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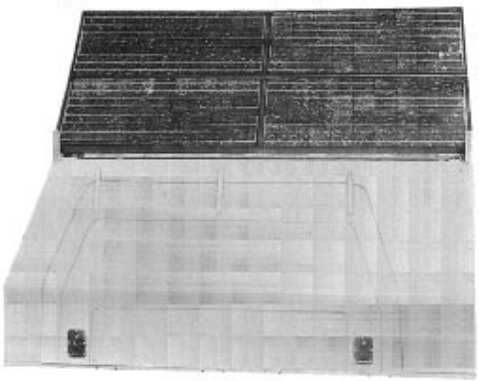

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Learn about Australian bush foods on page 20.

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The finish line of the World Solar Challenge...page 44. (Photo: Adrian Oakey)

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Regulars

ReNew

Technology for a sustainable future

Publication details

ReNew is published by the (Australian) Alternative Technology Association, a non-profit community group involved in promoting and using appropriate technology. ATA has members worldwide who share information and ideas.

Publisher: Alternative Technology Association
Editor: Michael Linke
Technical Editor: Lance Turner
Associate Editor: Suelette Dreyfus
Business Manager: Libby Anthony
Products Editor: Ben Foley-Jones
Cover photo: Adrian Braun, ph 9534 4385
Editorial and production assistance: Adrian Braun, Fiona Negrin, Ross Blair, Marish Mackowiak, Colin Vincent, Tania Birmingham, Bill Slade.

Advertising is available for products and services relevant to magazine content. We reserve the right to refuse advertising at our discretion. Please direct advertising enquiries to:

Libby Anthony ph: (03) 9650 7883 fax: (03) 9650 8574

Contributions are welcome, guidelines are available on request. Next advertising booking and editorial deadline: 14 January 1997. Please direct letters and contributions to:

ReNew
247 Flinders Lane
Melbourne VIC 3000
ph:(03) 9650 7883, fax:(03) 9650 8574
Email address: ata@ata.org.au
Web site: http://www.ata.org.au/~ata/
Internet services provided by Suburbia.net
Modem dial-up (03) 9819 9066.

Printed by Newsprinters, Shepparton, Victoria.
Distributed in Australia and New Zealand by Gordon and Gotch.

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

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

editorial

It's silly season again, and as the temperature rises, so does the level of activity in the back yards and on the rooftops of ReNew readers everywhere. This issue acknowledges that people will be spending more time in their gardens, with an introduction to growing native food plants. There is a whole smorgasbord of new flavours out there to be enjoyed, and by planting natives, you help preserve Australia's biological diversity. As an added bonus, native food plants also look more attractive than conventional vegies.

If you are fortunate enough to own your own roof, but don't have any renewable energy systems installed on it yet, we show you the ideal starting place with our solar hot water system buyer's guide. Ross Horman, who has years of experience installing many different models of solar hot water systems, guides you through the finer points of solar hot water technology.

There is also a garden water feature with a difference, with detailed how-to instructions from Lance Turner. It should help to keep your ornamental pond or dam oxygenated (and hence prevent the mossies from breeding in it), it's cheap to make, looks good, and of course, is solar powered.

For those of us who are not fortunate enough to live in a well designed passive solar house, summer can mean months of hot, sleepless nights. On page 52 we show you some easy ways to cool down difficult rooms, without paying a fortune.

We also have something to help put renewable energy in a world perspective on page 32, where Carl Frankel looks at the technologies that are likely to succeed in the coming years. In our own back yard, at least, it looks as though a lot of it will come from wind: Michael Gunter reports on NSW's recently announced wind farm, and we also visit New Zealand's first wind farm. If all this (and much more) isn't enough, you can always visit our 'new' web site–find out more about it and other Alternative Technology Association ventures on page 64.

Until next time, happy reading.

Michael Linke
Editor

Why not drop us a line?

If you want to have your say about environmental or related issues, or just want to let others know what is going on in your neck of the woods, why not contribute to ReNew by writing a letter? You may also want to tell us what you think of the new look magazine, we would love to hear your views and comments.

In order for us to publish your letter, we require that you supply your name and address. You can, of course, request that your details not be printed with your letter if you wish.

While it is not possible to publish every letter that we receive, we try to select letters covering a broad range of topics. We also edit letters for length and clarity.

Building in the bush

I picked up your magazine (Soft Tech) for the first time the other day and wondered why I hadn't been buying it before! Nice work!

I'm writing because I am about to purchase 70 odd acres of very hilly landscape about one hour away from Brisbane and want to know where I can find a builder who can help me put together plans which are sympathetic to the environment (I want to look at alternative materials) and probably totally energy efficient (the land is a bare block, no water, power, sewerage or anything!)

I would obviously prefer someone local to Brisbane but I suppose it doesn't have to be mandatory.

Would you be able to help me please? I would also be very grateful if you could recommend any books/literature to help me choose:

1) the best way to set up a water sys tem for the property
2) the best way to set up a power system for the property
3) the best building materials to use for the QLD climate, energy & environmental efficiency.

Erica Hughes,
Erica_Hughes@msn.com

There are many books on these subjects, some of which have been reviewed in Soft Technology in the past. Your local library may have a few of these, as might your local renewable energy installer. We also have some books that may be of use to you, including 'Build your own Green Technology' and the 'Green Technology House and Garden Book'. More details of these can also be found on our website.

Lance Turner

Recycling yourself

I have just read your article on recycling the dead in the first issue of ReNew. A very interesting subject which has often caused me to wonder about the legal requirement to be interred in a recognised burial ground/cemetary. It seems to me a great waste of resources to be burnt, and if I am to be buried there is very little likelihood that I will reappear in a few years as a pumpkin or peach or pomegranate, another waste of resources.

In your article you never mentioned being buried at sea. Surely this would mean fairly immediate recycling of your physical remains and could even dispense with the need for a shroud or a casket. The only need for a shroud would be to protect the sensitivities of the onlookers.

I realise that in this modern age of refrigeration they simply stick you in the coolroon until they can get you back to your loved ones if your demise comes while you are at sea. But what about becoming a seafood platter? It seems to me to be the most quick and efficient system of getting me back into the food web.

Are there any regulatory barriers to this solution? I can see many advantages in that I would not be occupying any arable land or polluting the atmosphere. And at that stage I couldn't give a damn if you removed all my old fillings before I was thrown overboard.

Do you have any information regarding this alternative disposal system?

Ross Horman, Riddells Creek VIC

Compact fluoro hassles

You requested in Soft Technology #51 that readers share their experiences with compact fluorescent lights (CFLs).

I recently returned home to find that the CFL which I leave on for security had blown. It was just over 12 months old, and had seen about 2000 hours service. I bought a replacement tube knowing that if it was the ballast at fault, I could keep the new tube as a spare, and repair the ballast using the list of likely faults given in ST51 as a starting point.

The first problem I encountered was that the ballast would not let go of the old tube, and in the end the tube fractured before I managed to remove it. It turns out that it would have been easier to pull the ballast apart first and push the tube out from above by drilling a hole through the top of the tube housing, and inserting a screwdriver through the hole. It seems that either the tube holder is over-designed, or was poorly manufactured in this case.

Having destroyed the old tube, I was hoping that simply inserting the replacement tube would solve my problems. No such luck – the fault was in the ballast!

I then discovered that the 8.2 ohm fusible resistor had blown (the first possibility you mentioned in ST51). As per your instructions, I replaced this with a standard 1/4 watt carbon film resistor of the same value, which blew the moment I turned the power on after re-assembly. I then re-opened the

ballast and checked several of the remaining components, which all proved to be ok. The only problem I noticed was that the 220 ohm, 1 watt resistor had been sweating a good deal, but it still measured 220 ohms on my multimeter.

I've now got to decide whether to replace the blown fusible resistor with a 1 watt carbon film equivalent (since the fusible resistor was the same size as a 1 watt resistor), or to throw the ballast away. I'm rather unimpressed with the short life I've got from the ballast, and the fact that I had to break a perfectly good tube to remove it.

I like to buy Australian whenever possible, especially in this case since I remember reading in an earlier ST issue that some of the imported ballasts emit RF interference (this Australian ballast also did this, and didn't get on with my cordless phone at all). I have three or four other CFLs of the same brand around the house, and am hoping that they do not also fail prematurely.

Thanks for a great magazine.

Paul Flint,
Paul.Flint@exchange.cra.com.au

Ethical investments

After reading in your Jan-March 1995 issue about *Money and Morals – ethical investment buying*, I decided to contact the Marysville Retreat Company Ltd about investing in their Lakeside cabins at Marysville.

Well, despite writing letters and phoning them, I've heard nothing since. Does this mean that they've got enough investors or that they're too ignorant to reply? Maybe you know more than I do about this company, so please let me know what the score is.

Also, despite this negative experience, do you know of any similar 'holiday cabin' schemes that I could perhaps invest in, especially in Tasmania or Victoria? Any information re this subject would be most helpful. Thank you.

T. Wilson, Launceston TAS

PS. Keep up the good work with your excellent and informative magazine!

Our brief investigation of Marysville Retreat Company revealed that they no longer exist, and were not able to go ahead with the Lakeside Cabins due to a lack of finance.

There are a number of reliable ethical investment companies in Australia, and these are listed in 'Ethical Investment in Australiasia' by Trevor Lee, published by Ethinvest Ltd. They can be contacted on ph:(02)9440 8024. You may also want to take a look at the Ethical Investment buying guide in Soft Technology #50.

—Ed.

A word from an old friend

Congratulations on the new direction you are taking with the magazine.

The change was long overdue, and you seem to be going about it the right way to make ReNew a resounding success. The pages seem absolutely crammed full of information, and I can't wait for the next issue.

Congratulations once again, and I will definitely be renewing my subscription when it comes due. ReNew is a welcome breath of fresh air here in the UK.

Alexandra Oke, London UK

Alexandra was a regular writer for Soft Technology for several years.

—Ed.

Food for thought

Thanks to Claire Beaumont for reviewing my book *Eco-eating* in the spring issue. It must be an onerous task for any committed cook to wade through my book!

For the benefit of readers I would like to add and clarify a few points.

Eco-eating describes an alternative technology of eating. It makes much of the equipment of the kitchen redundant, which is a big plus from the point of view of energy and resource conservation. It also promotes a diet very low in animal products, which is also a big plus for the environment.

The diet I recommend and explain is 70 percent fruit, 25 percent greens, and 5 percent nuts, seeds, and fish, preferably raw, once a week for non-vegans.

On page 87 is the anecdote of one ancient fruitarian which Claire overlooked: Dr Norman Walker who lived to 109 years old. Claire expressed concern about the potentially low kilojoule intake, but scientific studies in the US show that longevity is highly correlated with low kilojoule intake in mammals (see The Age, 15 July 96).

I hope everyone willing and able to make profound changes to their lifestyle for the sake of the environment will get the chance to read Eco-eating!

Sapoty Brook

Brainstorm in a teacup

Just a few lines to say thank you for a great publication and pose a few brain teasers.

I've just spent a most enjoyable winter's arvo sitting in front of my combustion stove drinking chi, eating sticky buns and reading back copies of Soft Technology. In one (issue 48) there was a blurb for a low voltage appliance course and water pumping systems.

Now as you can see from my address I live a long way away from Melbourne and not too damn close to anywhere else. I'm sure there are a few others out there in the same situation. So how about including articles on small appliance conversions and the items covered by the course?

Water works are always a problem: I've yet to find a really reliable 12-volt pressure pump for a household system. Problems abound with pressure switches, pump couplings and motor

failures. My latest episode involved replacing a broken pump coupling, which the supplier had never heard of before, and three days later a magnet falling off the casing and shorting out the motor. So how about an article comparing 12 volt pumps?

Now one for the engineers. A lot of people on solar systems are also using combustion stoves for cooking and hot water. Why can't we come up with a system to use the excess heat of the stove to charge batteries? Maybe a small steam turbine on a heating coil loop system to produce a few amps of power while cooking tea?

Gas, kero and some electric fridges run on a heat transfer system, so why can't the stove be used to power a refrigerator? How about a a solar panel similar to a hot water panel being incorporated in the refrigeration system to collect the heat to operate the system.

How about it inventors. Any solutions?

Howard King,
Penneshaw, Kangaroo Island, SA.

We have in the past presented articles for converting equipment to run on low voltages, the most recent of which was the 12 volt computer article in Soft Technology #54. Our main problem with presenting articles of this type is finding people who have actually done the conversions and are willing to let us know about it! The ATA also sells a booklet dealing with the subject of converting appliances for low-voltage use.

Look out for our 12 volt pump buyers guide in 1997, as well as the latest in ammonia/solar fridges.

—Ed.

Getting off the grid

I have been running a Brazilian-made 'Consul' brand absorbtion refrigerator on mains electricity for about eighteen months. It was bought new, but recently the electric heating element burnt out. The element was rated at 220 volts!

My plan had always been to run it on gas anyway, but the importer only had AGA approval for LPG and claimed that there was no market for these fridges to be run on natural gas. Indeed he stated that the approval process would cost him about $6,000. My problem was the rapidly thawing meat in the freezer! The electric element would not be replaced under warranty.

The fridge burner jet has now been converted to natural gas and it is working better than ever. Luckily I had done an energy audit operating on the electric element only a few weeks before the element died. By running a new audit on natural gas, I can now compare the greenhouse performance and cost of this fridge in its two modes of operation:

Electric: average power (one week sample) was 170 watts, or 4.1kWh/day. End-use electricity consumption from brown coal produces CO_2 at the rate of 392.5 grams per megajoule (g/MJ), more usefully expressed as 1,413 grams per kilowatt-hour. Thus at 4.1kWh per day, my fridge produced 5.8kg of CO_2 per day. An underwhelming performance!

Gas: hourly consumption is 1.2MJ, giving a daily figure of 29MJ. Victorian natural gas produces 54.2g/MJ, so daily emissions when running on gas are 1.56 kilograms of CO_2.

Comparison with a typical fridge: the average Victorian domestic fridge uses about 2.5kWh per day, producing about 3.5 kilograms of CO_2 per day. It thus appears that there are significant greenhouse gas reductions of over 50 percent available if Victorians convert to gas refrigeration. Admittedly my fridge, at 220 litres, is smaller than the average fridge, and cost over $1500. However, running costs are 19 cents per day, as opposed to the typical electric fridge, costing 30 cents per day. This saves $40 per year, so in ten years it will almost have compensated for the higher initial cost. In that time it will also have saved over seven tonnes of CO_2 emissions.

Exciting potential: from a personal point of view, I now have the option of disconnecting from the electric mains, and running a solar and gas house with a small photovoltaic/inverter system. A PV/inverter cost of $8600 and battery bank cost of $1340 represent a break-even cost compared to my present electricity bills. Such a small system would involve some lifestyle changes, such as colour TV viewing and computer use on sunny days only!

By avoiding energy costs of about $430 a year and connection charges of $134 a year, I could replace the photovoltaics and inverter every twenty years and the battery bank every ten years, and still be no worse off. In fact much better off in terms of greenhouse gas emissions.

Michael Gunter,
mickgg@suburbia.net

Biofuels in the US

Hello, and thank you for an inspiring web page/organisation. My name is Jeff Martin and I live on the island of Kauai where I run the only landfill rubbish dump out here. We have a ways to go with our solid waste but that's another story.

I've subscribed to *Home Power* in the past and I plan to design/build an earth-covered home on the west coast of California. I've just read David Baggs' article from edition #47 and wondered if he has email. Why don't more people see the elegance of such a building?

I worked on an alternative fuel survey for New Zealand and Australia back when I was a student at UC Davis in the late '80s under Proffessor Sperling and his grad students. I guess Australia is into alternative fuels by default; us Americans burn fuel like there's no tomorrow.

Letters

Kauai has a pretty amazing capacity to grow biofuel but the best plant is still outlawed so instead they grow sugarcane which has not one redeeming quality.

