around for many decades, digital meters are becoming more popular. There are several reasons for this.

Digital meters are very accurate—even the cheaper units are more accurate than the best (expensive) analogue ones. A $25 digital meter will out-perform a $100 analogue unit in most situations. Digital meters are also very reliable—having no moving parts, there is nothing to wear out.

Unlike analogue meters, digital units can read and display either positive or negative voltages. A negative value is usually preceded by a minus sign in the display. On the other hand, if a negative voltage is fed to an analogue meter, the meter needle will slam against the lower end stop, possibly damaging the meter movement.

Some digital disadvantages

However, there are a couple of problems that digital meters suffer from that analogues don't. The first is electrical noise, which can cause inaccurate readings in cheaper meters that don't have sufficient noise rejection.

Another problem is that of sample rate. Some digital meters only update their display every second or so, which can be too slow to register rapid fluctuations such as high surge currents. However, a good-quality meter will have a higher sample rate—up to 10 per second for some units.

Another point to note is that some digital meters will require their own separate power supply from which to run, and this may need to be isolated from the voltage being measured. This is especially true if the meter is monitoring tiny voltages like those across a shunt, which would be inadequate to run the meter's circuitry. The circuitry itself will often require a nine volt supply, and this can be supplied either by a battery or a small isolated power supply that takes its power from the main system battery. However, many digital meters don't have this requirement and can be run from the system battery directly.

Digital meters are also available already set up to measure a particular voltage range, such as 0 to 20 volts, or 0 to 200 millivolts for use as an ammeter. Like analogue meters, you can also buy

Setting up a voltmeter

All analogue meters measure voltage, but the voltage they measure is usually very small, just a few tens of millivolts or so. This means that you have to provide a suitable voltage to the meter for it to work properly.

For a voltmeter, this involves connecting the meter to the voltage to be measured via a suitable resistor (in series with the meter). The resistor drops most of the voltage from the source across it and so only a much smaller voltage appears across the meter.

To calculate the value of the resistor, you must know two things. One is the resistance of the meter itself (you can measure this with a multimeter), and the other is its 'full scale deflection' (FSD) current or voltage. If the voltage that the meter needs to read full scale is not marked on the back of the meter, you can find it by multiplying the meter resistance by the FSD current, if known.

Now you can calculate the value of the resistor as follows. Subtract the FSD voltage of the meter (50mV or 0.05 volt is a common value) from the value of the voltage you wish to represent full scale deflection of the meter, say 15 volts for a 12 volt system. In this example you would get 15 - 0.05 = 14.95 volts. This is the voltage that must be dropped across the resistor when the meter reads full scale.

The next step is to divide this value by the meter FSD voltage. For this example, we would have 14.95/0.05=299. This means that the dropper resistor's resistance will have to be 299 times the meter's resistance. Now just multiply this value by the meter's resistance, say 100 ohms for this example, to get the value of the resistor you need to use with this meter. This would be 299 x 100 or 29.9k. A 30k, 1 per cent resistor would be fine for this application.

An ammeter is easier

Contrary to what its name suggests, an ammeter actually measures the voltage across a low-value resistance (called a shunt) through which the current to be measured is flowing. As voltage drop is proportional to current flow, the meter provides an accurate representation of the current in the circuit.

An ammeter is most easily made by matching a shunt to the meter movement you have. If your meter has a full scale deflection of 50 millivolts, then a shunt will be required that drops 50mV across it at the maximum current you want the meter to read.

For example, to read a maximum of 100 amps, you would connect the 50mV meter across a 500 micro-ohm shunt (0.05/100).

Preset meters

Many meters are already set up to read a particular range of voltage or current. A voltmeter of this type will have a dropper resistor inside it in series with the meter movement, and an ammeter will have an appropriate internal shunt. Ammeters of this type rarely exceed 50 amp capacity due to the heat that the shunt will dissipate.

If you want to change a meter of this type to read a different range, then you will need to open it and remove whatever resistors are already inside it. This can be a delicate job, as the meter movement can be easily damaged.

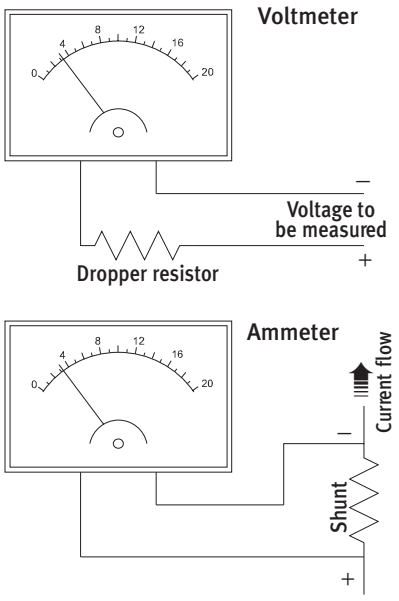


Figure 1. Setting up a standard analogue meter movement to measure voltage or current.

standard digital meters that are easily set up to read any range that you wish. All that is usually required is that a jumper be changed, or an extra resistor be added to the back of the meter. The instructions that come with the meter will usually explain what you need to do.

Smart monitors

Some devices allow the measuring of more than one value, alternately (or sometimes simultaneously) displaying them on a screen. Many newer power systems have such displays, which can give information on battery voltage and current draw, inverter output voltage, solar and wind power input voltage and/or current, and some even have event alarms. Some of these devices can also perform calculations on the data, such as integration of instantaneous voltage and current to display actual power consumption, as well as storing this information for later use.

Smart monitors range from basic digital meters with two functions, up to very advanced units with dot-matrix displays that can give system information in plain English, such as 'Battery voltage: 12.85 volts'.

Smart monitors usually contain a microprocessor that monitors the various system inputs and outputs, collects the information and displays it on request. Some of these monitors can connect to a computer, either directly or via a phone line, for uploading of the information to the computer, allowing the system to be monitored remotely.

The biggest drawback with smart monitors is their price. You can expect to pay over $100 for most of them, while some cost a lot more. This restricts their use to larger systems or for people who have the money to spend.

Other measurements

In some power systems, there will be measurements other than just voltage and current required. The frequency of the AC supply is one example, as this needs to be very accurate if clocks and other timers are running from it. Frequency meters are often analogue devices with a graduated scale running from 45 to 55 Hertz (Hz).

Power consumption, in watts (or kilowatts), is another measurement you might want to make. For DC measurements, a recalibrated ammeter will give an approximate value, but for AC measurements, a true RMS power meter will be required in most instances.

What do you need?

If you have only a small system, then you may be satisfied with just a couple of LED indicators to give you an idea of battery voltage (Good, fair or poor), or maybe a simple voltmeter for a better idea of battery condition.

All a LED indicator usually does is measure a voltage and light or extinguish the LED(s) accordingly. This can be done using very simple circuits (usually a single common IC will suffice).

Alternatively, a meter may be desirable. Analogue meters are widely available, with prices starting at about $15. Many meters come already set up to measure a particular voltage or current range, so it is just a matter of connecting them into your system. You can also use a standard meter movement and set it up yourself to measure whatever you want.

Another option is to use a meter from a piece of scrapped equipment to monitor your system. But unless it is already set up to measure the same range as you want to, then you need to reconfigure the meter for your uses. But first, you must determine what type of meter it is, and what ratings it has. For more information on converting an existing meter, see the box titled 'Setting up a voltmeter'.

When setting up your system, it is important to have all of the meters in one place, preferably mounted on a single panel so that the whole system can be monitored from one place. The meters can be laid out in groups, such as battery voltage and current together, AC voltage, current and frequency in another group, with solar, wind and other power sources in yet another. A good example of such a panel can be seen in the article 'Solar struggle in Warrnambool' starting on page 18 in this issue.

This, universal meter, available from Dick Smith Electronics, can be set up to measure almost any voltage or current.

[product review]

Greenspeed Touring Trike

It's aerodynamic, equipped with state-of-the-art components, made in Australia and, well, it's green. Michael Linke test rides a zero emission vehicle that's out of the ordinary

One of the most important dates in the recent history of human powered vehicles was the day that Ian Simms lost his job as a laboratory technician at ICI in Melbourne in December 1989. Of course, that day freed up Ian's time, but it also prompted him to be a little more frugal. He focused on one of his major expenses, transport, and began looking for cheaper alternatives to a car. He tried his son's mountain bike, but didn't feel safe riding it in traffic.

He had seen photos of recumbent bicycles in magazines. These two-wheelers had the rider sitting back with their legs horizontal, the pedals at the front of the bicycle. Because of the reduced wind resistence and reduced strain on the rider's arms, Ian felt that these were 'more intelligent machines' than conventional upright bicycles.

He was soon building two wheeled recumbents, but it wasn't until he saw a recumbent tricycle in an English cycling magazine that he discovered his dream machine. He soon built his own, with two wheels at the front and one at the back, and after making some design modifications, rode a trike in the 1990 Great Victorian Bike Ride.

The orders flooded in, and eight years later Ian Simms' Greenspeed trikes are sold all over the world. *ReNew* was fortunate enough to get hold of a current model Touring Trike for a test ride.

The first thing you notice about sitting in a Greenspeed is that it is comfortable. The 'saddle' is a plastic-coated fabric mesh, stretched across two uprights on the steel frame, and tied together with elastic shock-cord. Along with the pnematic tyres, the fabric and cord provide the suspension for the Trike.

Comfort is enhanced by the steering being positioned low, so that the rider's arms are in a close to relaxed position. The shoulder, arm and neck pain that can follow a day's upright cycling are eliminated.

The steering mechanism is very well designed. The handlebar attaches to a pivot point below the saddle, either side of which are two pivoting aluminium rods that cross over and attach to diagonally opposite front wheels. The result is highly responsive steering that doesn't take much effort. It is also safe at high speeds, as hitting pot-holes or road debris doesn't jerk at the handlebar.

Besides being low to the ground and dramatically reducing wind resistance, the Trike also makes pedalling easier by offering 63 gear combinations. There are three chainwheels at the front attached to the pedals, and a combination internal and external gear hub on the back wheel. There are three gear levers, which takes some getting used to, and the three internal gears are shifted while not pedalling or back-pedalling, which makes for a challenging first-time ride. All these gears are useful however, and mean that the Trike can cope with just about any gradient.

The test Trike came equipped with some very large Australian made Bunyip pannier bags. These bags fit as much in them as an upright bike's front and rear panniers combined, yet they didn't detract from the Trike's handling at all. Indeed, the extra weight meant that it didn't bounce around on rough, corrugated dirt roads.

The Trike is stopped by two drum brakes, one on each of the two front wheels. As with the internal gears on the rear hub, the drum brakes are sealed from dirt and moisture, and therefore require little maintenance. They also stop the Trike very smoothly, and have the added bonus of a locking button that acts as a 'hand-brake'. The levers for the brakes are positioned on the handlebar, and are easily operated without compromising steering. The brake and gear cabling is all the low-friction, teflon-coated 'Ride On' variety, which makes a big difference to performance and reduces the amount of maintenance required.

The first questions that many people asked upon seeing the test Trike were 'Is it safe? Do cars see you?' Because it is lower to the ground, the perception is that it will be harder to see from a car. On the open road this is certainly not true. In fact, most car drivers slow down for a good look and a friendly wave. In congested inner-city streets there is an increased likelihood of having a door from a parked car open in front of you, but giving parked cars a one metre clearance will avoid this problem.

For a non-cyclist, the Trike would be an easy way to get started. It doesn't require great balancing skills, doesn't cause wear and tear on the upper body, and because of its lower wind resistence, it isn't frustrating to ride into a headwind.

Unfortunately, the Trike's hand-made frame and high quality Sachs German

components don't come cheap. At $4,400, it is a serious investment. There are cheaper options available from Greenspeed, however, like two wheeled recumbents for between $2 to $3,700, and a 21 speed Commuter Trike for $3,400.

It is ironic that as more and more people are attracted to 'eco-tourism' holidays they are often travelling further in petrol driven cars or four wheel drives to get there. The Greenspeed Touring Trike is perhaps the perfect eco-tourism vehicle, because it creates no pollution, and ensures that the journey is as enjoyable as the destination.

For more information on Greenspeed cycles, contact Greenspeed at 69 Mountain Gate Dve, Ferntree Gully Vic 3156. Ph (03) 9758 5541. or visit their web site at http://ihpva.org/com/Greenspeed/index.html

Above: the Trike with the Burley d'Lite trailer.

Right: The Trike's underbelly, showing how the steering rods connect to the wheels.

Below: The Trike in action

[Product review]

Baintech 500 watt sinewave inverter

Sinewave inverters are now becoming more popular. We take a look at one of the smaller models on the market

My first surprise on getting the Baintech 500 out of its box was its very light weight. It was also quite pleasant in appearance with a white exterior dominated by a large section of perforations for ventilation. A dual array of LED's labelled Volts and Watts and a small on/off switch are located on the front panel. Two additional LED indicators with international symbols for battery and temperature plus one labelled 'Standby' are also located on the front panel.