Jeff Martin, jcmartin@hawaiian.net

Australia into alternative fuels by default' – now there's a good one! Unfortunataly, there is very little utilisation of biofuels, or any other types of renewables for that matter, in this country. The largest photovoltaic installation we know of provides about 140 kilowatt-hours a day, about enough to run a dozen homes or so.

It seems our governments feel that it is up to the individual and the renewable energy industry as a whole to install renewables in this country.

It is also a fact that Australians use more energy per capita than any other country besides the US – a situation that needs to change if we are to become a sustainable society.

—Ed.

Kinetic energy device

A friend and I recently purchased some back issues of your great magazine and were intrigued by an article entitled 'Harnessing Kinetic Energy.' It appeared in Soft Technology #51. We have been arguing ever since on the exact method that is used to power the flywheel.

Are the four chains around the four gears connected to different points on whatever the source of power is? How are the gears selected? Manually, or are they always selected and the stretch in the bungie cord selects the gear? (see the second paragraph under the heading of 'The drive mechanism')

We await your answers to stop our arguing! This was a very interesting application of a ratchet mechanism and we are planning to build our own model in the near future.

Thank you for such a wonderfully informative and technical magazine. Looking forward to your reply.

Andrew Murdoch,
murdocha@zen.ocean.com.au

Andrew, we will pass your request onto George Cant, the designer of the device.

—Ed.

New solar panels

I am interested in any information or leads you might be able to provide with regards to powering a residential house from the new improved solar panels due for release soon in the USA.

I am also after information regarding generation of methane gas and its feasability for use in residential applications. How does one calculate the amount of methane gas required per day and how could it be utilised if sewerage and/or kitchen scraps were used as starting material. I expect that the amount of methane available would at best supply only part of a household's energy needs, but I will be using it in conjunction with other forms of alternative energy.

Fred Scuttle, fred@cin.gov.au

The solar panels you refer to are, I assume, the nine-layer amorphous panels developed by Canon and Energy Conversion Devices. These panels are made from layers of silicon applied directly to sheets of stainless steel or another substrate.

Using these panels would be the same as using any other solar panel, requiring energy storage (batteries or the mains grid itself), a regulator and an inverter.

We have covered the use of methane in past issues of Soft Technology, but in general there seems to be little interest in small-scale applications due to maintenance and operation requirements of this type of system. Large-scale systems are becoming more popular, however, with power being pro-

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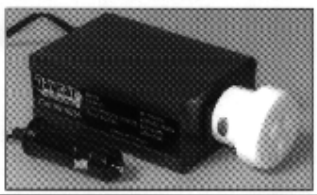

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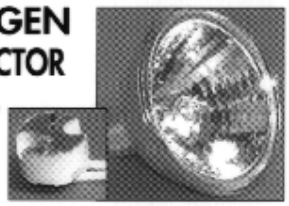

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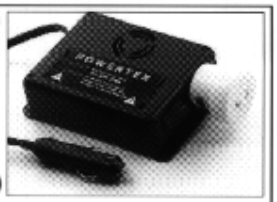

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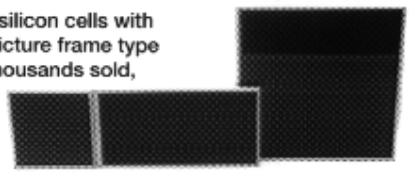

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Letters

duced from rubbish dumps and other methane sources both in Australia and overseas. The Werribee sewerage farm article in this issue describes such a system.

If any readers have any more information on methane production and use, we would be happy to pass the information onto Fred.

—Ed.

Pedal power

I'm interested in attaching an excercise bike to a generator to power my television or other appliances. Do you have any information about how to do this, or could you direct me to someone who might? Thanks in advance.

Chris P, prynoski12@aol.com

Chris, This is something quite a few people have asked us in the past year or so. The problem with generating power from this type of energy source has been finding generators efficient enough at the low rpm of a bike.

High-quality permanent-magnet low-voltage DC motors can be used in reverse to generate electricity. These can often be found in computer and electrical salvage and recycling yards.

Connecting the generator is usually a matter of attaching it to the bike and driving it either directly from the wheel, or via a belt and pulley system. The generator is connected to your battery via a power diode rated to handle the maximum power from the generator (about 10 amps if you're really fit). The diode stops the generator from being driven by the battery when you stop pedalling.

The type of regulator you use, if any, is up to you, but if you don't use one, then keep an eye on the battery voltage so that you don't overcharge it. The simplest regulator would be a shunt type.

We hope to present an article on use of these motors in the near future, particularly with low-speed wind generators, as well as a design for a serious (over 30 amps) shunt regulator. Stay tuned!

Lance Turner

A bit critical

At last I have been moved to put pen to paper, and write to you about the Alternative Technology Association, and ReNew in particular.

If we intend to win converts to our cause then we must be seen to be practical and knowledgeable. We will not capture the minds and hearts of mainstream Australia, if we seem to be too 'way out', or 'nutters'!

Regrettably, my perception and growing disappointment in both ATA and ReNew has almost reached a point at which I may not renew my membership of ATA, and if ReNew does not improve I will not renew my subscription.

I have little contact with ATA, but I did spend two days at Agfest in 1994, and went to Hobart to meet Mark Mather and express my support for an active branch in Tasmania. ReNew, and *The Sun* are my windows into the ATA.

ReNew – what a joke! I used to display *Soft* around my home and recommend to visitors that they should buy it, as it contained much useful and practical information. In particular I used to think that your buying guides were very good. These have degenerated into a regurgitation of manufacturers' information, and are not of practical assistance to a genuine buyer. For instance, the Raps Fridge Buying Guide in issue #54 stated that there are two types of fridge that can be considered. The article then goes on to describe three!

In my experience absorption fridges around Australia are not commonly known as 'gas fridges' as stated in the article. I have used fridges that burn kerosene, and have had friends in the bush with kerosene fuelled fridges, which were always referred to as 'kero fridges', never 'gas'. The article goes on to say that gas fridges 'should never be built in', but in fact many are designed for, and indeed built into, caravans and mobile homes.

I could make disparaging remarks about the maintenance section but it is best not said, so will move onto running costs. How helpful is an approximate average cost? Who came up with this bit of useless information? There is not much else of interest in Issue 54, such as, how many people seriously consider building in bamboo?

Let's move on to Issue 55. Interesting? Yes. Practical? ... Do I need this magazine? No.

Issue 56, interesting? Yes. Practical? Credible? No. On page 34, an AC electric motor has 'as few as three moving parts, compared with up to 1500 for an internal combustion engine'. Now that is really absurd. Count them. At worst case a four valve per cylinder V16 would have about 500 moving parts, and who has one of these? Our three-cylinder Daihatsu has about 50. Do I need this magazine? No.

Readers Pics

Like the new look and trust it will be as popular as ST. Also enjoyed the Tassie tip article in the last issue. You mention having a say on environmental matters, hopefully the photos will save too many words. I've always been a scavenger, forever on the lookout for useful items.

I applied to our local council for access to our local tip and was turned down due to danger from heavy machinery and litigation. However, by a stroke of luck I gained entry to a privately owned trade waste tip, used mostly by construction firms and builders to dump offcuts.

I was able to start on various projects using the timber, ply, versalux, laminates, bracing etc, the photos being a record since early '93.

It seems to me, with automation, computerisation, globalisation etc, we have jobless economic growth, especially for men, with a lot of part-time work for women, often at low rates of pay. Both sides of the political spectrum are clueless as to where jobs will come from. In any case, the pollies no longer have any real clout, being in thrall to whatever economic theory happens to be in vogue at the time, so perhaps it is pointless looking to them for ideas.

It seems local authorities are showing a lot more interest in recycling than they used to, with some admirable examples, like Revolve in Canberra, Reverse Garbage and a few more, some employing 30 or more people. It might help in some small way for councils to steer all useful materials towards local crafties or, at the really big tips, set up community workshops to teach a few skills. I realise it wouldn't even scratch the surface, but at least it's a small step. We do live in the waste age, might as well make use of it, and it could generate a few permanent jobs.

I can't make any wild claims about making heaps of money, a little perhaps. One thing is for sure, it's easy to save money and it's a truism that saving money is a lot easier than earning it.

I've had no woodwork training at all, had to learn as I've gone along. I've been a postie for 30 years, I reckon if you've a liking for something it's a big help. If I can do it, I'm sure others can.

Alan Stuart, Alexandra Hills QLD

At last we have ReNew. Page 53 is the most interesting, gives me just what I need – an article on underwater tractors, no less!

ReNew – interesting, yes. Informative. A little. Do I need it? No. Do I recommend it? No. Sorry fellas, for me to sit and write all this tells it all – you have lost the plot! ReNew now winds up on the pile with Grass Roots which I last purchased in 1992, and Earth Garden in 1994.

Page 7 states, 'a new magazine about people and their dreams'. Give me back the old magazine. I understood that it just had a new name. I am not interested in people and their dreams. Surely this magazine is not for the dreaming, but for those who seriously want to put practical ideas into action. I am into real things, things that work, not dreams. I did not dream of building a low energy home – I did it. I do not dream of cheaper power, I have it. We do not dream about self sufficiency, we live it.

Regardless, I do feel that there is a need for an alternative energy magazine that tells it how it is and shows how things can work and become part of a very normal and generally acceptable way of life.

Robert E Pearson, Blessington TAS

Robert's letter was edited for space (yes, there was more). We hope that Robert will use the reader survey in this issue to tell us what he thinks should *be included in the magazine.*

—Ed.

up front

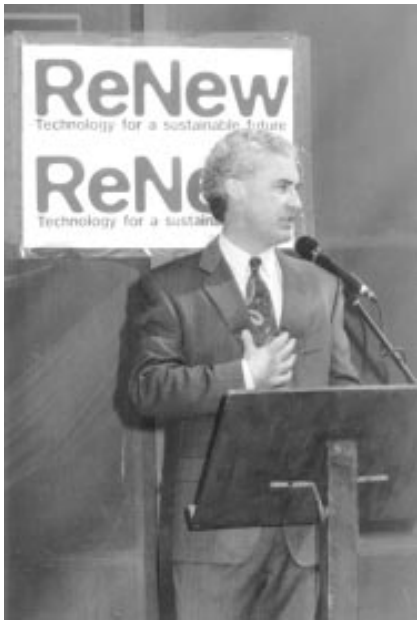
This section used to be called 'energy flashes,' though as several people pointed out to us, the information contained within it often has little to do with energy. We hope the new name doesn't offend anyone.

ReNew is launched

The launch of this magazine under its new title was a major event, held at Albert Park Lake in September. Alternative Technology Association members and curious members of the general public came from far and wide to see a huge variety of renewable energy displays including electric cars and bicycles, solar boat, composting toilet, hot water heating, inverters, and the Alternative Technology Association's Energymobile and Solar Shuttle mobile displays.

Ray Prowse, Executive Officer of the Solar Energy Industries Association, and Rob Gell, ACF counsellor and Melbourne television personality, were guest speakers at the launch.

A special thanks from all of us at ReNew to the numerous volunteers who helped make the day a sucess.



Rob Gell, Australian Conservation Foundation Counsellor and Channel 9 Melbourne weather presenter, officially launches ReNew.

Less filth to the gallon

New electric and extra-efficient vehicles are popping up everywhere lately – everywhere except Australia, that is. In Europe, Greenpeace has unveiled the Twingo SMILE (small, intelligent, light, efficient), which has a fuel efficiency of between 3.26 and 3.75 litres per 100kms. In a press release, Greenpeace Executive Director Thilo Bode said 'we are not here to promote cars, but to demonstrate that the automobile industy is obstructing feasible technology which would help prevent dangerous climate change'. Greenpeace claims that the car industry has lobbied against minimal European standards, saying that efficiency of 5 litres per 100km is not feasible. At current estimates, the world's car fleet will grow from 500 million to 2.3 billion by 2030, and its CO_2 emissions will double to 7.5 billion tons.

Audi have launched a commercially available hybrid combustion/electric vehicle. The A4 Avant Duo III can be driven either by a three phase AC, 21kW electric motor at the rear, or a 1.9 litre 66kW diesel engine at the front, which can also run on modified canola oil. The idea is that the electric motor is used for around-town driving, while the diesel motor kicks in for long distance highway driving. The Audi will also be marketed with a solar array, and gets a thumbs up from ReNew. Audi's Australian General Manager, Danny Rezek, may need to take out a subscription, however. Danny is quoted in the press release as saying 'electric cars in Australia are next to useless, they just don't have the range for open road use...' If Danny had read July-September's *Soft Technology*, he might have noticed that the Solectria Sunrise set the electric vehicle distance record of 600km on a single charge. Six hundred kilometres is a long way from useless.

Solar a/c competition

The Western Australian Office of Energy has announced a $25,000 prize for designing 'a world breakthrough in the use of solar power for air-conditioning'. The winner will also have the opportunity to install the system in a demonstration house at Fitzroy Crossing in the north of the state, where air-conditioning costs are high.

The competition is open to anyone, and the main requirement is that the design be superior to standard refrigerative air-conditioning. We have just one question: why not make the prize available for innovative passive solar renovations? After all, the design of a house can mean the difference between very high heating and cooling bills and very low ones, or none at all.

– For application information contact the Western Australian Office of Energy, Ph:(09)327 5698.

A blast from the past

Thanks to John and Cheryl Seamer from Innisfail, who sent in a copy of an article from *Home Beautiful* April 1957, entitled *Heating from the sun is here!*. Expecting some wacky claims about how solar energy would power everything by the year 2,000, we were surprised to find that the article was incredibly accurate in predicting future trends, and pointed out that much of the solar technology we have today has not changed much in the last forty years. Solar hot water was presented as the fastest renewable technology money and energy saver, as it is today, and the high price per watt of solar electricity (£50 per watt) was lamented.

Agriculture and environment

A report from the Australian Bureau of Statistics released in September gives an insight into the environmental prob-

lems caused by farming in Australia. It reveals that the agricultural sector contributed about 15 percent of all greenhouse gases in Australia in 1994. Sheep and cattle were the main sources of methane emissions, contributing an estimated 2.8 million tonnes.

The report also claims that in 1993, farmers estimated that about 16 million hectares (3.4 percent) of all agricultural land was degraded by erosion, salinity and acidity.

– Agriculture and the Environment

Fridge testing

Rainbow Power Company in northern NSW has obtained funding from The NSW Sustainable Energy Development Authority (SEDA) for six renewable energy projects.

The projects include data logging of the Rainbow Power Company power system, comparison tests of five different types of PV modules, improved production facilities, training programs and a 'solar trailer' mobile renewable energy education system.

The power consumption of a number of refridgerators commonly used in independent power systems will also be tested. A range of 12 volt, 24 volt and LP gas fridges will be tested with the aim of establishing a full life cycle cost of the three different types.

Progress and results from the different projects will be announced in the coming months.

From RPC press release

Solar Summit's absentees

The first World Solar Summit, held in the Zimbabwean capital, Harare, in September, was focussed on delivering electricity to some of the world's 2.8 billion people who are estimated to live without it. The summit launched several proposals, such as mobile solar systems for Mongolian nomads and a 40 megawatt wind farm in the Canary Islands.

The main aim of the Summit, to encourage the world's governments to spend more on renewable energy programs, was somewhat jeopardised, with only nine (mainly African) heads of state attending.

Toxic trading

Australia has a bad record for dumping toxic waste in nearby countries, and the latest report from Greenpeace on toxic trade shows that we are not improving. Between October 1994 and March 1996, Australia was the second largest exporter of hazardous waste to India, totalling 9034 tonnes, including 4016 tonnes of lead acid batteries and lead waste. In the past three years we have also become one of the major exporters of scrap car batteries to the Philippines.

Recycling workers in these countries are usually made to work without adequate safety equipment, and often don't even have basic clothing such as boots. Greenpeace tests around one site in the Philippines found lead levels 50 times higher than the safe limit.

– from *the Age*, 13 Sept. 1996

ICI's *dirt*y laundry

ICI Dulux has opened what they claim is the world's largest soils washing plant to treat lead-contaminated soil at a disused paint manufacturing site in Cabarita, Sydney. The plant is expected to return 70 percent of the 140,000 tonnes of contaminated earth as clean soil. The waterside property is expected to be used as a medium density housing development.

– ICI Dulux press release

browser

compiled by adrian braun
adrenal@netspace.net.au

Planet Ark: [http://www.planet.ark.com.au/]

If you're a younger person, a parent or an environmental educator, you'll be impressed by this site, especially the Earth disk. Actually, you don't have to be any of these to enjoy this free multi-media show, which can be down-loaded and installed into your computer with minimum fuss.

The audio-visual presentation encourages you to question the practices of the (older) people around you and to take steps to help instigate environmental practices such as saving water, energy conservation and waste recycling. The show had this (older) person stumped for a while – a hint: don't ignore the dripping tap!

Alternate Energy Engineering [http://www.asis.com/aee]

While we're on the subject of educating ourselves, this site would be useful for do-it-yourself-ers who are designing their own alternative energy systems. You'll find over 100 work sheets which step you through dozens of design projects including: PV installations, solar pumping systems, energy efficient lighting systems, sizing of battery banks and inverters and more.

The work sheets link you with a range of manufacturers' specifications for currently available components relevant to each design step. It's really a clever marketing exercise so you'll see specifications only from manufacturers who have some commercial ties with the site. Nevertheless, the work-sheets make good pro-formas for you to plug in your own data.

Solar Cooking Archive [www.accessone.com/~sbcn/index.htm]

Lots of good gear on this site for people who are into cooking under the sun. Several solar cooker designs are detailed, and you can catch up with news about aid programs for solar cooking technology in places like refugee camps in Kenya, where solid fuel has been exhausted.

Feeding power into the grid

STUART McQUIRE explains how he and his familiy came to be living in one of only three Australian houses that feeds solar electricity into the grid

When the sun shines, our electricity meter runs backwards. An array of solar panels on the roof of our house generates electricity which is fed into an inverter, with any excess flowing back through the meter across to the wires in the street. At night, or when it's cloudy, we draw electricity from the grid. Ours is the third house in Australia to have a grid-connected solar panel system. Similar systems are also operating in Europe, Japan and the USA.

Background

In July 1994, a front page article in the local paper announced that the council-owned Brunswick Electricity Supply was extending the Aurora Project to commercial and residential buildings in Brunswick. The Aurora Project consisted of a wind generator and solar panels at the site adjacent to the CERES environment centre in the Melbourne suburb of East Brunswick, with power from these fed into the electricity grid. Brunswick residents had the option of purchasing a solar panel for $600 (or half a panel for $300, or a quarter for $150) and receiving a credit on their electricity bill for the amount of power generated.

We read this article with excitement and after speaking to the staff involved wrote a letter formally expressing interest in the project and offering the roof of our house as a possible site for solar panels. Initial discussions were along the lines that we would contribute $5,000 towards the cost of a $10,000 system.

Shortly after, the electricity industry in Victoria was restructured and then privatised, meaning that we were living in the area serviced by CitiPower. For a while it was uncertain whether CitiPower was committed to developing the Aurora project any further. Fortunately they saw the benefits of the project, and in September 1995 the array of solar panels was installed on the

Photo courtesy CitiPower

Stuart McQuire, Wendy Orams and their daugher Alex outside their grid-interactive home. The house is a four bedroom 1929 bungalow style weatherboard. As with most houses of the time, it was not designed with energy efficiency in mind–most of the energy-saving features have been installed by Stuart and Wendy. The house is also shared with Alex's sister, Kendal, and Stuart's brother Scott, who stays three days a week when he is not working in Geelong.

Photo courtesy CitiPower

Photo courtesy CitiPower

Above: *The house has two electricity meters–one for billing and one for measuring output from the solar panels. The CSA inverter is to the right of the meters.*
Right: *Stuart on top of his roof*

roof. In April 1996, with the inverter in place, the wiring was finished and the system started to operate.

Cost

The system ended up costing around $26,000, with our contribution being $5000. Under the agreement we have with CitiPower they own the inverter and 16 of the 24 panels. We have agreed to open the house for display six times a year. With the meter running forward and backwards CitiPower effectively credit us at the retail rate for any surplus electricity generated, but because they paid for most of the system they will not be sending us money for the surplus. We still pay the service charge of about $11 a month.

How the system has performed

Over the last winter we used more electricity than the system generated, but with summer approaching the meter winds back each day and is almost back to where it was in April. CitiPower estimate that the system will average 6 kilowatt hours per day, which will exceed the amount of electricity that we use (they say a typical household uses 5.25 kWh per day). Each day I read the meters to record the amount of electricity generated and the amount we use. Our winter electricity consumption is still relatively high because it includes some electricity for heating. By coincidence, the 29º angle of the roof will maximise the amount of electricity generated by the panels in summer, as they are aligned with the path of the summer sun.

Greenhouse emissions

About three years ago we did a greenhouse audit of our household energy use. We found that the electricity and gas we used contributed the equivalent of about 10 tonnes of CO_2 per year. The off peak electric water heater was contributing about half of this, yet costing very little to run. We had already had the thermostat fixed so that we could turn it down, and had fitted a low-flow shower rose to reduce our hot water consumption. We decided to replace the electric water heater with a second-hand gas one. Later we added a solar water heater, also purchased sec-

Technical details

- The system consists of an array of twenty-four 83 Watt Solarex photovoltaic panels mounted on the north-facing roof of the house, covering an area of 18 square metres.
- The solar array has a total generating capacity of about 2 kilowatts, and is mounted flat onto the sloping roof.
- The array leads into a 2.2 kilowatt CSA inverter converting the electricity to 240 volts AC for use in the house, with any surplus feeding into the grid.
- Two meters have been installed, with one being used for billing purposes. It runs either forward or backwards depending on the amount of sun and the amount of electricity being used in the house at the time. The other meter measures the amount of electricity generated by the solar panels and also allows us to work out our household electricity consumption.
- Because the system is grid connected it doesn't require batteries.

Average daily electricity use and solar generation for Stuart and Wendy's house between April and October 1996.

Month	Av. daily use (kWh)	Av. daily solar (kWh)
Apr	5.92	4.74
May	5.41	3.06
Jun	5.60	3.54
Jul	4.15	3.06
Aug	5.08	3.98
Sept	4.74	5.38
Oct	3.19	7.13
Apr-Oct	4.84	4.44

Total use Apr-Oct = 1020.9 kWh

Total solar Apr-Oct = 937 kWh

Note: This period does not include summer months, when solar generation will be much higher than for the rest of the year.

ond-hand, to act as a pre-heater for the gas unit. The combination of the solar/gas units cut our household greenhouse emissions in half. Gas produces the equivalent of about a quarter of the greenhouse emissions of conventional electricity, with the sun providing about two-thirds of the energy for the solar/gas unit.

With the addition of the photovoltaic panels, the household greenhouse emissions have been cut a further 35 percent, making an overall cut of 85 percent. The energy debt of the panels, or length of time it will take them to generate as much energy as it took to make them, is said to be around 18 months.

Heating is our other main energy use. This is mainly from a gas space heater, with support from an electric heater. We also use gas for cooking, and electricity for the fridge, washing machine, TV, and other appliances. To help reduce energy consumption we have insulated the ceiling, planted deciduous trees on the north side of the house, put a pergola and vines on the west side, fitted weather stripping and replaced most light bulbs with compact fluorescent lamps.

FOR MORE INFORMATION

CitiPower has produced an information sheet about the grid connected system at our house. To get a copy of this or to find out about other renewable energy initiatives phone Peter Zwack on 1800 650 540.

Other Australian grid-interactive houses in Australia

Solar One, Sunshine Coast, Queensland

Back in Soft Technology issue 51 there was a story about Solar One, a project house in Queensland that had just begun selling electricity back to the grid.

The project, funded by the South East Queensland Electricity Board (SEQEB) and the Australian New Zealand Solar Energy Society (ANZSES), had two main objectives. ANZSES wanted to promote energy efficiency in the home, by demonstrating low power consuming appliances and fittings and other aspects of energy efficiency. Gas boosted solar hot water, compact fluoro lighting, and passive solar design were all integrated with the solar power system.

For SEQEB, the project provided the opportunity for a trial of Queensland's first solar grid-interactive system. Using only Australian-made equipment, Solar One's system comprises:

• a 1.3kW solar array, using 16 Solarex 83 watt panels connected in series/parallel to produce 96 volts DC.

• A 1.5 kilo-volt amp grid-interactive inverter from Butler Solar.

The project was for a two year period, over which time SEQEB monitored all aspects of the system. Over this time the system exported back to the grid about the same amount of power as it used.

The project test period has officially finished, and the data collected over the two year period has formed the basis of SEQEB's 'Buy Back Policy'.

This policy includes rates for grid connection by private generating souces and an agreed 'buy back' rate. What this means is that if anyone is thinking of putting in a solar grid interactive system in Queensland, the peak rate would be the agreed rate for electricity purchased by an electricity utility.

For further information on selling electricity back to power authorities in Queensland write to Mr Graydon Johnson, SEQEB, GPO Box 1461, Brisbane 4001, or phone (07) 3407 4130.

by Paul Edwards. Paul was one of the installers of Solar One's solar power system.

Tracking the sun in Canberra

Photo: Peter Bachman

Peter Bachman's backyard in Canberra may look like a postmodern art installation, but it is actually a trial area for various solar equipment. The 1,000 watt stable array (on the left of the roof) provides most of the power, which feeds excess electricity into the grid through a CSA 2500 inverter. At night, or on less sunny days, power is drawn back from the grid.

Peter is a solar tracking enthusiast. The panels near the fence, and those on the right hand side of the roof (also pictured below) are all connected to different tracking systems.

A tracking system allows an array of panels to follow the movement of the sun during the day, and therefore get greater power output from them. The roof-top tracking system comprises three panels bolted together and guided in four bearings, with a total rotation of 120°. A small gear-motor drives the setup from east to west during the day, and returns it to the east once the sun sets.

Up to 30 percent more electricity can be gained from using the trackers, and on a sunny day the three 80 watt panels generate around 1.5 kWh of electricity.

Peter Bachman manufactures two different solar tracking controllers, both of which have been installed on tracking systems Australia-wide. For more information, contact Peter Bachman: Electronic Lab, 11B Mawson Dve, Mawson ACT, 2607. Phone/Fax: (06) 290 1639.

Photo: Peter Bachman

Australian native food plants

Potatoes, spinach and tomatoes may soon become a thing of the past in backyard vegie gardens. Native food plants, used by aboriginal people for thousands of years, are now available at nurseries all over Australia, and as SARAH HILTON explains, their appeal is growing fast...

Bush foods are not only tasty, but they look good too. The flowers on this native leek lily (Bulbine Bulbosa) are bright yellow, and the tuberous base makes great eating.

Australians are expressing a renewed interest in growing our native flora — not simply for its ornamental value, but for its capacity to provide foods with unique flavours and textures that can be integrated into almost any cuisine style. Restaurants and retailers serving various bush foods and bush food products are growing in number as chefs experiment with flavours that have been in Australia for thousands of years.

So why this growing interest in bush tucker, and bush food plants in particular? Gil Freeman, co-founder of the Southern Bush Food Network (based in Melbourne) says there are a number of factors involved: 'Small land holders are looking at other options in terms of making the land productive without degrading it. So far the options have been native oils (such as Ti-Tree) or agro-forestry.' Now, there is a realisation that native food plants can be used as wind breaks or soil stabilisers while also providing a source of income.

Freeman mentions other factors, such as a genuine interest in Aboriginal history and culture, as well as the desire to create a uniquely Australian cuisine; part of a wider sense of nationalism, and the endless search for a culture that is recognizably Australian and representative of us all.

There are other advantages in growing bush food plants, and no matter how large or small your garden, you can reap some of these benefits. A good selection of plants will provide you with plenty of visits from native birds, but will also allow you to harvest and cook with some wonderful, untamed flavours.

In her recently published book, *Wild Lime: Cooking from the bushfood garden*, Juleigh Robins expresses the hope that bush foods can provide one path to reconciliation between Aboriginal and non-Aboriginal Australians. Growing bush food plants is a good way to learn about indigenous culture and flora, while creating an edible landscape — productive and beautiful.

Aboriginal people still gather bush foods. Much more than sustenance, bush tucker represents just one part of a complex system of cultural beliefs and practises. Many foods are the subject of important ceremonies and celebrations. Kinship groups are governed by the laws of their Dreaming, where all things, including plants were created by the spirits of the ancestors. The rules govern where and when certain foods may be gathered.

Some forms of cultivation were and still are practised. These include: the selective firing of the land to encourage the germination of certain seeds and attract grazing animals; the diversion of water courses to encourage the spread of certain species, and also the dividing and replanting of tuberous plants such as yams. Plant foods made up the major portion of bush foods for Aborigines in desert areas, but in coastal

districts, where other foods like fish and game were plentiful, the percentage was less.

The first Europeans in Australia depended on bush food plants to combat disease such as scurvy. Those on large stations in the outback who learned about foods from the local people would certainly have had a better and more balanced diet than those who did not. However, as the European population grew and supplies of more conventional foodstuffs became available, valuable Aboriginal knowledge began to be ignored. This knowledge is now being called upon again, as many gardeners and enthusiasts of all things gastronomic explore the possibilities of growing and cooking bush foods.

If you already have a penchant for gardening, you may unwittingly have some bush food plants growing in your garden. Genera such as *Prostanthera* (Native Mint Bush), *Banksia* and *Acacia* have long been cultivated in home gardens for their ornamental qualities alone.

Cultivating bush foods is a great way to explore unfamiliar flavours, and as Gil Freeman says, some have 'strong, unique tastes', and you don't need large quantities. Try for example: 'Bush Tomato, Kakadu Plum and Lemon Myrtle — a little bit can give a strong flavour.' If you're unsure about which flavours will best suit your palate, try some of the commercially available products, such as Kakadu Plum jelly or barbeque sauce.

Rhys Freeman, the bushfood nurseryman at CERES native plant nursery in Melbourne, holds an Illawarra flame tree seedling. The seeds can be ground up to make flour..

Planning your bushfood garden

Realistically, you would need an awfully big back yard to keep yourself and your family in bush tucker, but you can always rejoice in your first harvest, just as you do with other food plants in your garden. Herbs to use as supplements to meals are the best option if space is limited. No matter how small your garden, there will be room for at least one bush tucker plant.

Climate will be the biggest factor in determining what you can grow successfully, so initially, it's best to choose species which are indigenous to your area. Contact your local Aboriginal community to learn more about the history and cultural signifigance of local bush foods and how best to prepare them. In time, you can then be more adventurous with your plantings. Try creating micro-climates in your garden; raised beds with sandy soil and large, heat-absorbing rocks facing north or west, can replicate arid conditions in temperate climates.

Some nurseries are beginning to stock bush tucker plants and have a separate section for them. Specialist

Some common bush foods plants

Listed below are ten plant species which are today cultivated and used in commercially available bush food products. Most should be obtainable at specialist nurseries.

*** Bush Tomato — *Solanum centrale***

A staple of the desert peoples because of its high vitamin C and carbohydrate content, this fruit is strong on flavour and makes a good addition to savoury dishes such as soups or casseroles. A small shrub to 30cm, it favours dry conditions and is therefore a good plant for arid zones. Fruit is best sun dried as it is in the wild.

*** Wild Lime — *Eremocitrus glauca***

A very juicy fruit with a flavour close to that of the West-Indian lime. The plant tolerates drought, frost and alkaline soils and can be container grown. A prolific bearer of fruit, it responds well to pruning. Good for pickles and curries.