Unfortunately no manual or warranty information was supplied which I hope was just an oversight. A label on the side indicated the unit was rated at 500 watts, 12 volts DC input and its output voltage 230VAC. The unit was labelled with the European 'CE' mark for EMC compliance but not the Australian 'C' tick. No power outlet was fitted indicating the unit needs to be installed by a licensed electrician. No battery leads were supplied.

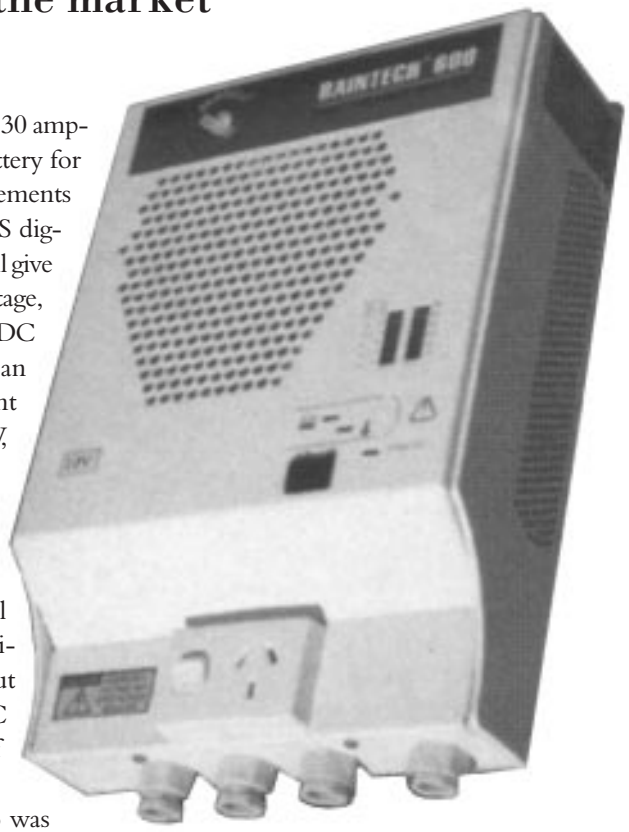
Connections

I made two 1.5 metre battery leads from 15mm^2 cable and terminated them with suitable lugs. These were fitted by removing two small screws which secure a removable plate below the front panel. The terminals for connecting the leads are clearly marked with large '+' and '–' signs. Three car-style 25 amp blade fuses are located between the battery terminals, and a small red LED nearby is labelled 'Polari'. I suspect this is a reverse polarity indication.

On the left hand side is a small terminal block for the AC connections. I connected a short length of three-core flex to these and the other end to a three-pin socket.

Testing

I used a new, fully charged 130 amp-hour, 12 volt deep-cycle battery for all tests. AC voltage measurements were made with a true RMS digital meter (an RMS meter will give a true indication of AC voltage, non-RMS meters may not). DC volts were measured with an identical meter and current was measured with a 50mV, 50 amp shunt and analogue meter placed in series with the negative battery lead.



After turning on the inverter with the front panel switch the 'volt' LED indicated 12 volts and the output measured 240.5 volts AC with a standby current of 1.15 Amps.

A 9 watt compact fluoro was connected for the first test and all worked well. Current on the 12 volt side was 2 amps which was due to inverter inefficiency at low load levels. This is typical of most inverters.

Next on the appliance list was the computer, a 486 DX4/100 with 14inch monitor. The monitor is normally powered on when the PC is switched on so this was a reasonable test of surge capacity. With the light still on I switched the PC on. The light flicked off momentarily (which was a little disconcerting) but the PC and monitor started okay and ran for three hours without a hitch. Battery current while running was 12 amps. The printer was also used periodically with no problem. The LED wattmeter indicated 100 watts when both monitor and PC were operating but no LED indication of watts occurred when the energy saving feature on the monitor came into effect. The inverter's built in cooling fan operated frequently during this period which was also interesting, as the inverter must have been generating a reasonable amount on internal heat.

The toaster test was next up. My two slice toaster is rated at 850 watts and this was duly plugged in and switched on, after disconnecting the computer and light. The output voltage fell to 180 volts during this test which I conducted twice in quick succession allowing the toaster's pop-up mechanism to activate normally both times. Battery volts dropped to 11.6 volts, measured at the inverter terminals.

The wattmeter indicated around 400 watts which suggests the reading was lower than the actual power used. Once again, the cooling fan ran continuously during this test.

I then tested my 600 watt Makita drill with the Baintech. Using a 7/8 inch wood bit I drilled four holes through 40mm hardwood without any problem. Output voltage varied from 220 volts with the drill free running down to 210 volts at full load. The wattmeter varied between 200 and 300 watts while the battery current ranged between 22 and 35 amps. Once again all worked well.

One of the most common uses for inverters is a colour TV. I used a 14 inch colour TV which operated normally and consumed 6 amps. Output voltage measured 238 volts. I did not try a video recorder but expect to add around 2 amps to the battery current if using one of these. I have no doubt that fans and most other small appliances would operate satisfactorily on this inverter.

I recharged the battery and noted the voltage readings and the LED display to check the accuracy. It appeared to err on the low side at all times with the actual voltage around 0.5 volts higher than indicated. At 14.75 volts the 'Battery' LED came on and the inverter shut down. Reducing the battery voltage allowed the inverter to operate again automatically.

The last test conducted was to run a 113 litre bar fridge. This is also a good test of start-up surge capability. The fridge ran fine and used around 10 amps DC with a starting surge of approx 80 amps. Although I suspect the inverter would operate a small AC fridge without any problem, most people would be wiser to convert to a DC fridge to maximise battery life and reduce the requirement for extra costly solar panels.

Conclusion

All-in-all this inverter performed well in all areas tested. I would suggest that it be supplied with appropriately sized DC connection leads and a prewired AC outlet which is typical for products of this type. A well written manual should be included. The standby current of 1.2 amps is too high in my opinion. The inverter efficiency is claimed to be 85 per cent, which is adequate but not as good as it could be.

Updates

Our test was done prior to November 1997, when this model was released in an updated version. Changes to the ratings are the continuous power rating, which has been increased to 600 watts (at 45°C), while standby current has been reduced to a just acceptable 0.6 amps. The new version also has a power outlet and has the Australian 'C' tick approval. The country of origin is France.

Review by Brian Bartlett. Brian runs his own renewable energy installation business, and is a qualified electrician.

Distributor contact:
Bainbridge Technologies
PO Box 33, Cleveland QLD 4163
Ph:(07) 3821 3333
fax:(07) 3821 3977

Price: $995 plus 22 per cent tax if applicable.

Gas, 240 or 12 volt fridges — which is the best option?

Peter Pedals takes a look at three different refrigerators and examines the costs of owning each type in an independent power system.

The use of domestic and commercial refrigeration contributes to two of the biggest threats to the global environment: ozone depletion and the greenhouse effect.

Refrigerators are now considered to be a necessity of life. Providing power for refrigeration usually leads to pumping more greenhouse gases into the atmosphere and the improper disposal of the fridge at the end of its useful life invariably adds to the ongoing and long lasting ozone depletion of the ionosphere. It is the ozone in the ionosphere that filters out much of the ultraviolet (UV) radiation of sunlight. High UV levels are associated with the increased incidence of skin and other cancers, long term eye damage, and the increased stress on all flora and fauna.

In Australia, most of the power that is produced and distributed through the grid is produced by coal-fired power stations. Unfortunately, the power stations of Australia are one of our major contributors to the release of greenhouse gases into the atmosphere.

It is because of such concerns that the Rainbow Power Company (RPC) conducted a series of tests on three different types of refrigerators.

Stand-alone renewable power systems

When it comes to designing cost effective stand-alone (ie not connected to the power grid) or remote area power systems (RAPS), the cost of providing the power, and the energy efficiency of the appliances, can make a lot of difference to the final design. Next to heating, refrigeration is second in line in the energy consumption stakes in the average household.

How to choose a fridge

The questions that need answering for both grid-connected and independent power systems are: Which option is the best for the environment? Which option is the most cost effective?

Hopefully the answer to both questions are the same. If not, we are left with the difficult choice of cost versus the environment.

To our knowledge, there was no existing data that could be used by customers or industry to satisfactorily evaluate the options for refrigeration. As part of a contract with the Sustainable Energy Development Authority of NSW (SEDA), the Rainbow Power Company conducted tests on the three most commonly available types of refrigerators in order to try and answer these questions.

The three fridges that we tested were chosen because of their relative similarities in terms of size, insulation thickness and capacity. They were:

- 240 volt Kelvinator 220 litre 2 door fridge/freezer (three star rating at 620kWh per annum)
- 12 volt Kelvinator 220 litre 2 door fridge/freezer (converted with a Danfoss compressor)

- an LP gas Consul 220 litre 2 door fridge/freezer.

There are no star ratings on fridges converted to 12 volt DC or on fridges that use LP gas. Wherever possible and applicable, for our tests we used Australian Standards (AS 2575.2 - 1989 and AS 1430 - 1986). Data was measured and collected by the following methods: AC consumption—AC watt-hour meter (mains quality); DC consumption—DC amp-hour meter (purpose made); LPG consumption—Mechanical scales; Air-conditioning controlled environment test with data logger for ambient and internal temperature sensors. Uncontrolled environment test with a SCADA data logger installed at RPC.

Note that the LPG fridge may not work very effectively in very hot climates and the 12 volt 220 litre fridge may be stressed under those conditions due to the fact that there is only one size of 12 volt compressor motor being commonly used and a 220 litre fridge/freezer combination is at the upper limit of its capability.

Environmental impact

The environmental impacts exclude transmission losses which can be as high as 95 per cent in some rural locations and they also exclude emissions at the time of manufacture and the environmental impact associated with insulation or refrigerants.

The environmental impact of the 12 volt and 240 volt fridge options in stand alone power systems is zero due to the fact that the ongoing power supply comes from solar radiation. The LPG fridge produces about 2.6kgs of CO_2 per annum and uses ammonia based refrigerants which have little environmental impact if the refrigerant leaks out. On the other hand, the standard 240 volt, 220 litre fridge would produce 383 to 620kgs of CO_2 from the coal-fired power station (not including transmission losses) and uses ozone destroying CFC's.

If only a 240 volt fridge can produce this much CO_2, no wonder the world is in the environmental fix that is becoming more and more apparent. Every household with a solar or LPG powered fridge deserves a pat on the back for environmental initiative.

Results

The test results can be seen here in two forms. Table 1 shows the amount of power consumed by each fridge, and includes both the best and worst figures recorded. The second table gives the cost of the fridges themselves and the power system components required to run each one. While the 240 volt fridge is far cheaper to buy, the power system to run it is around three times the cost of the 12 volt unit. The third table lists the actual system components required to run each of the fridges.

As can be seen, 240 volt fridge is the most expensive to run, while the LPG fridge is the cheapest, although the environmental effect of burning a fossil fuel to run it has to be considered.

Overall, the 12 volt unit appears to be the best proposition when cost and environmental factors are balanced.

Details of test results are available from Rainbow Power Company for $5.
Phone:02 6689 1430.

Test Results

Table 1. Power consumption

Fridge type	Minimum power consumption	Maximum power consumption
240 volt AC	1.3kWh per day	2.4kWh per day
12 volt DC	0.5kWh per day	0.9kWhr per day
LPG	507 grams per day	507 grams per day

Table 2. Cost comparison. Overall cost of fridge and independent power system

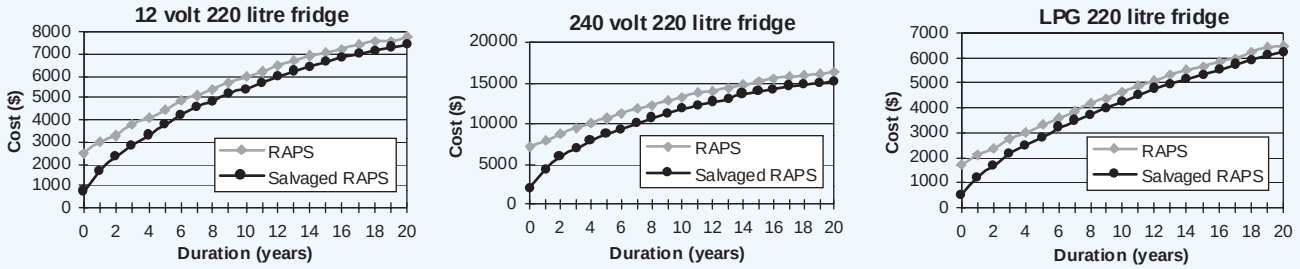
Fridge type	Fridge cost	PV power or LPG cost*	Present value over 10 years†
240 volt AC	$599.00	$12,844.00	$13,221.00
12 volt DC	$2,020.00	$4,393.00	$5,963.00
LPG	$1,689.00	$50.00	$4,629.00

Table 3. Components of fridge power systems

Fridge type	PV array	Battery bank	Inverter
240 volt AC	9 x 80 watt	12 volt, 2200ah	630VA
12 volt DC	3 x 80 watt	12 volt, 580ah	NA
LPG	4.1 x 45kg of LPG per annum		

*PV power costs include the upfront costs of the major components of the electrical system and does not include installation. The calculations for the system cost are based on insolation data for Nimbin, northern NSW. The LPG cost is based on the first 45kg gas bottle and does not include installation cost.