*** Quandong — *Santalum acuminatum***

Already a popular commercial crop, and still an important food source in the outback, this fruit is also high in vitamin C. A beautiful tree, which grows to 7m in optimum conditions, its fruit can be eaten fresh or dried; the kernel is also edible as a source of protein. It is salt tolerant and therefore good for revegetation purposes, though it won't appreciate colder climates. The quandong is a long-lived, semi-parasitic tree that requires suitable 'companion' plants and good drainage for successful cultivation. A relative, *S. lanceolatum* (Native Sandalwood) is also edible, but is not widely grown in cultivation.

*** Kakadu Plum — *Terminalia ferdinandia***

Growing up to 10m in height, this a good shade tree for far northern Australia. It was recently discovered to be the world's highest fruit source of vitamin C, and also has good antiseptic qualities. Not for cold areas, it requires sandy soil and lots of sun. Kakadu Plums are good for jams and chutneys.

*** Appleberry — *Billardiera scandens***

A twining creeper, this makes a good plant for fences or trellis. It tolerates a variety of conditions but is drought sensitive. The juicy fruits have a subtle flavour and make a good accompaniment for white meats. Appleberry occurs naturally throughout south-eastern Australia.

*** Lemon Myrtle — *Backhousia citriodora***

A native of the sub-tropics, this beautiful tree is frost tender, but will grow in cooler regions. The incomparably fragrant leaves, along with the flowers and seeds, are edible and are a good substitute for lemongrass. Lemon Myrtle needs a warm position and plenty of water.

*** Warrigal Greens — *Tetragonia tetragonoides***

A versatile, spinach-like trailer, spreading to 2m, this plant can be grown in all states except the Northern Territory. Leaves should be harvested in spring and summer and are great for soups, or as an accompanying vegetable or warm salad. Cook is said to have used it as a tonic for scurvy and the first European settlers relied on it as a food source.

*** Wattle — *Acacia spp.***

High in protein and leguminous, Acacias have the extra quality of fixing nitrogen in the soil and are therefore a good planting choice for those with an acreage of degraded land. There are many species worthy of cultivation, among them the Mulga (*A. aneura)*, a staple of the central desert peoples. Depending on the species, Wattle can be eaten raw straight from the pod, or roasted and ground into flour to make damper or bread.

*** Lillipilli or Riberry — *Syzygium & Acmena spp.***

There are over sixty species of Lillipilli found in many different areas of Australia, so it should be easy to find the best one for your region. Many are grown as street trees in cities. *S. luemanii* has a delicious clove-like taste and is great with white meats or in sweet pastries. It was probably one of the first native fruits to be tasted by Europeans.

*** Ruby Salt Bush — *Enchylaena tomentosa***

A small shrub to 50cm with small, sweet red berries. A gardener from Dampier whom I met via the internet tells me it is commonly grown as a garden shrub in the Pilbarra region and is a popular food plant also. It will grow in inland arid areas, but also on the coast south of the Tropic of Capricorn. Fruits can be dried and reconstituted.

Begin planning your garden by considering:

- the look or feeling you want to create
- any existing features you would like to retain
- soil type, aspect, and any damp or dry areas
- what food plants you will get the most use from

Plenty of research is a must:

- visit your local botanic gardens
- know botanical names to ensure you get what you want
- check with local nurseries or organisations on the availability of plant species.

Native guava are often used as ornamentals without their owners realising that they bear edible fruit.

nurseries are always the best places to visit to find out what's readily available.

Keep in mind that most Australian natives do not respond well to high degrees of phosphorous in the soil. And remember: your main aim is to cultivate, not forage; many indigenous plants are protected species. If you'd like to have a hand in nursing a rare Australian native back from the brink of extinction, you should contact your local Department of Natural Resources and Environment to apply for a permit to collect plant material for propagation. Murnong (*Microseris lanceolata*) is one species worthy of investigation. Once a staple of the Koorie people of the south-eastern states, it grew in abundance, but is now only found in patches in the wild.

There are several thousand edible plant species native to Australia, so any comprehensive guide would need to be of encyclopaedic proportions. Some better known species are omitted here because of their unsuitability for the average back garden, but if you've plenty of space and the right climatic conditions, you might like to try growing, for example, the Bunya Bunya (*Araucaria bidwillii),* which can reach 50m in height, or the tasty Illawarra Plum (*Podocarpus elatus*). If you'd like to share in the secret of Burke and Wills' last supper, you could grow the pretty, clover-leafed water plant, Nardoo (*Marsilea drummondii*); and the list could go on. The list on the opposite page gives some commonly available plants from different areas of Australia. ✲

There are many bushfood plants that hide their wares, like this tuberous mountain vanilla lily.

HELPFUL ORGANISATIONS

The Society for Growing Australian Plants
48 Montrose Rd, Montrose, Victoria.
Ph: (03) 9728 5891

Greening Australia
Buckingham Dve, Heidelberg, Victoria
Ph: (03) 9457 3024

The Nursery Industry Association of Australia (NIAA)
307 Wattletree Rd, East Malvern
Ph: (03) 9576 0599 freecall:1800 032 109

The Southern Bush Food Network
21 Smith Street, Thornbury 3071

There are other state branches of some of these organisations, so check for the one nearest you.

ESSENTIAL READING

Cherikoff, Vic and Jennifer Isaacs, *The Bush Food Handbook*, Ti Tree Press, Sydney, 1989.

Low, Tim, *Bush Tucker: Australia's Wild Food Harvest*, Angus & Robertson, Pymble, 1992.

Robins, Juleigh, *Wild Lime: Cooking from the Bushfood Garden*, Allen & Unwin, St Leonards, 1996.

Free range travel

the art of ecologically sensitive tourism

NICOLETTE BOULE looks at some creative and effective solutions to managing energy issues in two of Australia's more remote ecotourism destinations

The 'environmentally sensitive' badge is being used to sell everything from food and detergent through to cars and houses. The tourism industry has latched onto the idea that green is sexy, and there is a growing number of eco-tourism resorts in Australia. Several ventures are even going beyond bushwalks and dolphin spotting as their main credentials, and incorporating renewable energy, sustainable architecture and appropriate technology into their facilities.

By starting with an energy efficient building envelope you cut costs for power supply by up to 90 percent–and we know how expensive it can be to put in a wind turbine or solar photovoltaic system. The managers of these ecotourism destinations have used a range of initiatives including passive solar design, energy efficient appliances, solar hot water systems, photovoltaics, wind and micro-hydro electric turbines.

One of the passive solar huts at Eco Beach resort. Smart architecture saves the owners of this resort between $15,000 and $30,000 per year on air conditioning running costs.

Passive solar design at Eco Beach Resort

near Broome, Western Australia

Karl Plunkett has a way of making his dreams come true. His ways are not exactly orthodox, but then 'you don't get things done' if you have to please everyone, says the Managing Director of Eco Beach Resort near Broome on the Kimberley Coast in Western Australia.

Karl was involved with setting up *the Last Resort*, Australia's most successful backpackers' hostel. Considering Broome's remote location, Karl and his colleagues did surprisingly well to turn a patch of red dirt into a lush love-pod, a mecca for backpackers and the envy of many a hostel manager's eye. Backpacking tourism is reliant nearly wholly on

PASSIVE SOLAR CABINS AT ECO BEACH

The accommodation cabins at Eco Beach are wholly passive solar and require no mechanical heating or cooling. This is achieved by:

- angling the roof pitch to 45°
- incorporating long eaves for shade
- raising the structures between 1.5 and 2 metres above ground height to allow the building envelope to ventilate
- using light-weight building materials with short thermal lag times
- omitting glass for windows to enable natural ventilation
- using reflective roofing materials that do not conduct radiated heat.

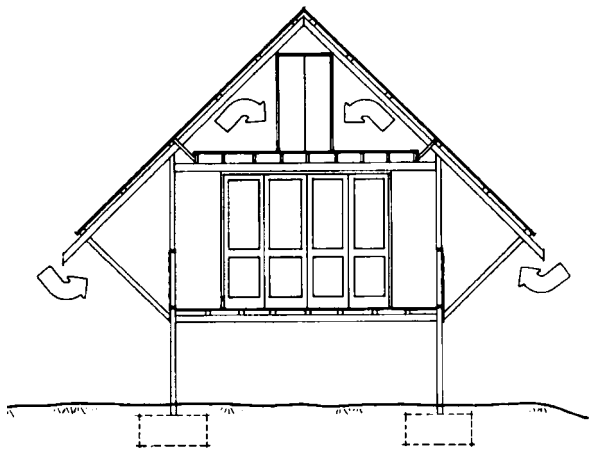
COST SAVINGS

The passive solar cabins are not only highly cost effective to build–due to reduced material requirements (for example, no glass for windows or plasterboard for the ceiling) and hence reduced labour requirements–but they are also significantly cheaper to operate.

If the 20 huts were mechanically air-conditioned, the operating costs would be high. Consider this scenario below.

Cost per kilowatt of diesel generated power	$0.20
Air-conditioning operated 10 hours/day (at 2kW per unit)	$4
Number of accommodation huts	20
Total cost per day for 20 huts	**$80**
Number of days (assuming a modest 50% occupancy)	180
Savings per year, starting year one	**$14,400**

The rough cost for running air-conditioning in the accommodation huts alone would be between $15,000 and $30,000, depending on occupancy. These figures do not include the capital outlay and ongoing maintenance costs associated with operating air-conditioning systems.



This diagram shows the direction of air circulation in the cabins, which helps to eliminate the need for conventional air conditioning. Courtesy of Paul Meschiati and Associates Building Designers and Planners, Perth. Ph:(09) 322 4454.

word of mouth (OK, a little on the *Lonely Planet Guide Book*) and tourism surveys reveal that many backpackers to Broome visit with the primary purpose to experience *the Last Resort* – a great credit to management.

Karl is creating new waves near Broome, but without stirring up the dirt. He has conceived and given birth to Western Australia's first true ecotourism resort. Not only is it designed and constructed around the principles of ecologically sustainable development (ESD), but guests, during their stay, develop a respect and understanding for the environment – a main tenet of ecotourism.

Stage one of the resort – made up of 20 passive solar designed huts–is located in the dunes of the south-western tip of Roebuck Bay, which is 17 nautical miles by sea or 150 kilometres by road from Broome.

You won't find any of the luxuries of a conventional 'eco resort' there. There is no air-conditioning or room service. Rather, guests are offered something unique to the location: 'the benefit of being able to luxuriate in nature, becoming intimately acquainted with the stunning ocean views, the deserted beaches, the cooling sea breezes, the prolific display of stars visible each night in the clear Kimberley sky, the diversity of plants, animals and birds, the changing mood of the landscape, and timeless serenity of the natural environment…' or so says the brochure.

The resort's buildings are linked by raised walkways so as to minimise the impact of the development on the movement of animals and the growth of plants on the site. Much of the material used was reclaimed from obsolete development sites. This material makes up the resort's walkways, roofs, furniture, fittings and retainers for the road.

Jan Talacko, of Eco Solutions, helped focus Karl on the issues of waste streams associated with a remote development of this nature. Prior to development, there was literally nothing at the site, so everything had to be imported. That meant that every bit of packaging taken to the site had to be taken away again.

Even now that it is up and running, the area is not serviced in a conventional sense for waste, water, electricity or phones. In fact, the only phones used at the site are mobiles.

It was not economically viable to connect to the grid so Eco Beach Resort is powered by a diesel generator and photovoltaic panels. A wind turbine is also planned and is awaiting assistance from the Western Australian government before it is commissioned. All the lamps are high efficiency and gas is used in the kitchens.

Key development challenges

Building footprint–the dunes on which the resort stands are covered with fragile vegetation. Assembling the huts before they were erected on site minimised the potential dam-

age to the environment.

The huts' large air inlets are excellent for ventilation but leave little protection from prevailing winds and storms. Large, heavy duty tarpaulins can be fixed across the huts' open sides during storms.

Orientation of the huts northward gives excellent views of the bay but it also means that they are subject to undesirable solar gains. The mezzanine balcony helps shade the area below. The long eaves protect the huts from morning and afternoon sun.

CONTACT

Call Rachel at Eco Beach Resort for more information: 1800 636 414

Micro-hydro power at Lemonthyme Lodge

near Cradle Mountain, Tasmania

Lemonthyme Lodge is located near Daisy Dell, between the Lemonthyme Valley and Cradle Mountain, in the midst of forests above Lake Cethana in Tasmania's northwest. The main building was constructed from plantation-grown Ponderosa pine logs in 1990. The complex has conference facilities and 18 self-contained cabins of which many are pole-framed.

The Lodge was originally sited to take advantage of local hydropower potential. However, due to a shortage of capital, the system was not established until the current owners purchased the property and invested in the turbine and its related infrastructure. The total development cost of the resort was $2.5 million and the current owners invested a further $500 000 in the property, including $130 000 for the micro-hydroelectric power system, which has a payback period of five to eight years.

The management desired to use the energy in the stream flowing through the property–energy potentially available at very low running costs.

The closest powerlines were approximately two kilometres through forest and the connection costs would have been $40,000. At the time, the two options for grid connection would have created major impacts on the landscape. The shortest and cheapest option, from the grid through the forest to the Lodge, would have had the greatest environmental and aesthetic impact, as it required repeated clearing under the powerlines.

A diesel generator was considered but rejected on the potential noise and exhaust from its operation, incompatible with the wilderness experience.

The power system was designed to provide electricity 24 hours a day; supply the Lodge with its potable water; serve as a fire fighting facility; and be a visible feature of the place. The total power requirements of all lighting is approximately 6kW with an average of 70 lights on during the evening.

The ingredients required for the successful installation and operation at Lemonthyme Lodge were:

The ability to collect water in the PVC intake pipe laid in Bull Creek;

Suitable fall, which is 208 metres of practical head (static head), but friction losses in the pipeline mean that the water effectively falls the equivalent of 142 metres (nett head) with a flow rate of 46 litres per second; and

Turbine location at the Lodge, where it provides a rated maximum of 52 kW of power and normally operates at around 48 kW capacity. The noise level immediately outside the turbine building is low, and it is inaudible a short distance away from the building.

The system is a Pelton Model 250P from *Tamar Designs*, built in 1991. The alternator is a Mecce Alte 3-phase and the governor is a specially designed Tamar Electronic full shunt load 3-phase. The life of the machine is expected to be approximately 50 years.

• The author wishes to acknowledge Mark O'Brien, RAPS specialist for the Lemonthyme Lodge case study information.

CONTACT

Ph: (004) 92 1112 Fax: (004) 92 1113.
Address: Off Cradle Mountain Road, Sheffield, Tasmania, 7306.

Nicolette Boule has researched sustainable energy solutions used by the tourism industry world-wide. The results will be published under the title *Tourism Switched-On*, and will be available from Tourism Council Australia by Christmas. Ph: (06) 273 1000. Nicolette is now a project leader with the New South Wales Sustainable Energy Development Authority.
Email: nicolette@seda.nsw.gov.au

Solar and mudbrick at Bungaree Earth Cottages, Wentworth Falls, Blue Mountains, NSW

Bungaree is an aboriginal word that loosely translates as 'oneness with the land,' and this has been the Curtis family's guiding principle in developing and operating the Bungaree Earth cottages, which overlook the Blue Mountains National Park in NSW. Seeking to have minimal impact on the land, the Curtis' were careful to clear the smallest amount of vegetation possible for fire safety and used human-powered building methods whenever possible.

The three cottages have been built progressively over six years from mudbricks made entirely on-site. Mudbrick walls provide thermal mass which helps maintain comfortable temperatures in the cottages all year round. The timber framework for the cottages was built on-site, and the doors and windows have been hand crafted using purchased timber and glass. Instead of using nail guns and air compressors, the Curtis family hammered every nail by hand. Excavating for the concrete slab flooring was also carried out by hand.