†Present value over 10 years includes the upfront cost and ongoing maintenance and fuel cost for the LPG fridge (4.1 x 45kg) calculated back to today's value assuming 3 per cent per annum inflation and 6 per cent interest rate. The battery bank and refrigerator have an assumed lifespan of 12 years and the solar array is assumed to be totally replaced after 20 years.



These graphs illustrate how the costs compare over any duration up to 20 years. The salvaged RAPS cost indicates the final cost to the consumer after selling (salvaging) all of the components for what they are worth at the end of the period.

Magic hot water?

Heat pump systems are the most greenhouse friendly option for water heating where solar, gas, or sustainable timber cannot be used. Normally known for their solar water heating systems, Solahart has now released a heat pump system known as the Sorcerer.

The Sorcerer is far more efficient than a conventional electric water heater, as it only moves heat from one place to another rather than using electricity to create it. The unit moves approximately 2.5 units of energy (heat) for every one equivalent unit of electricity that it uses, and because it has a low power draw compared to other electric systems, it does not require a dedicated electrical circuit, thus reducing installation costs.

The Sorcerer is designed to directly replace most standard water heating systems, taking up only the same space, and having standard fittings.

rrp: 250 litre: $3645, 315 litre:$3752

Manufactured by Solahart, ph:(08)9458 6211, fax:(08)9351 8034, email: solahart@solahart.com.au, WWW: http://www.solahart.com.au

Passive solar design video

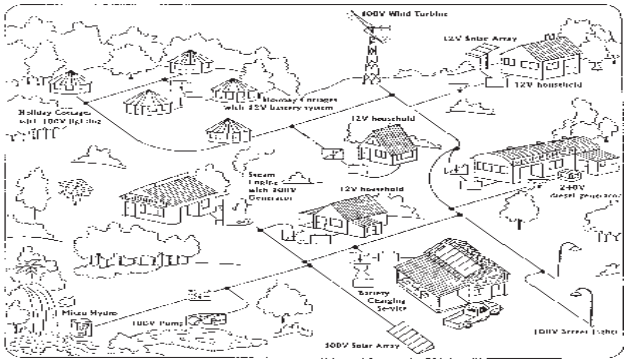
There are many ways to save energy in the home, but one of the best is to start out with a well designed building. Using passive solar principles in your home can drastically reduce heating and cooling bills, in some cases eliminating them altogether.

The video 'Passive Solar Design of Buildings' provides a basic introduction to the principles of designing a home to use natural heating and cooling systems. It is professionally produced, and would make an excellent tool for educators teaching newcomers to the field of passive solar building design.

The video covers such areas as the use of thermal mass, building orientation, window placement, ventilation, insulation and integrated gardens.

rrp: $49.95

Distributed by: Candlelight Farm Permaculture, 100 Falls Rd, Hovea WA 6071, ph/ fax:(08)9295 4627, email: ross.mars@eepo.com.au



Powering your community

The Microgrid, from Rainbow Power Company, allows small communities that are not grid connected to share their power generating resources with others in the community.

The Microgrid uses a 100 volt DC distribution grid to provide power to each house via a 100 volt to 12 volt converter. The 12 volts is then used to charge batteries locally, or can run appliances directly.

Houses and generating sources can be connected almost anywhere in the grid and appliances such as lighting and pumps can be run directly from the 100 volt line.

The power converter has a maximum power output of 10 amps, an input voltage range from 70 to 130 volts DC, an adjustable output voltage, an amp-hour meter for separate billing and a peak efficiency of 84 per cent.

rrp $535 including sales tax for each 100 to 12 volt converter.

Manufactured by Rainbow Power Company, 1 Alternative Way, Nimbin NSW 2480, ph:(02) 6689 1430, fax:(02) 6689 1109.

Reflecting the heat

We all know solar power works, but in summer the heat of the sun can work against you, heating the roof space of your house to 70°C or more.

Ceratech radiation control coating is designed to reflect 80 percent of heat radiation, reducing the buildup of heat within the roof cavity and therefore reducing heating of the house.

The water-based coating has many uses other than private homes, including factories, shopping centres, poultry sheds, refrigerated storage facilities and fuel storage tanks. Ceratech also acts as a sealant and water repellant barrier, helping to reduce corrosion and roof leaks, and can be applied to steel, aluminium, cement sheeting, wood and concrete.

rrp: around $15 per square metre (applied). Also available for DIY application.

Distributed by Fashionwall Coatings, 359 Warrigal Rd, Cheltenham VIC 3192, ph:(03) 9584 5388.

Make your toilet a dual flush

If your toilet is an older style that only allows a full flush, then you are using a lot more water than you need to. However, most toilets are capable of being converted to a half flush cystern with very little effort.

The Ace Magic Flush is a simple dual button adaptor that fits over the top of the standard button and allows either a full or partial flush of the toilet. When the full flush button is pressed, the cistern is operated as normal, but when the half flush button is pressed the cistern mechanism is only operated far enough to allow water to start flowing, so you can stop flushing when adequate water has flowed to do the job.

The unit, made of powdercoated diecast zinc, can be fitted to most cisterns with smaller sized buttons, but may not fit cysterns with large buttons, so check this first.

rrp: $18.95

Distributed by Ace Gutters Pty Ltd, PO Box 613, Mordialloc VIC 3195, ph:(03)9580 9088, fax:(03)9580 3563.

Low mercury fluoros

While fluorescent lamps use much less power than incandescent lights, they do contain the highly toxic metal mercury, which becomes a hazard when the tubes are disposed of.

The Alto Triphosphor range of fluoro tubes from Philips have been designed to use only 30 percent of the mercury of a conventional tube. By combining a new mercury dosing system with new phosphors they have produced a range of tubes which they claim have the same luminous output of other tubes but with far less mercury, thus greatly reducing the amount of this toxic substance being released into the environment from discarded tubes.

The tubes come in a range of standard sizes, and can be differentiated from other fluoro tubes by their green end caps.

Trade prices are 18 watt: $7.50, 36 watt: $7.90, 58 watt: $10.50

Distributed by Philips Lighting, 34 Waterloo Rd, North Ryde NSW 2113, ph:(02) 9805 4113, fax:(02) 9805 4495.

Changeover contactor

If your independent power system uses a 240 volt generator for backup power, then it makes sense to power the house from the generator while it is running, rather than drawing power from the batteries that you are trying to charge. You can change the connections manually, or use a changeover relay of some kind to do the job automatically.

Sun Real make a contactor set (a large relay) designed specifically for this task. The unit consists of a 30 amp, 240 volt rated contactor combined with an adjustable time delay controller, all enclosed in a sealed water resistant enclosure. When the generator is started, the time delay activates the contactor after the set time, which is adjustable from 6 to 60 seconds. This allows the generator to warm up and its output to stabilise.

rrp: $360 plus tax if applicable.

Distributed by Sun Real, RMB 1773, Benalla VIC 3673, ph/fax:(03)5768 2248.

DIY sun tracker kit

A sun tracker can provide up to 40 per cent or more power from your solar panels, but they can be uneconomical for small installations. However, if you are a do-it-yourselfer, then B W Solar's new sun tracker kit could be the best option.

The tracker unit is available in two versions, the STC 124B, which is housed in a standard Clipsal 3-way junction box, and the STC 40CR, which also has a built-in battery charger and is housed in a standard 11-pin relay base for fast in-the-field servicing. To complement the two controllers, two linear actuators (the device that physically pushes the solar array) are available, the LA 2412, a 12 inch ram which can provide a force of up to 400kg, and the LA 2424, a 24 inch unit with a thrust of up to 700kg.

rrp: STC 124B $150, STC 40CR $315, LA 2412 $250, LA2424 $300. The kit consists of the STC 124B controller and an actuator for $350.

Distributed by B/W Solar, 9 Newborough St, Scarborough WA 6019, ph/fax:(08)9341 8711, email: bitt@perthpcug.org.au

Cool yourself with hot air!

This is not as silly as it sounds, and indeed, hot air powered fans preceded the electric fan, but have now become quite rare. However, up until a few years ago they were manufactured in Pakistan, and when we were told that they may become available again in limited numbers, we thought we would help the process along.

The fan seems to be a very robust Stirling engine powered machine with a blade diameter of around 600mm. It stands 86 cm high to the top of the fan guard, with the chimney, which keeps the warm exhaust out of the air flow, being just over one metre high.

The cast iron Stirling engine has a ball bearing crankshaft and is heated by a dual wick kerosene/paraffin lamp which uses one litre of fuel every 36 hours.

Andy Eisemann, of Moana in South Australia, would like people who would be interested in buying one of these fans to contact him. If enough people express an interest in purchasing a fan then the manufacturer in Pakistan is willing to do a short production run of the machines.

The fan is expected to cost around $500 when manufactured.

Contact: Andy Eisemann, 39 Macquarie St, Moana SA 5169, ph/fax:(08)8327 3039.

Low cost wind powered pump

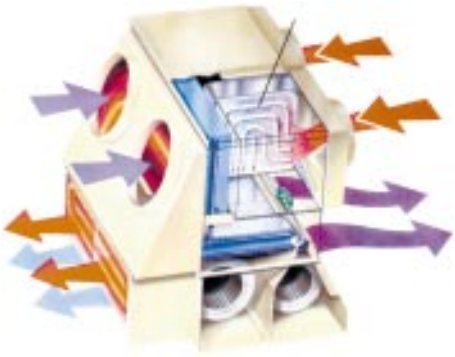
Looking much like the old Southern Cross windmills, the Oasis Windmill is designed to provide water pumping in remote areas, but has incorporated some more up-to-date engineering.

The windmill has features such as fully sealed ball race bearings, an even loading, double acting one inch pump, and the use of stainless steel and brass to reduce maintenance. There are also a range of different size pumps available to suit differing applications.

The Oasis Windmill is also self governing in high winds and can be partially or completely shut down if required.

rrp: $1350 for the standard windmill complete with 10 foot tower and 1 inch pump.

Distributed by Paul Trickey, 30 Baldock St, Dookie VIC 3646, ph:(03) 5828 6452, mobile: 0418 340 717.



Counter-flow heat exchangers

It is important to maintain good air quality inside buildings, whether they be residential or commercial, but conventional air-conditioning systems can use enormous amounts of power. Eco Air claim that their counter-flow heat exchange systems can improve air quality while keeping running costs and pollution down.

In winter, heat from the outgoing air is transferred to the incoming fresh air, reducing the need for extra heating, and in summer, heat from the incoming air is transfered to the exhaust air, reducing the need for air-conditioning. There are two units available, the Eco Plus which has gas heating and evaporative cooling, and the Eco Power, with gas heating and a 10kW refrigerated cooling system.

rrp: $3400 for the Eco Power, $5600 for the Eco Plus

Distributed by: Eco-Air Ltd, PO Box 2131, Taren Point NSW 2229, ph:(02)9526 2133, fax:(02)9540 3495, email: sales@eco-air.com.au

Painting the old fashioned way

Modern paints contain many weird and not so wonderful chemicals, most of which are bad for you, but just a few decades ago, none of these chemicals existed. Old fashioned paints were usually very simple in formulation, yet often lasted many years without deterioration.

Porter's Original Paints have a range of basic paints made from ingredients such as milk, lime and chalk combined with various pigments. There are several different paints in the range, including Boncote cement paint for outdoor use, milk and limewash paints for indoor use, sealers, undercoats and decorative finishes such as crackle glazes and patina green solution.

rrp $92 for 10 litres Boncote cement paint, $60 for 4 litres Interno interior lime wash, $82 for 4kg interior milk paint. Many others available.