Each cottage faces north-south, in keeping with good passive solar design. Verandahs surround the cottages, providing shade during summer and extending the roof area for maximum rain water catchment. Collected tank water is pumped to a 300 litre header tank in the ceiling, which gravity feeds water to the kitchen, bathroom and shower. The Curtis' have found that this low-pressure system results in large water savings. For example, the shower uses only about three litres of water per minute, which is as good a saving, if not better, than installing an economiser shower head on mains pressure.

The cottages have their own kitchens with gas-powered stoves and fridges. Heat can be provided by slow combustion wood heaters. A 75 watt BP Solar solar panel and 120 amp/hour battery powers each cabin for lights and the water pump. The pumps run directly off 12 volts and lighting is provided by six 12 volt quartz halogens. The average cost for this simple power system is $1,200 per cottage. The Curtis' have found that there is always enough power available, as long as guests turn off the lights when they no longer need them. The batteries have been replaced once in the six years of operation.

In keeping with the philosophy of living close to the land, there are no televisions, radios, telephones or power points in the cottages. Guests are encouraged to spend their time relating to nature, and the cottages are very popular with people who enjoy bush walking, bird watching and just getting away from it all. The Blue Mountain National Park has the most well developed network of walking tracks in the world, and the garden festivals in spring and autumn are also very popular attractions for guests. For those who do not like to cook for themselves, there are local restaurants within a gentle twenty minute walk.

The extended Curtis family live on the property and power their two residences with ten 75 watt BP Solar solar panels, battery bank and a 1.5 kilowatt inverter. When the Curtis' first moved to the property they were quoted a cost of $40,000 to have mains power travel less than a kilometre to their site. The retail price for their solar system was $25,000 and the NSW government's remote area power system rebate scheme refunded them 50 percent of that price. In over six years they have never had a system failure, whereas the local electicity grid goes down four to five times a year. The Curtis' are also delighted not to have to pay monthly electricity bills.

–Libby Anthony

CONTACT

Bungaree Earth Cottages, Wentworth Falls, NSW. Call Paul or Joanne at Bungaree on (047) 573 096.

BOOKING DETAILS:

Weekend bookings usually need to be made a couple of months in advance.

Cabins cost from $75 per night for two adults.

The Bungaree Cottages in the Blue Mountains use mudbricks for thermal mass and solar panels for electricity generation.

Wind power in New Zealand

New Zealand's first commercial wind farm began generating earlier this year, and as CATHY SHEEHAN explains, the plans for the next one are already approved

A new era of power generation for New Zealand dawned in May this year, when the current began to flow from Wairarapa Electricity's first wind turbine generator at Haunui wind farm, southeast of Martinborough on the North Island.

The first of the towers was erected on 4 May. A crane lifted the generator and nacelle (hub and blades) into place.

The seven wind turbines at Hau Nui are all operating, less than 12 months after the company gained final government approval, and produce enough electricity for 500 homes each day (the current output would average 13 gigawatts a year). Wairarapa Electricity hopes to increase its capacity to 1500 homes a day next June. The farm experienced a poor month for wind initially, but the two following months were better than expected, so the average power generation is living up to expectations.

The speed of wind

The time from erecting the turbines to commissioning and generation was considerably shorter than the time to construct a hydro power scheme or gas-burning station, and has caused little disruption to the sheep grazing nearby. Wairarapa Electricity's distribution manager, Jeff Kendrew, said the project had strong support from local people. He said it would contribute to the reduction of New Zealand's CO_2 emission levels.

No new transmission lines have been needed, but existing ones have been upgraded. The total cost of the project

Hoisting a blade assembly on to its tower at the Haunui wind farm.

is NZ$8-$9 million (AUD$7-$8 million), with NZ$2.7 million (AUD$2.3 million) spent in New Zealand.

A visitor information display is under construction 500 metres from the first turbine. It will provide clear views of the wind farm and information about the project including actual output, wind speed and wind direction. The opportunity to see a real wind farm will help people assess their effects and make better-informed submissions on proposals for other wind farms.

Wind farm number two

New Zealand's second wind farm is likely to be Tararua Wind Power's planned 137-turbine project above Aokautere, 11 km east of Palmerston North (also on the North Island). Tararua Wind Power is a joint venture between electricity supply company CentralPower and American windpower giant Merrill International.

Bids have recently been called for the first 30MW of a potential 65MW capability for the site, and Tararua has shortlisted two suppliers, Zond Corporation of America and Vestas Danish Wind Technology.

There are several incentives for companies to buy electricity from the farm. Part of the scheme will allow companies to take out long-term electricity supply contracts to gain price certainty over a long period. The contracts will also allow companies to obtain confidential commercial and technical details about the wind farm – particularly useful for companies interested in future wind investment. Contract holders would have the right to promote themselves as supporters of the project.

A study by the National Institute of Water and Atmospheric Research (NIWA) has shown conditions are world-class, with a wind-run resulting in speeds of 12 metres per second (43 km/h). The completed 137-turbine windfarm could supply half of CentralPower's 60,000 domestic customers. It will cost $50 million (AUD $42 million) and will include an operations building, switchyard, transformers, anemometer towers, a substation, access roads and power lines.

Tararua Wind Power plans to build the first stage – 60-70 turbines, enough to supply 30MW, or 25% of CentralPower's requirements – when a certain rate of return is able to be achieved. CentralPower managing director Derrick Walker says it is waiting to see how the wholesale electricity market develops before making a move. 'The start date depends on a number of issues, including equipment prices, and electricity pricing evolving out of changes to the market—how transmission cost impacts on our avoided costs. The trigger hurdle is the rate of return at which the project will go ahead.'

In the meantime, requests for proposals to supply the equipment were to be issued internationally by the end of May. Walker estimates the tendering process will take another two or three months. The resource consent stays operative for six years; if the wind farm is not built by then, another consent must be applied for.

The consent was granted in spite of opposition by TransPower NZ, Tranz Rail, the Airways Corporation and Telecom. Telecom was concerned the towers and turbines would interfere with telecommunications signals. Tararua Wind Power agreed to several conditions which would address objectors' concerns. The wind towers will be at least 200 metres from any communications towers. Enough separation will be allowed to leave a corridor for microwave signals to pass through. To comply with airways requirements, four turbines on the plan had to be lowered and relocated.

Reprinted with permission from *Energy-Wise News*, a publication of the New Zealand Energy Efficiency and Conservation Authority.

HAUNUI WIND FARM SPECS:

- The 44-metre rolled steel towers were made by a New Zealand firm, Acme Engineering (based in Petone on nearby Wellington Harbour), and were erected in two sections.
- The blades are fibreglass-reinforced epoxy, each weighing 850 kg. They rotate clockwise.
- The gearless ring generators are designed with as few moving parts as possible.
- The German-made E-40 Enercon generators and nacelles (hub plus three 20-metre blades) were assembled on the ground, then hoisted by crane and fastened to the top of the towers.
- The variable-speed operation allows the machines to automatically adjust to changes in wind speed, for maximum efficiency.
- Pitch control systems on each blade allow them to be independently adjusted to allow for different wind conditions. (Pitch control means changing the angle of the individual blades).
- Yaw control is active, through adjustment gears damped through friction bearings. (Yaw control changes the direction of the entire wind generator head).
- The variable operation and pitch control combine to reduce stress on the generator-rotor unit, tower and foundation.
- The machines are nearly one and a half times taller than the generator in Brooklyn, Wellington, and produce nearly twice as much power. They are twice the height of the Breamlea generator in Victoria.
- They generate electricity when wind speeds are between 10 km/hour and 120 km/hour (10 metres per second equals 19 knots, or 36 kilometers per hour).

Green Computing

MICHAEL GUNTER explains some simple ways to reduce computer power consumption by up to 70 percent

Offices, homes, schools... the number of computers and uses for them is increasing all the time. Multimedia and the Internet are enticing us into cyberspace in ever increasing numbers, to the extent that for many jobs we can potentially stay off the physical roads and commute via a modem. This probably reduces our rate of energy usage by a factor of about 20: sitting at a computer needing 100-200 watts of electricity, compared with probably 10-20 kilowatts (in the form of petrol combustion) for driving a car for a couple of hours a day.

With the rapid obsolescence of just about all computer hardware, coupled with the expendable nature of certain parts, such as the highly polluting rechargeable batteries in laptops, computers too have a significant environmental cost.

Increasing complexity of operating systems such as Windows 95 means that turning off the computer for brief periods to save power can become a tedious business, so how can we best reduce power consumption and extend the life of expendable components during those inevitable idle periods experienced by most computers?

There are some fairly simple things that computer users, whether in business, school or home settings can do to reduce the environmental cost of computing. *ReNew* recently tested a fairly typical multimedia computer for power consumption, and found that energy savings of up to 70 percent (during idle computer time) are readily achievable.

The graph below shows test results (a kilowatt/hour meter was attached across the power input) for five different modes of operation of the one computer/monitor setup.

Normal operation

Normal operation of a Pentium 90 multimedia computer and 14" monitor, whether being fully utilised or left unattended for extended periods, uses 125 watts x 8 hrs/day x 250 working days/yr = 250 kWh (or $30-$45 worth of electricity) each year–probably cheaper than the replacement cost of batteries in a portable computer!

Screen saver active

The graph shows that 'screen savers' do nothing to reduce the power consumption of the monitor or computer, although they will probably extend the life of the display screen (if most of the screen is black, most of the time).

Energy Star

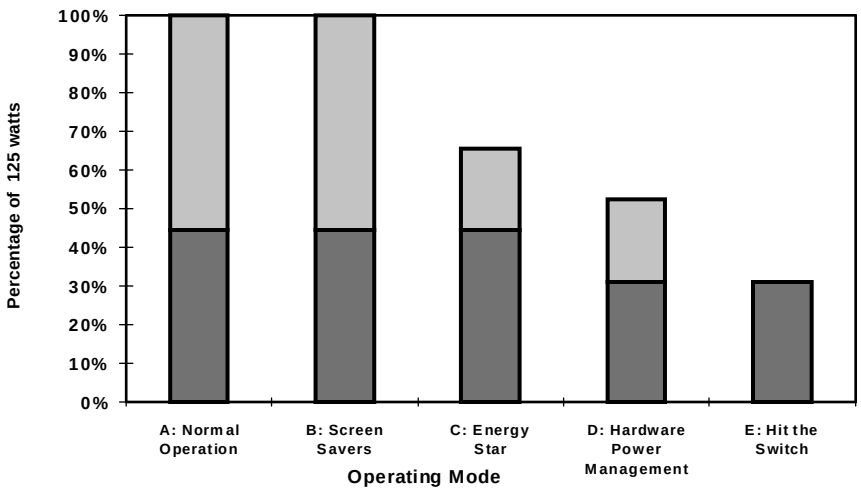
Modern operating systems such as Windows 95 can switch 'Energy Star' monitors to standby mode (and with some monitors, completely off) after a pre-set time of inactivity of the mouse and keyboard. Around a 30 percent energy saving is achieved during standby. Our monitor would not switch off when Windows 95 told it to do so, but it did still go into standby mode.

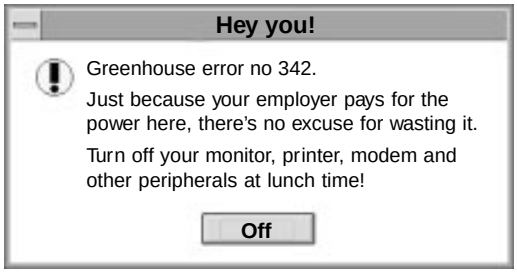
Hardware power reduced

Many modern computer motherboards contain sophisticated built-in setup programs in their memory chips (ROM BIOS). If you press the 'delete' key during the memory-test phase (about 3-5 seconds after turning on the computer), a menu screen will appear with various options for configuring the computer. If you are lucky, one of the options will be 'power management', or words to that effect. Highlight it with the arrow keys and press 'enter'.

Hey presto, another menu appears: one option allows you to change 'Power management: Disable' to 'Power management: Enable'. When our computer was configured this way, and re-

Test results for pc in different modes of operation





started, it saved only a modest 15 watts after going into shutdown mode. Most of this saving appears to come from reduced power to the hard disc (which stops spinning) and the CPU.

In a business environment, especially a network, be sure to check with the boss or computer system administrator before enabling this function. Technically speaking, if other users in a network are trying to access files on your hard disk, the 'wake up' signal (IRQ) from your network card must be configured to restore your computer to full operation.

Monitor switched off

Hit the switch! This is by far the simplest and single most effective way to save computing energy. All it needs is for you to *develop a routine of turning off the the monitor's power switch* every time you move away from the computer. Even without any other measures implemented, it typically saves more than 50 percent of the system's operating power (70 watts out of a total of 125 watts in our case). Switching off the monitor does not affect open files or programs–it simply means you can't see them.

When combined with hardware power management in the computer itself, a substantial 85 watts is saved. Our monitor was a 'plain vanilla' 14 inch SVGA model with fairly low screen resolution. Bigger screens with a very fine dot pattern use even more power, so 'hitting the switch' saves even more power. There is a power surge when monitors are turned on again, but this is equivalent to only 10 seconds of normal operation. Please note that the graph actually shows the effect of turning off the monitor, *combined with* hardware power management in the computer.

Check out your operating system, and see if it has the ability to send your monitor into hibernation. Just to be confusing, Windows 95 hides this function at the bottom of the 'Screen Saver' tab under the 'Display' configuring option of 'Control Panel'. Alternatively, display driver software often has a utility (for example, 'DPMS' for Trident cards) for Energy Star operation.

If tweaking computer settings is not your scene, then the 'hit the switch' option is for you: it results in even greater power savings and all that's required is a little self-discipline. Just remember when you return to your desk that the computer is still running: *don't accidentally push the computer's power switch, when you really meant to push the monitor's power switch!* This could result in the loss of whatever work you were doing. Maybe an adhesive reminder sticker on the computer's power switch would be a good idea initially.

A note to Macintosh users: no, we haven't forgotten you. For users of older Macs, turning off the monitor will be just as effective as for IBM compatibles. For users of newer Macs, the convoluted process outlined for configuring power saving in Windows '95 will no doubt leave you feeling superior–power saving on Power Macs is configured simply by selecting 'sleep' mode and an onset period in minutes in the power saving control panel.

RUNNING A COMPUTER ON A RENEWABLE ENERGY SYSTEM

The average computer user these days will use their home pc for word processing, playing games, accounting and surfing the internet. For most of these applications, a large, high resolution monitor is not essential, so there is potential for enormous energy savings. A laptop computer with a liquid crystal display (LCD) monitor is designed to be energy efficient, as it has to run for extended periods on a compact battery. These displays are also available in colour, and the prices are now comparable with conventional desktop computers (IBM compatible laptops with 8mb ram and 850mb hard disc are now commonly available for less than $2000.

Laptops are particularly useful for use in renewable energy systems that uses DC to run household appliances, as they can often run directly from a filtered 12V DC power source. LCD monitors also emit much less electromagnetic radiation than conventional monitors, making them much better for users' health.

A sustainable sea change

The worldwide energy market is poised to go alternative

Photo courtesy of CADDET Centre for Renewable Energy

A 1 megawatt wind turbine at Avedøre Holme, south of Copenhagen, Denmark.

by KARL FRANKEL

A sea change is set to sweep through the worldwide energy market. An unprecedented wave of technical, demographic and infrastructural developments is opening up vast vistas of opportunity for sustainable energy alternatives (SEAs), such as wind power, solar power and fuel cells. There are four basic reasons for this marked turnaround:

Population

An estimated two billion people world wide currently have no power whatsoever and another one billion have access for only a few hours a day. In addition to testifying to the immense gap between rich and poor, these sobering figures also reflect the staggering size of the worldwide energy market. Consultants Arthur D. Little estimate that over the next ten years developing countries will spend over US$700 billion on electricity supply and transmission infrastructures. While energy forecasts are notoriously unreliable, ADL's number does give a rough sense of the market's extraordinary potential.

Technology

Steady progress has been made in reducing the cost of SEAs, so much so that in some situations they are now directly competitive with conventional resources. In addition, energy technologies are undergoing the same process of miniaturisation and modularisation that information technologies have been going through for the past several decades.

Just as computing power has migrated from the mainframe to the PC, so are energy technologies becoming smaller and more suited for local usage. Experts agree that the energy architecture of the future will be modular, with utilities managing a portfolio of technologies that includes SEAs, and large numbers of consumers opting to stay entirely off the central grid.

Competition

Policy-makers in developing countries are coming to the rather obvious conclusion that a clunky, bureaucratic, underfunded monopoly is probably not the best way to bring electricity to the masses. In the United States, a similar recognition—namely, that market forces cut costs and improve services—underlies the move toward market restructuring.

Environment

With consensus emerging among scientists that global climate change is not so much a threat as a certainty, it is becoming increasingly difficult to defend 'business as usual' as a feasible option. We cannot continue to rely on burning carbon as our prime fuel source.

The convergence of these trends has opened up dramatic opportunities for SEA's. The key beneficiaries are outlined below:

Wind power

One of the most obvious candidates. In 1995 global installed wind capacity grew to more than 5,000 megawatts (MW), representing a 1,300 MW increase over 1994. Equipment sales soared above the $1 billion level.

Driving this spectacular upturn have been sharp improvements in price and performance. In the United States the cost of wind power is down to 4.2 cents/kWh (kilowatt-hour), making it cost-competitive with traditional energy sources, while improvements in blade design, power conditioning equipment and system electronics have made the technology much more efficient and reliable than hitherto.

Almost all the growth has come from outside the United States. Germany and India accounted for almost two-thirds of all new wind power installations in 1995—nearly 900 MW—with India increasing its capacity by over 200 percent. Nor were these countries alone in embracing wind power: Spain doubled its installed capacity, Holland's grew by 69 percent and China's by 23 percent. Meanwhile in the United States, which only a decade ago was the world's foremost consumer of wind power, potential buyers were snoozing in the breeze—the country added only 41 MW of wind capacity, a paltry 2.4 percent growth rate. This may, however, be only a blip in an exponential curve.

Sun power

The market for solar power is also thriving. In recent months, U.S. manufacturers have announced plans to build seven plants, and industry insiders suggest another three will be announced by the year's end. Several of the new facilities will be located overseas, with 70 to 80 percent of the total output to go to developing countries.

In areas without power transmission lines or electricity grids, solar power could play a key role. 'Many of these countries simply won't run wires,' says Scott Sklar, executive director of the Washington, D.C. based Solar Energy Industries Association, 'and this opens the door to solar and other renewable technologies.' By way of example, Sklar points to Thailand, which recently invested $8 billion in a phone system that will be mostly cellular—and driven in large measure by photovoltaics. Further confirmation comes from Kenya and Brazil, where of late more homes have been electrified via photovoltaics than through the extension of the grid.

In countries ranging from South Africa to Vietnam, national governments are actively supporting solar electrification. The non-U.S. market for solar technology has been growing at 30 percent annually for the past three years and the pace is expected to continue through the end of the decade.

Interest in solar is not limited to developing countries. Over 1,000 buildings in Switzerland and Germany have been solarised under government-funded programs, while Japan, ever ready to take a good idea one step further, plan to install some 62,000 solar generators in buildings by the turn of the century. Even in the United States, where utilities for the most part have been shy about investing in SEAs, solar is starting to make headway as one of several renewable options within a portfolio of modular technologies.

Cell power

Fuel cells are another SEA with exciting market potential. This remarkable technology, which was first used in the 1960s to provide electricity for orbit-

Photo courtesy of CADDET Centre for Renewable Energy

The growth of solar power is following a path foreseen by few: developing countries are turning to photovoltaics to provide energy to areas without power transmission lines or electricity grids. Thailand's new phone system, for example, will be mostly cellular and driven largely by photovoltaics.

Alternative alternatives...

Wind power, solar power and fuel cells are not the only SEAs with considerable market potential. Biomass, co-generation and energy-from-waste also merit mention.

Biomass

Biomass is essentially a form of stored solar energy in that it uses organic materials as a fuel feed stock. It is not a new technology: the forest products and agriculture industries have long burned biomass residues to generate process steam and electricity, and wood is the prime fuel for most of the worlds rural poor—often with devastating environmental consequences.

Over time, however, biomass will move beyond waste and wood as farmers increasingly grow crops specifically for their energy content. The usual SEA problem also dogs biofuels, however—that of making them cost-competitive There are also the normal environmental question marks over any intensive agriculture.

Photo courtesy of CADDET Centre for Renewable Energy

In energy farming, a two-to-three year cycle will yield up to 25 dry tonnes of timber per hectare per year. Burning chips create steam to run turbines. Energy-crop heat and power systems work well for midsize housing developments.

Energy from waste

Generating power from incineration of general wastes is thriving in Europe against a background of regulatory curbs on landfilling. This is creating momentum for an integrated waste management strategy that includes the usual suspects—reduce, reuse, recycle—and also the conversion of waste into energy. An analysis by the technical consultancy Juniper Research indicated that the amount of waste burned from energy would grow from 33 million tonnes in 1993 to 83 million tonnes by the year 2000.

But there are pressing health and environmental concerns. State-of-the-art incinerators reduce dioxin emissions to an extremely low level, which may or may not be reassuring, since even low level concentrations may be strongly carcinogenic. Willy Van Belle, scientific adviser to the European Energy-from-Waste Coalition, claims that in addition, incinerators can actually reduce background depositions of dioxins by concentrating them in post-burn fly ash—by 'non-dispersing' them, as it were. Van Belle also argues that incinerators do not contribute to global warming. Although they do emit carbon dioxide into the atmosphere, Van Belle contends that this process is net-neutral because any related CO_2 would have been emitted anyway as part of the natural putrefaction process. Others remain unconvinced, and many environmentalists are at best lukewarm towards energy-from-waste. Most electricity is generated by a thermodynamic steam process that generates excess heat which is released into the environment.

Cogeneration

Cogeneration takes that excess heat and makes use of it by applying it to industrial processes or by heating buildings or entire districts. The potential savings are enormous: whereas the United States has an overall energy efficiency in the 40 to 45 percent range, Finland's is almost 80 percent, thanks largely to cogeneration. The potential market impact is enormous, too. According to Worldwatch Institute's Chris Flavin, 'Most of the new generating capacity installed in Europe in the last five years consists of relatively small cogeneration systems. Only wind power is growing as rapidly.'

ing U.S. spacecraft, generates power through an electrochemical process rather than combustion. It is reliable, flexible in terms of its fuel sources, and virtually pollution-free—at least in terms of output.

So why doesn't everyone have one? The answer, in a (predictable) word: price. The technology is in a relatively early stage of the commercialisation process—it was only in late 1995 that ONSI Corporation launched the world's first commercial fuel cell factory—and it is still rather expensive.

Obstacles to market penetration are improbably few. Once prices decline, the sky appears to be the limit, with potential application areas including small-scale power plants, battery alternatives and also the great white whale of the energy world—transportation. The spade work is already well underway, with Ballard Power Systems of Canada among the companies that are developing fuel cell engines for mass transit.

Developing countries are without question the primary market for SEAs, a fact that raises a thorny question for equipment vendors: how to bridge the gap between skyrocketing demand and the developing countries' empty coffers?

Through the world's bilateral and multilateral financing institutions, that's how, and indeed a noteworthy beginning has been made. Two key routes are emerging: the Global Environment Facility (GEF) and the World Bank's own Solar Initiative, which is supporting wind, solar and other SEA projects in countries ranging from Argentina to Sri Lanka. The Asian Development Bank is also starting to back SEAs, so, on the surface at least, the trend is headed in the right direction. But more, much more, is required.

Future demand

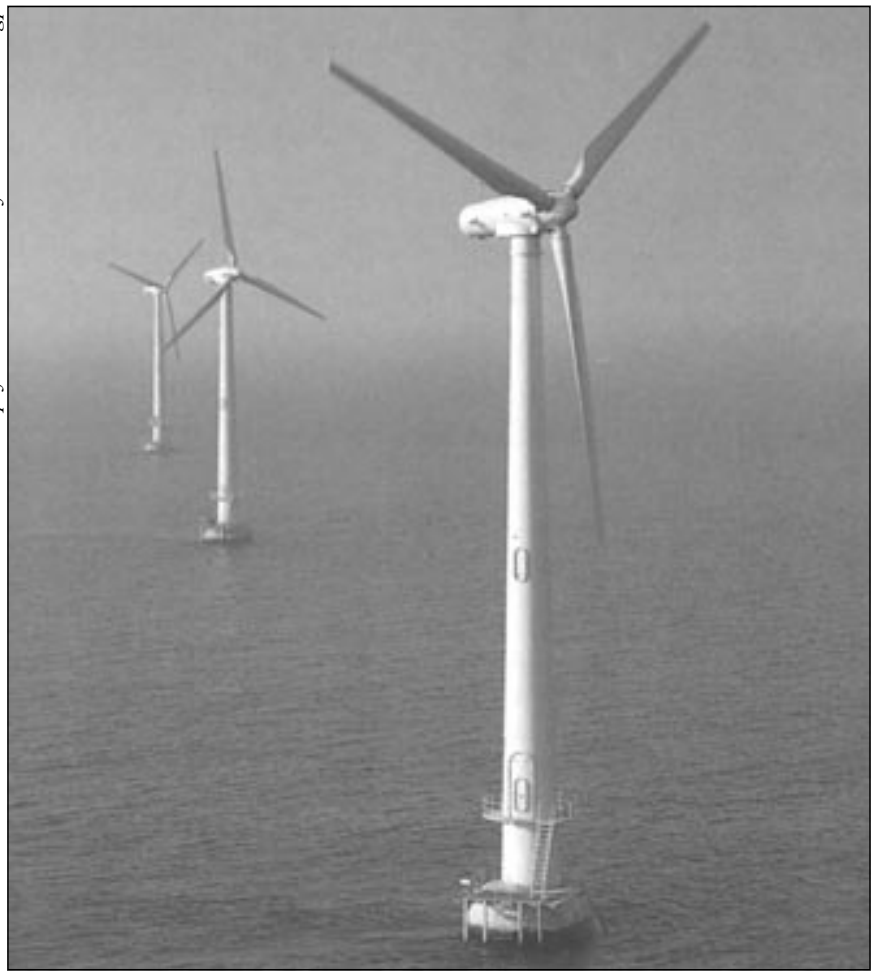
Asia could account for 35 percent of the world's total energy demand by 2015, with China's energy demands in particular rising sharply, according to reports by the U.S. Department of Energy and the international consulting firm, DRI/McGraw Hill.

While that growth may increase world oil consumption from its 1995 level of 66 million barrels a day to 100 billion barrels a day in 2015, natural gas use is expected to increase faster than any other fossil fuel.

The U.S. DOE's annual *International Energy Outlook* predicts world energy use will jump 60 percent by 2015, with China and India leading the way. Asian demand alone will expand by 150 percent between 1993 and 2015, according to the DOE.

—Greenwire

Photo courtesy of CADDET Centre for Renewable Energy



This offshore wind farm near Vindeby, Denmark, demonstrates the kind of innovation and development that renewable energy technologies require to compete with fossil fuel power generation. The windfarm is the first of its kind, and produces more power than it would have if it was located onshore.

And then there is the matter of securing payment. FloWind, a California-based manufacturer of wind turbines, has orders from India for over 400 machines. One tiny problem, though:

'In India,' reports Bob Lynette, FloWind's chief operating officer, 'there are no sovereign guarantees.' Which means that if a customer declines to pay, FloWind will have no legal recourse and be left to twist slowly, slowly in the wind.

For the foreseeable future, though, developing countries will see some of the strongest growth.

Energy analysts anticipate that eventually this focus will pry open the recalcitrant U.S. market. Economies of scale are critical to reducing manufacturing costs, and as more and more product is sold into developing countries, the price of SEAs in the United States will decline to a point were they become price-competitive with non-renewables. 'The technologies will be nurtured in developing countries and then brought back into the industrialised ones,' predicts Keith Kozloff, a senior associate in the World Resource Institute's Climate, Energy and Pollution Program.

So where's big business? The mainstream energy services industry is approaching the heady SEA markets with a mixture of terror and fascination. Utilities have their hands full trying to cope with restructuring; they are also heavily invested, both psychologically and financially, in non-renewables. As a result, most of them are cautious to the point of paralysis. Still, with the spectre of modularity looming, even these behemoths are turning their attention, albeit reluctantly, to renewables.

Meanwhile, a smattering of major corporations is boldly moving forward with new ventures. In the United States, EnergyWorks is a joint venture between Bechtel Group, the largest engineering and construction company in the United States, and Pacific Corp Holdings, the unregulated arm of the Oregon-based utility. Bechtel was the driving force behind the joint venture. 'The company realised that the energy markets are changing,' explains Pat DeLaquil, EnergyWorks' director of technology, 'and that modularity doesn't offer the same engineering and construction opportunities as the traditional market. Bechtel decided it wanted to be a player in the new energy market.'

EnergyWorks' goal is to give SEA applications the sort of leverage and credibility that will earn them the respect and financial support of Wall Street. 'One of our managers put it this way,' says DeLaquil: '"We need to take the confrontation between the greens and the greenbacks, and make a marriage out of it."' To that end, the company is supporting small-scale (50 MW or under) SEA projects in developing countries (India, Indonesia and Brazil for starters), with a focus on three general application areas: grid-connected projects, industrial power (including cogeneration—see sidebar, 'Alternative Alternatives') and rural electrification.

Amoco Corporation and Enron Corp have also joined forces under the SEA banner. Their Amoco/Enron Solar Power Development joint venture has set its sights high: it aims to bring enough manufacturing capacity on-line to make photovoltaics truly cost-com-

petitive with conventional resources for grid-connected applications in those many locations where sunshine is plentiful and there is no ready access to fossil fuels.

Christopher Flavin, vice president for research at the Worldwatch institute, believes that 'during the next few decades new technologies will allow today's giant power plants and refineries to be replaced by a new generation of small, decentralised energy systems, just as personal computers replaced mainframes.' In his view, this will eventually allow oil to be replaced by hydrogen produced from solar and wind energy using electrolysis. Hydrogen would be turned back into electricity and heat by fuel cells located inside homes and factories.

Can anything derail SEAs? Probably not—too many forces are working in their favour. But two critical issues will have a powerful effect on how fast SEAs are adopted. The first is costs—not only of sustainable energy technologies, which of course must continue to decline, but of their non-renewable rivals as well. As long as the cost of fossil fuels remains low, SEAs will be up against an imposing barrier to entry.

The second critical issue involves institutional backing, or rather the lack thereof. SEAs need public-sector R&D support, and while the U.S., Department of Energy's National Renewable Energy Laboratory has made important contributions to the state-of-the-science, its funding is chronically at risk. Money is tighter than ever as the laboratory stares down the barrel of a conservative-dominated congress. Similar reluctance is evident in Europe.

In addition, more financing support from international funding organisations is required to help the market in developing countries reach its potential. While the World Bank and other institutions have made a beginning, a much more concentrated effort is needed.

Finally, national and local governments must give SEAs a boost in the competition against non-renewables. California, as ever a leader in matters environmental, is considering adopting a 'renewables portfolio standard' that would require renewables to meet or exceed a fixed percentage of the overall energy mix, and then ratchet up that minimum level over time.

But all this is about timing, not the end result. For SEAs these are sunny days: the imperatives have spoken and the issue is not if, but when. ✲

Reprinted from *Tomorrow: Global Environment Business*, July–August 1996.
For more information, contact:
Tomorrow Publishing AB,
Hälsingegatan 9
SE-113 23 Stockholm, Sweden.
Email: 100126.3133@compuserve.com

Solar water heater buyer's guide

Solar hot water expert ROSS HORMAN explains what you get for your money.