Distributed by Porter's Original Paints Pty Ltd, 895 Bourke St, Waterloo NSW 2017, ph:(02) 9698 5322, fax:(02) 9698 5449, email: porterspaints@bigpond.com.au

[Sustainable technology events]

Send details of events to *ReNew*, 247 Flinders Lane, Melbourne 3000, Fax:(03) 9650 8574, Email: ata@ata.org.au

For event updates, see our web site at http://www.ata.org.au/

Going Solar events

- **13 June—Wood heating and using sustainable wood fuel**
- **11 July—Introduction to Permaculture / earthworms**
- **8 August—Sustainable living**
- **12 September—Bio Paints / Aromatherapy**
- **10 October—Composting toilets and greywater systems**
- **12 December—Solar hot water**

Contact: Liz or Pippa on ph:(03)9328 4123.

European Biomass Conference

8-11 June, 1998
Congress Centre, Würzburg, Germany
Contact: WIP, Energy + Environment, Sylvensteinstr. 2, D-81369, München, Germany, ph+49 89 720 1235, fax:+49 89 720 1291, email: renewables@tnet.de

Sustainable Energy & Enviro. Technology

14-17 June, 1998
University of Queensland, Gold Coast
Contact: APCSEET '98 Secretariat, Intermedia, PO Box 1280, Milton QLD 4064, ph:(07)3369 0477, fax:(07)3369 1512, email: apc@cheque.uq.edu.au

Good Life Festival

26-28 June, 1998
Kilkivan Show Grounds, QLD
A celebration of all things rural, either traditional or alternative.
Contact: Kilkivan Landcare Group, PO Box 62, Kilkivan QLD 4600, ph:(07)5484 1261, fax:(07)5484 1409.

World Energy Council Congress

13-18 September, 1998
Houston, Texas, USA
'Energy and technology: sustaining world development into the next millennium'.
Contact: Register in the WEC database at: http://www.wec98congress.org/17regis.htm

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

Congress on the Environment

27-30 September, 1998
University of Tasmania
Will consider the sustainability of southern hemisphere marine and terrestrial ecosystems.
Contact Professor Jim Reid, ph:(03)6226 2604.

Electric Vehicle Symposium

1-3 October, 1998
Brussels, Belgium
Contact: EPE Association, c/o VUB-TW, Pleinlaan 2, B-1050, Brussels, Belgium, ph:+32 2629 2819, fax:+32 2629 3620, email: evs-15@etec2.vub.ac.be

Renewable Energy Asia-Pacific '98

14-16 October, 1998
Shanghai Worldfield Convention Centre, China
Will examine the issues, developments and the regulations affecting the renewable energy industry in the Asia-Pacific region.
Contact: Ms Tracy Cook, ph:+852 2574 9133, fax:+852 2574 1997, email: info@adal.com

World Solar Challenge

18-27 October, 1998
Darwin, NT to Adelaide, SA
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

Energy and Energy Conservation

20-22 October, 1998
Shanghai, China
Renewable energy, energy conservation for buildings and energy management.
Contact: Mr Zhou Shunzhi, Rm 1322, Bldg 3, 1486 Nanjing Rd (W), Shanghai 200040 P R China, fax:+86 21 6204 9481, email: wjyao@online.sh.cn

Ecobiz '98

22-23 October, 1998
Adelaide, SA
Focusing on the relationships between business and the environment.
Contact: Ecobusiness Consultants, ph:(08) 8212 8050.

Electric & Solar Vehicle Conference

26-27 October, 1998
Adelaide, SA
Provides a forum for the exchange of ideas on sustainable vehicle energy solutions.
Contact: World Electric and Solar Vehicle Conference, PO Box 8178, Adelaide SA 5000, fax:(08)8322 6290, email: conference@wsc.org.au

Seedsavers Workshop

31 October-1 November, 1998
Melbourne, VIC
Will include all aspects of seed selection, collection, storage and propagation, as well as Permaculture, heritage fruits and organic growing.
Contact: Permaculture Melbourne, ph:(03)9853 6828.

China waste expo

19-22 November, 1998
Beijing Exhibition Centre
Technology for environmental protection and regeneration of waste products.
Contact: Mr Wang Shu or Mr Lu Zhanliang, Ph +86 10 6526 5302, fax:+86 10 6526 9675, email: beico@Chinaonline.com.cn.net

Solar '98

25-27 November, 1998
Christchurch, New Zealand
Technology, commercialisation, education & policy in renewables and energy efficiency.
Contact: Solar '98, PO Box 1140, Maroubra NSW 2035, ph:(02)9311 0003, fax:(02)9311 0004, email: ANZSES@keystone.arch.unsw.edu.au

Renewable Energy Education Symposium

26-27 November, 1998
New Delhi, India
Will provide a forum for discussion on all aspects of renewable energy education on all levels.
Contact: Mr Anil Misra, Organising Secretary, ISREE-6, TERI, Darbari Seth Block, Habitat Place, Lodhi Rd, New Delhi - 110 003, India, ph:+91 11 462 2246, fax:+91 11 463 2609, email: akmisra@teri.res.in

Strawbale Workshop

Summer 1998—date to be announced
Melbourne, VIC
Contact: Scott (03)9369 2418

World Renewable Energy Congress

10-13 February, 1999
Murdoch University, Perth WA
Will highlight the role of renewable energy technology for the next century.
Contact: Dr Kuruvilla Mathew, Environmental Science, Murdoch University, Murdoch WA 6150, ph:(08)9360 2896, fax:(08)9310 4997, email: mathew@essun1.murdoch.edu.au

World Solar Challenge

17-26 October, 1999
Darwin, NT to Adelaide, SA
Contact: World Solar Challenge, PO Box 1111, Kent Town SA 5071, ph:(08)8303 2337, fax:(08)8303 2339, email: wsc@saugov.sa.gov.au

World Solar Cycle Challenge

20-27 October, 1999
Alice Springs, NT to Adelaide, SA
A race for hybrid, solar assisted human powered vehicles.
Contact: World Solar Cycle Challenge, PO Box 1111, Kent Town SA 5071, ph:(08)8303 2337, fax:(08)8303 2339, email: wsc@saugov.sa.gov.au

World Solar Gliding Challenge

17-23 October, 1999
Darwin, NT to Adelaide, SA
Contact: World Solar Gliding Challenge, PO Box 352, French's Forest NSW 2777, fax:(02)9453 0777, email:hxmor@msn.com

World Electric & Solar Vehicle Conference

October, 1999
Adelaide, SA
To be held after the finish of the World Solar Challenge.
Contact: World Solar and Electric Vehicle Conference, PO Box 8178, Station Arcade, Adelaide SA 5000, ph:(08) 8387 3877, fax:(08) 8322 6290, email: Myriad@wsc.org.au