That's a lot of hot water! These solar water heaters provide the hot water for half of this shower block in the Grampians.

Our last review of solar hot water was in Spring 1993. Since then there have been a few changes in ownership of brands, some changes in prices and also a few changes in the range of models. One thing that has not changed though, is the price of sunshine.

For the uninitiated, a solar hot water system usually consists of a hot water storage tank connected via pipework to solar collector panels. These collector panels should be placed on a north facing roof and at an angle of no less than 15° to the horizontal. The tank can either be situated immediately above the panels on the roof, above and a small distance away from the panels within the roof cavity, or at ground level, in which case a pump is required to circulate water through the panels.

How does it work?

A solar water heater collector panel consists of a collector plate to which a network of pipes is bonded. This arrangement is then placed in a metal box with insulation behind it and a glass cover on the top.

As the sun shines on the panel the water in the pipes becomes hot due to conduction from the collector plate. This heated water rises through the panel and out through a pipe to the insulated storage tank. Cooler water from the bottom of the storage tank enters the panel at the bottom to replace the warmer water.

This is called the thermo-syphon process and requires no pumps or other electro-mechanical devices. Simple and very effective. It does however require that the storage tank be situated above the collector panels.

From this we can see that the collector panel is the driving force for the circulation and so due care must be taken with its mounting and orientation if we are to get maximum benefit from it.

Where the tank cannot be located above the collectors, a pump and a differential temperature controller must be used to provide water circulation. The controller also turns the pump on when the temperature drops to 5°C as an anti-freeze function.

Collectors

The collector plate is usually copper or aluminium, however Solahart use mild steel for most of their models. This plate is coated with special treatments to increase the absorption of the solar heat energy. These are a big improvement on plain matt black paint.

Bonded to this plate are copper pipes, or, in the case of the Solahart, steel collectors formed into many small bore channels. In all cases these pipes or channels are connected top and bottom to header pipes which also provide the connection points to the external pipework.

Most manufacturers are now using low-iron tempered glass in their collectors for its greater absorbency and reduced re-radiation. It is also stronger than normal glass.

Beasley, Rheem, Solahart, Aquaheat and Edwards make their own panels while Sunbather and Sundowner only make collectors and supply tank manufacturers.

Tanks

For mains pressure systems the tank must be strong enough to hold pressures of 1000kPa and above. This means they must be made of steel. Some companies (Beasley & Edwards) use marine-grade 316 stainless steel while others use mild steel with a coating of vitreous enamel ('glass').

Solahart, Rheem and Quantum use glass-lined tanks.

Glass-lined tanks have a sacrificial anode fitted which is designed to be eaten away by galvanic (read corrosive) action in preference to the tank material. These anodes should be checked at regular intervals to assess wear and be replaced if required. With good-quality water this replacement time may be every five to seven years. If the water quality is poor then the replacement time will be much shorter. Failure to replace the anode when required will generally result in premature failure of the tank.

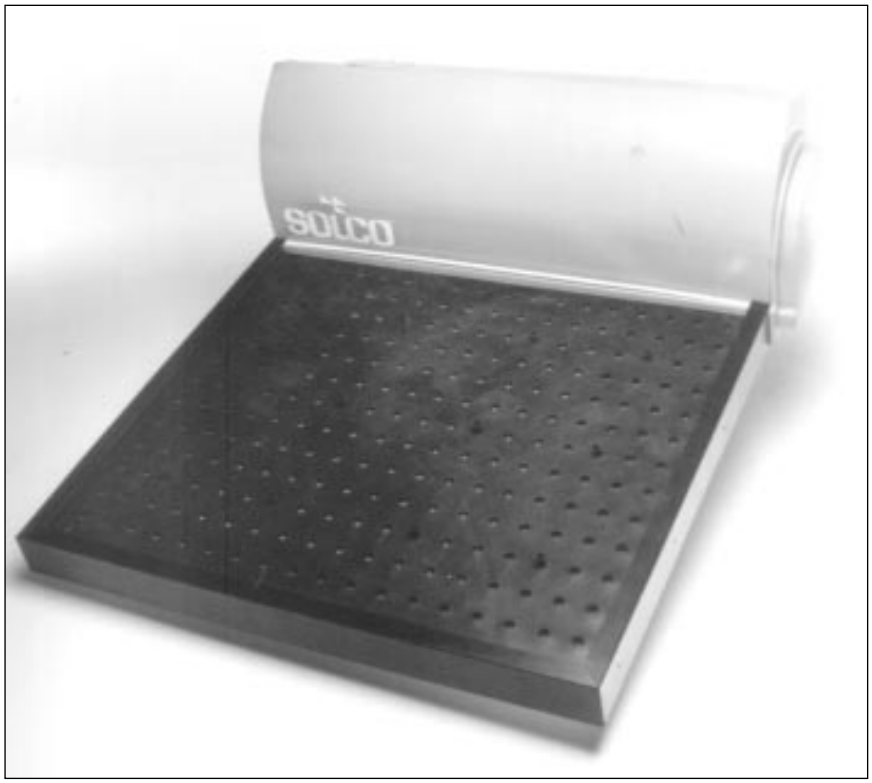
Insulation

Mains-pressure tanks are insulated with polyurethane foam. The normal industry standard foam is CFC free. Some manufacturers build the horizontal tank such that the insulation on the top is thicker than on the bottom which makes a lot of sense considering the hottest water is at the top of the tank.

Low pressure, gravity feed, constant pressure systems are all very similar and usually use copper tanks. These tanks are placed in the roof and are open vented. This means they can be directly connected to the heat exchanger on a wood stove. They are suitable for most water conditions and give many years of service before failure, usually due to corrosion or failed seams. Copper is very popular with recyclers. Copper tanks are made by Beasley (SA), Aquaheat (SA), Gra-mall (SA), Wilson (Vic), Edson (Vic), Astra (Vic) and JEM Products (QLD). The Sunsaver II is made entirely from plastics by the rotomoulding process. This unit has the tank and collector as the one moulding.

Mains pressure tanks can be set up as gravity feed systems by adding a feed tank. this may be desirable where there is no available roof cavity but the incorporation of a wet back is planned.

An Edwards solar water heater.



Made almost entirely from plastic, the Solco is the cheapest commercial heater on the market (though it is also one of the smallest).

Boosting

All heaters on the market incorporate some form of boosting for times of insufficient insolation (sunshine). People on remote area power supply (RAPS) systems use woodstoves or LPG for boosting. Townsfolk have the option of gas or electricity.

Electric elements are the most common, as they fit in well with night rate tariffs and are much cheaper to fit. Gas burners and control equipment cost around $500 more than an electrical element and this is reflected in the price of the systems. Environmentally, gas is preferable but only one manufacturer, Solahart, offers a system where you can overide the thermostat and prevent the gas burner from igniting while there is sunshine available.

Frost protection

All manufacturers offer frost protection for their systems. This is important for anywhere that a frost may occur. The

Retrofitting existing systems

It is possible to retrofit an existing electric storage hot water system to use solar heat. For a ground level mains pressure system, a special fitting can be installed on the cold water inlet. A pump circulates water from the bottom of the cylinder to the solar collectors. The hot water is injected through a small diameter pipe back into the cylinder and rises (by convection) to the top of the cylinder, where it is drawn off for normal use.

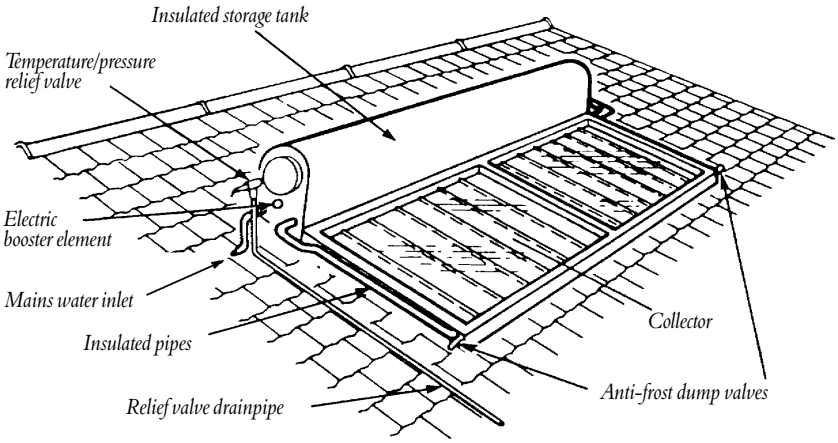
A controller switches the pump on whenever the solar collector(s) are hotter than the water in the bottom of the cylinder, and also in near freezing weather, to prevent the water in the collectors from freezing.

Gravity feed cylinders in the ceiling can have solar collectors connected to them, as long as the cylinder is above the collectors. If there is not a pair of unused connections available on the cylinder, an extra pair can be attached by a competent installer in about two hours. Combustion cookers used for hot water are also attached in this way, but it is not a good idea to connect a combustion cooker and solar collector pipes to the same cylinder outlets.

It is not really advisable to connect solar to gas storage hot water systems because they are designed for the gas to reheat the water as soon as some is used, so the sun can't really contribute any heat. Preheating the water with a solar hot water system before it goes into the gas storage system is a possibility.

most commonly used system involves dump valves which open when the temperature drops to around 4°C. As warmer water from higher in the system passes out through the valve it closes again. This process is repeated until the temperature rises again.

Solahart, and more recently Edwards, offer a system with a heat exchange fluid which flows through the panels and into an outer tank around the main storage tank. The fluid in this outer circuit has an anti-freeze additive and does not require dump valves. However the level of fluid in this circuit must be checked regularly and replaced after an interval as directed by the manufacturer. This fluid is more slippery than water and has been known to slip right out through the panel connectors. Owners should look out for this and replace the seals and fluid before irreparable damage is done to the collector panel.

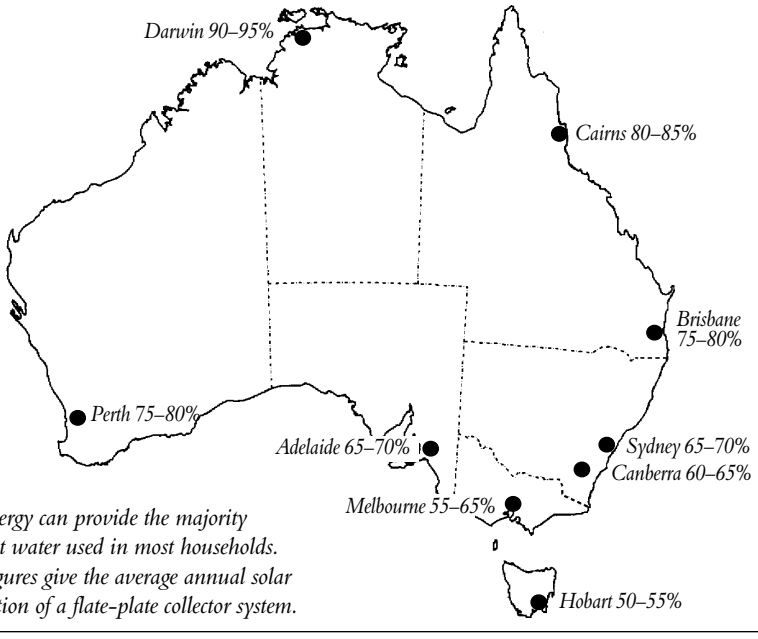


The main components of a typical mains-pressure solar hot water system.

What size will I need?

Systems are usually sized the same way as off-peak electric systems, as they have a similar window of access to the booster, be it the sun or off-peak electricity. The Sun is most effective during the six hours in the middle of the day. Night-rate tariffs commonly run for six hours, from 1am until 7am.

For a one- or two-bedroom house a 180 litre system is recommended. For a three-bedroom house a 300 litre system is desirable. Four to five bedrooms should be served by a 440 litre system. This sizing looks at the potential maxi-



Solar energy can provide the majority of the hot water used in most households. These figures give the average annual solar contribution of a flate-plate collector system.

Make	Model	Capacity (litres)	Pressure	Tank material	Insulating material	Collector area (m^2)	Number of collectors	Material	Glass	Boosting	Made in	Price
Aqua Heat Aust. P/L PO Box 19, Highbury, SA, 5090 Ph:(08)82893666	315SF&R	370	Gravity	Copper	Polystyrene	4	2	Copper	Low Iron	Electricity	SA	1950 inc anti-freeze
Beasley Industries Bolton Ave, Devon Park, SA, 5008 Ph:(08)8340 2299	26S300	300	Mains	Stainless steel	Polyurethane	4	2	Copper	Low Iron	Electricity	SA	2390
	5MSC370	370	Gravity	Copper	Polystyrene	4	2	Copper	Low Iron	Electricity	SA	2197
Edwards Energy Systems 109 Vulcan Rd, Canning Vale, WA, 6155 Ph:(09)455 1999	L305	305	Mains	Stainless steel	Polyurethane	4	2	Copper/ Aluminium	Low Iron	Electricity	WA	2595
Quantum Link Energy Systems 109 Long St, Smithfield, NSW, 2164 Ph:(02)9725 2944	Pacific Split	340	Mains	Vitreous Enamel/Mild Steel	Polyurethane	4.2	3	Aluminium	N/A	Electricity	NSW	
	Eyre	340	Mains	Vitreous Enamel/Mild Steel	Polyurethane	N/A	N/A	N/A	N/A	Electricity		2795
Rheem Southcorp Water Heaters 13 Rachael Cl, Silverwater, NSW, 2128 Ph:(02)9748 5400	52F300	300	Mains	Vitreous Enamel/Mild Steel	Polyurethane	4	2	Copper	Low Iron	Electricity	NSW	2200
Solco ADRO NT 12 Albatross St, Winnellie, NT, 0820 Ph:(08)8984 4332	Sunsaver II	180	Gravity	Polyethylene	Polyurethane	2		Polyethylene	Acrylic	Electricity	NT	1150
Solahart 126 Pilbara St, Welshpool, WA, 6106 Ph:(09)458 6211	302K	300	Mains	Vitreous Enamel/Mild Steel	Polyurethane	4	2	Mild Steel	Low Iron	Electricity	WA	2795
Sunbather Hot Water Systems 2174 Frankston-Flinders Rd, Hastings, Vic, 3915, Ph:(03)5979 2777	—	—	—	—	—	4	2	Copper/ Aluminium	Low Iron		VIC	428 per panel
Sundowner AB&S Solar Industries Cnr Hume & Shafton Sts, Huntingdale, Vic, 3166, Ph:(03)9543 7249	—	—	—	—	—	4	2	Copper	Low Iron		VIC	450 per panel

About the table

There are many different types and sizes of solar hot water systems on the market. For purposes of comparison, our table lists the 300 litre (or nearest equivalent) model, as this is a commonly used size for the average family of two adults and two children. For details on other sizes and products in a particular range, contact the manufacturer directly at the adress listed in the table.

mum number of residents rather than the actual number, as the hot-water service is a fixture in the house but the residency often changes.

What about heat pumps?

A heat pump is a process used in refrigeration where heat is moved, or 'pumped', from one medium into another. Air conditioners and refrigerators are the most common forms of heat pumps. In our refrigerator we pump heat from the food and dump it to the air outside the fridge through the coil at the back.

The Quantum system pumps heat from the air and dumps it into the water storage tank. They are very efficient heaters, having a coefficient of performance (efficiency) of around 300 percent. Unfortunately they need to be operating all the time with a duty cycle of eight to ten hours per day. This means they are not suitable (or acceptable) for off-peak tariffs.

In situations where shading is a big problem for conventional systems, and

drastic tree surgery is not an option, then the Quantum deserves strong consideration.

Temperature control

Under the new plumbing code AS3500.4 it is a requirement that all water heaters connected to an uncontrolled heat source (solar and wood stoves) must have a 'tempering' valve fitted. This valve limits the maximum temperature for hot water to sanitary fixtures (bath, shower and hand basin) to a maximum of 50°C. There are several brands available which are approved for use.