Environment Centre of WA Events

The Environment Centre has a web site where many of their events are listed.
Contact: Internet at http://www.iinet.net.au/~ecwa/

Wind generator buyers' guide update

Several wind turbines did not make it into last issue's buyers' guide. Whisper turbines are available from **Southwest Solar**, RMB 2309, Portland VIC 3305, ph:(03) 5523 7252, fax:(03) 5526 5349 and **Gordon Wilson Solar**, 74 Skene St, Dunkeld VIC 3294, ph:(03) 5577 2205, fax:(03) 5577 2402. Bornay, Lagerwey and Pitchwind turbines are available from **Advanced Wind Technologies**, 16/206 McCormack St, Manunda QLD 4870, ph:(07) 4053 1255, fax:(07) 4032 1209, email: wind@midcoast.com.au, www: http://www.midcoast.com.au/users/wind/

Table 1. Small wind turbines (up to 10kW)

Brand/ Made in	Model	Power/ at speed	Cut-in speed	Voltages available	Overspeed protection	No. of blades	Blade Material	Rotor dia.	Weight (kg)	RRP
World Power Technologies USA All have brushless alternator, two-year warranty and slip rings	Mariner H500	500/12.5m/s	3.4m/s	12 to 48	angle governor	3	fibre-reinforced	1.5m	13	$3,000
	Whisper 600	600/11m/s	3m/s	12 to 48	angle governor	2	fibre-reinforced	2.1m	21	$2,790
	Whisper H900	900/12.5m/s	3.4m/s	12 to 48	angle governor	3	fibre-reinforced	2.1m	25	$4,190
	Whisper 1000	1000/11m/s	3m/s	24,32,36,48	angle governor	2	epoxy coated wood	2.7m	30	$4,700
	Whisper H1500	1500/12.5m/s	3.4m/s	24, 32,	angle governor	3	epoxy coated	2.7m	35	$7,900
	Whisper 3000	3000/11m/s	3m/s	32, 36, 48	angle governor	2	carbon fibre	4.5m	70	$11,000
	Whisper H4500	3000/12.5m/s	3.4m/s	32, 36, 48	angle governor	3	carbon fibre	4.5m	82	$13,000
Bornay Spain 3 phase permanent magnet, 2 year warranty and slip rings	G-60 W	60/10m/s	3m/s	12, 24	inclination	5	fibreglass	0.75m	9	$1,200
	Inclin 250	250/11m/s	3.5m/s	12,24	inclination	2	nylon	1.35m	32	$2,250
	Inclin 600	600/11m/s	3.5m/s	12, 24	inclination	2	carbon fibre	2m	38	$2,850
	Inclin 1000	1000/12m/s	3.5m/s	12, 220	inclination	2	carbon fibre	2.86m	45	$3,850
	Inclin 1500 neo	1500/12m/s	3.5m/s	12, 220	inclination	2	carbon fibre	2.86m	42	$4,400
	Inclin 3000 neo	3000/12m/s	3.5m/s	24, 220	inclination	2	carbon fibre	4m	105	$7,090
	BK 12	—	3.5m/s	120, 220	automatic brake	3	carbon fibre	5.8m	450	$17,600
Lagerwey Holland	LW 18/80	80kW/12m/s	2.4m/s	grid	spring pitch	2	carbon fibre	18m	3,900	$100,000
	LW 50/750	750kW/12.5m/s	3m/s	grid	pitch control	3	carbon fibre	50m	—	$999,000
Pitchwind Sweden	14/20	—	2.2m/s	as required	passive pitch	2	carbon fibre	14m	500	$60,000
	14/30	—	2.2m/s	as required	passive pitch	2	carbon fibre	14m	510	$60,000

Local Suppliers' Directory

National

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fax:(03)9214 8997,
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Wind Generator—"Survivor" 1 kilowatt, 48 volts, approx 25 metre tower. Needs new bearings. $6,000 ono. Ph:(03)5474 2875.

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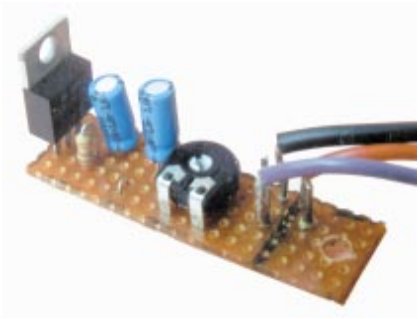

In issue 61 we ran an article on making an answering machine power supply to run from a 12 volt system. We have since learned that all devices connected to Telstra phone lines, including power supplies, must be approved by the Australian Communications Authority (formerly known as AUSTEL). The approval process apparently costs a lot of money, as does the fine for failing to comply. Our apologies to anyone who has built the device for an answering machine, but bear in mind that it can still be used as a power supply for other devices that require voltages lower than 12 volts.

Clarifications from #63

In issue 63, our cover story on solar powering your shed contained a potentially misleading statement about sealed lead acid batteries. The article said that sealed batteries have 'none of these problems' in relation to hydrogen off-gassing. While the amount of hydrogen produced by these batteries is normally insignificant, if seriously overcharged they may produce dangerous amounts of hydrogen, which will explode if ignited. It is therefore advisable to locate sealed batteries in an enclosure vented to the outside of your shed.

On page 29 we printed a photo of a solar concentrating dish. The caption stated that a liquid salt is pumped through the focal point. The liquid is in fact ammonia, which is split into hydrogen and nitrogen for storing solar energy.

In Up front there was an item about tidal power in Western Australia, which stated that electricity from the proposed plant would supply electricity for 20,000 homes. It should have read 'supply *enough* electricity for 20,000 homes'. The figure quoted was intended as an illustration: the electricity will be used by mines and industry. Also incorrect was the suggestion that research at the Northern Territory University will be utilised. The research involves tidal*flow* turbines, and will not be used in the tidal *basin* project.

Another minor error in Up front: we stated that the new energy information number was a freecall—a call will in fact set WA callers back 25 cents.

Solar Future

Solar Future is Australian Inland Energy's green power scheme. All funds raised by Solar Future will go towards the capital installation of solar power stations like that at White Cliffs in the north-west of New South Wales.

For more details on Solar Future, contact:

Australian Inland Energy
PO Box 800 Broken Hill NSW 2880
Tel: (08) 8080 2444 Fax: (08) 8080 2420

Left, solar powered community UHF CB repeater at Mt Shannon, near Tibooburra, NSW. Above, solar powered street light. Right, reflector dish at White Cliffs Solar Power Station, NSW.

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