Installation

The installation of any system should be carried out by appropriately qualified and experienced tradespeople. Unfortunately, too many systems have been badly installed in the past, resulting in poor performance and a loss of faith in solar water heating technology by the owners. Solar hot water systems do work, and work well, if properly sized and installed.

Manufacturers can usually supply the name of a competent installer in your area. The Solar Energy Industries Association of Australia (SEIAA) has recently developed a course for installers to provide the necessary training which will enable them to install and service all brands of systems, including fixing any problems that may be encountered. Plumbers interested in doing this course should contact the SEIAA on ph:(03)9866 8977.

How can I get the most out of my solar hot water system?

To optimise the performance of your system, hot water usage should occur in the morning as much as possible. This means showers in the morning and possibly putting on a tub of washing, as well as the dishwasher (if you have one) before going to work. This way the sun has the first go at heating the water before the electric element kicks in around midnight. If the sun has done its job well the electric element may not be required.*

Ross Horman runs his own renewable energy installation business, specialising in solar hot water systems. He can be contacted on ph:(054)28 7676.

Solar panel buyer's guide – an addendum

Due to circumstances beyond our control, we were unable to provide an up-to-date listing for Siemens solar panels in the Solar Panel Buyer's Guide in ReNew #57. The table below contains information on a range of Siemens solar panels for electricity generation and should not be confused with the Solar Hot Water Buyer's Guide above.

Model	Made in	Power (Watts)	Volts	Amps	Cell Type	Construction	Size (mm) (L x W x H)	Warranty (years)	Price
Siemens Solar									
GL148N	Japan	70	23	3.05	monocrystalline	aluminium/ glass	1290 x 430 x 35	Conditional warranty up to 10 years dependant on capacity	Contact Sylvania Lighting on (043)298888 for current prices
GL136N		54	17.4	3.1			977 x 430 x 35		
GL136		53	17.4	3.05			1291 x 329 x 35		
GL133		48.5	15.9	3.05			1218 x 329 x 35		
GL130		43	14.5	2.96			1081 x 329 x 35		
GL234		24	16.2	1.5			510 x 430 x 35		
GL230		22	14.4	1.5			567 x 329 x 35		
GL434		12	16.2	0.75			360 x 330 x 35		
GL634		8.1	16.2	0.5			360 x 235 x 35		
GL833-TF		5.4	15.5	0.35			330 x 195 x 16		
GL418-TF		5.5	8.5	0.65			304 x 245 x 16		
M110	USA	110	17.5, 35	6.3, 3.15			1316 x 660 x 40		
Pro4 JF		75	17	4.4			1200 x 527 x 40		
M55		53	17.4	3.2			1293 x 329 x 40		
M75		48	15.9	3.02			1219 x 329 x 40		
M65		43	14.6	2.95			1083 x 329 x 40		

Model solar boating

MONTY RUSSELL reports on a regatta in miniature

Model solar car and boat building captured the imagination of students, teachers and parents at the Victorian model solar vehicle challenge, held in October at the Scienceworks education centre in Melbourne.

The models are fully solar powered and no battery storage is allowed. The cars race on a 100 meter figure-8 track, following a pair of guide channels, and achieve speeds of over 20 kilometres per hour. The boats race on a straight 10 metre pond following a pair of tightly stretched guide lines. Both events are run as two-at-a-time contests which eventually produce a grand finalist.

The car race is open to all students up to year 12. The boat race is in two parts, with division one open to primary school students with a strong emphasis on the use of recycled materials, and division two open to students up to year nine with most materials allowed.

About 60 boats were entered, all of which exhibited excellent planning, innovation and quality of construction. The boats were required to use the 3 x 0.45 volt, 3 amp solar cells supplied in a starter kit, but the motor and method of propulsion were open. Hulls were made from drink containers, carved out of polystyrene blocks, or fabricated from plastic, metal or balsawood sheets.

The Challenge is an exciting annual event, and a great way for students to experience science, planning, energy efficiency, design and construction, teamwork and problem solving, to name a few.

It was great to feel the enthusiasm and sense of achievement of the competitors. The young people who competed so successfully in these events will be the ones who will take the development of the solar industry well into next century. It was particularly heartening to see that the primary division of the boat race was won by an all-girl team. The 'Green Machine' team from Fitzroy Primary School even went on to beat the secondary school entry in a final showdown.

The Victorian Model Solar Vehicle Challenge will be on again next October. Information kits are available from: Dept. of Mechanical Engineering, Monash University, Box 197, Caulfield East 3145. Phone (03) 9903 2156. Similar events are held in other states. Information should be available from school science departments.

BUILDING A BETTER BOAT

- A smooth hull with clean entry and exit lines is more energy efficient than one which produces a big wake or a lot of turbulence. A high profile can result in wind interference, and may indicate unnecessary weight.
- The motor should be carefully matched to the solar cell output, and tested over a range of sun brightness.
- An easily changeable propeller will enable a smaller or flatter pitched one to be used on a dull day when a large one would overload the motor and not thrust efficiently.
- Drive shafts should be secure and accurately aligned, and couplings not introduce unnecessary friction.
- Electrical connections should be neat and well protected, and all components well fastened down.
- Careful observation of real boats in action can teach a lot.

Tension at the starting line.

Honda's *dream* run

ELIZABETH WALTON follows the World Solar Challenge from Darwin to Adelaide

The Honda Dream team won the 1996 World Solar Challenge, scraping two hours off their 1993 record. Honda's hard work, dedication and consistent financial investment have guaranteed the Honda Dream's place in the solar vehicle hall of fame.

Honda's formula for success is dependent on number crunching skills, tight team work, and technical know how. Their support crew numbers 50 people, all with dedicated tasks like road repairs, marshalling, calculating, and even catering. Their supply truck carries everything they will need – and all spare parts are labelled, sealed, and numerically filed on board.

By 5 pm each day the Dream team stopped on the side of the road to set up camp. The array would be tilted due east, soaking up every last drop of sunshine before dusk. A crew of six would sit behind the array, brandishing calculators and computers, shouting figures, tightening nuts and bolts right and tweaking wires right up until sunset. Throughout the race, the Dream team downloaded personalised weather reports via Japanese satellites. 'The car will arrive at the media stop at 4.46 pm,' the team manager declared at two o'clock one afternoon. But the car didn't arrive until 4.50 pm. 'Why are you late?', the official observer asked. The Dream had hit an unexpected cloudy patch.

Strategies

Naturally, when clouds obscure the sun, the level of energy extracted from the array is reduced and the car slows down. This is when the car's maximiser comes into action. The maximiser is an instrument which dictates whether the energy coming in from the array should go to the motor or the battery. The teams must predict weather changes ahead and decide whether to tax the batteries, or run flat chat on pure solar power. For all teams this requires a different procedure. For Honda, it's all precision by numbers. The McGill team from Canada also relied heavily on numbers, using computer simulations to plan their strategy. The Japanese Waseda team made lengthy calculations on note pads, relaying instructions to the driver by radio. But for teams such as the Brazilian SunBa, decisions were made according to experience – a combination of gut feeling and an educated guess.

Bad weather

No matter how carefully a team plans their race, nothing can spare them from

The Honda Dream broke the Honda team's previous race record, and averaged almost 90 km/h.

rain. Around the eighth day of the race, teams still in the field began experiencing extremely trying weather conditions. Solar cars are not generally known for innovative windscreen wiper design – or any other water proofing measures! Cars whose shell consisted of delicate materials were now in a very fragile position.

As the rain fell, so did the hopes many teams held of ever reaching the finishing line. Some teams deployed human wiper blades to walk alongside the car. The Mad Dog team from the UK was forced to drill a hole in bottom of the vehicle to stop it filling up with water. Annesley Girls College had a narrow escape when lightening scattered pieces of their trailer up to 25 metres away from the road. Thankfully their car and crew was spared, but the team lost their computer controllers.

Bunyips outback

And what would a race through the Australian desert be without animals? There were near collisions left right and centre. Brumbies, kangaroos, and even goannas all did their bit to create hazardous road conditions. The Mad Dog team collided with their namesake – a mad dog – on their way out of Darwin.

The Schooler from Switzerland finished second, with an average speed of 86 km/h.

The Japanese Crested Ibis team was determined to leave its mark on the race. Not satisfied with merely breaking the world record for their class, two team members were married under the finish line, keeping a promise made during the 1990 World Solar Challenge. The Crested Ibis team arrived in Adelaide on day eight, travelling 3010 km in just 67.51 hours.

Crested Ibis were the only team in the 1996 race using amorphous (unpatterned) cells, which achieve only eight percent efficiency. All other teams used crystalline (grown crystal) cells, ranging between 12 to 23 percent efficiency. The efficiency rate indicates the percentage of sun striking the array which is converted into usable energy.

Next generation

After the race finished in Adelaide, a young electrical engineer from a United States university came into the

Above: Cultural diversity – to the bewilderment of local onlookers, Japanese crew members find an alternative to Champagne for celebrating victory – beer.

Left: Inside the two person cockpit of the Honda Dream.

SUN AND PEDAL POWER

The World Solar Cycle Challenge

This year's solar cars were accompanied by another race – a race of solar assisted cyclists. The World Solar Cycle Challenge was the first open road solar cycle race in the world, and travelled the same route as the cars. It was created after World Solar Challenge Director, Hans Tholstrup, lead a research and development team through a trial run down the track in January 1996, in temperatures soaring up to 49ºC.

The cyclists raced in extreme conditions and they raced to prove something to us all – that we can get ourselves to work without fossil fuels, and without building up a sweat – although in cycling from Darwin to Adelaide these cyclists certainly got down and dirty!

Track temperatures reached up to 60ºC, due to the reflected heat off the road. According to the WSSC medical officer, cyclists would be losing 1 to 2 litres of fluid, or 1 to 2 kg of bodyweight per hour under these conditions. Keeping fluids up for the cyclists is a hazardous job. The support team must drive on the wrong side of the road and pass water to the cyclist, whilst avoiding oncoming traffic.

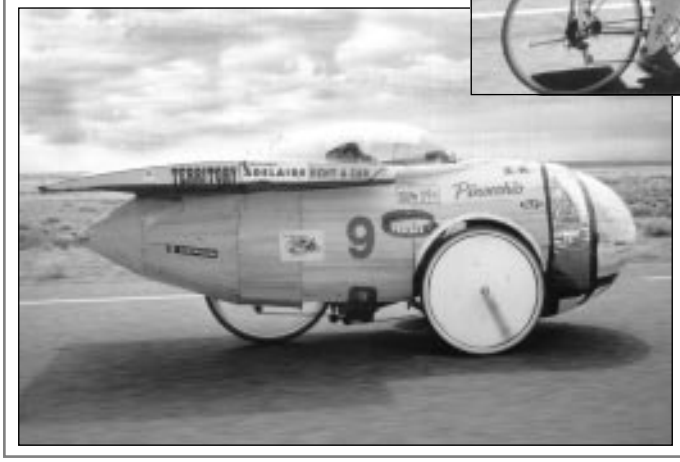
On one day we found the Australian Sunstrike C3 team on the side of the road fixing mechanical problems on their aerodynamic cycle. They'd thrown a chain, and they'd lost power a few times, but they were still averaging an incredible 40 kilometres per hour. On another day we found the Japanese Tennen C16 team, a standard production cycle, stopped on the roadside. The medical officer stopped to check on their health. All was fine with the team. They had interrupted their race to assist two stranded travellers whose (petrol driven) car had broken down!

At night the solar cyclist crews burned the midnight oil, rebuilding their bikes, repairing the damage from the days' cattle grids and pot-holes, and restoring their spirits and sanity in preparation for the next day's torture.

The World Solar Cycle Challenge is a completely separate entity to the Solar Car Challenge. Although entrants cover the same track, the race conditions are altogether different. Solar cars travelled only between 8am and 5pm daily, whereas the cyclists could travel between dawn and dusk. Aerodynamically designed cycles were also restricted to an 8am start. The goal was to reach a set point each day, travelling anywhere between 220-390 kilometres per day. Any cycles failing to reach the night stop were carried in to the control point by their support vehicle.

Both the BPAL Zero to Darwin team and the Aerovironment teams achieved astonishing results in this inaugural race. Had the teams entered the solar car race, they may have achieved placings well within the top half of the field. But as Hans Tholstrup says, the point of the race is not to draw comparisons between two totally different concepts. 'The cyclists raced to prove that solar power and human power produce a great combination... It's an extra 200 watts towards the human 100 watts.'

Sadly, the Solar Cycle Challenge was marred with tragedy, through the death of Wilfred Baler, who died after cycling out of Darwin on the first day of the race. Baler, from Germany, was a close friend and cycling companion of Hans Tholstrup, and will be missed by his family and community.



Bottom left: Pinocchio from Italy was one of the most striking entrants in the Cycle Challenge with its bamboo fairing. Left: Anyone for 3,000 km of desert? This design, with a panel mounted on the pannier rack, was most common among the upright bicycle entrants. Below: Zero to Darwin came finished first in the Cycle Challenge, and averaged 55.9 km/h.

Once the vehicles left the road, the hard work began. Many teams had large, professional crews maintaining their vehicles. The Mitsubishi Materials Corporation team works on some silver zinc batteries, part of a 4.7 kWh storage bank.

event office for some post race advice from World Solar Challenge Director Hans Tholstrup. His burning question for the next generation of solar racers: 'How do you manage a team of volunteers, who owe you absolutely nothing, yet succeed in running a tight ship?'

'It's simple,' Hans replied, 'You run it like a college football team. You must workshop it, brainstorm it, but above all, you must motivate sponsors and universities. Of all the university teams, there is hardly any coordinated support. Rarely even a shed or workspace. There's not one department in a university which isn't crucial to your team.' He listed the faculties – marketing, manufacturing, design, textiles, arts, accounting... 'And', he told his enthusiastic apprentice, 'you currently only represent one per cent of the population. You must stimulate the imagination of the masses in order to receive full sponsorship.'

It's a familiar story in alternative ventures. Attracting sponsors with the vision to back the race is a difficult task, and this time round the race ran without a major sponsor. 'If I bought pizzas and beers for everyone tonight, would that make me a major sponsor?' an official observer jokingly asked. Regardless of who buys the pizzas, it's 'The Yellow Shirts' who are the crucial sponsors of the race – the 105 individuals who came from all over the world to give their time freely to run the race. Without their support, there would be no World Solar Challenge, and no Honda Dream.

Australia's next major solar race is the Adelaide-Melbourne Great Southern International Sunrace, from 24-28 January 1997. The Sunrace is for solar cycles. Ph: (03) 9820 9032 for more information.

A renewable-powered workshop in the suburbs

MARISH MACKOWIAK visits an engineer who uses solar and wind to power much of his workshop.

As with many ReNew readers, Sam Vella decided to put his good ideas into practice. At his small engineering shop in the Melbourne suburb of Brunswick, Sam has installed both solar and wind electricity generation systems.

After being inspired by a visit to the CERES environment education centre near his home in East Brunswick, Sam bought four BP Solar solar panels from Going Solar in North Melbourne.

Although the cost of panels and batteries alone was $3000, Sam says the system is paying off financially. Whilst the lathes used in his workshop require three-phase power from the mains grid, Sam's solar system is able to power all of the lights in his factory, as well as power tools like grinders, circular saws and, of course, the radio!

The home-made wind generator has been slightly less successful. Sam used a 12 volt DC motor as the power generator in this device. Whilst even on a dull day the solar panels will generate 5 amps of current, it has to be a fairly windy day to get 4 or 5 amps from the wind generator.

By contrast, on a sunny day, the solar panels are able to produce 18 to 20 amps. The sun's rays consistently pro-

Sam on the roof of his solar- and wind-powered workshop in East Brunswick.

Sam's system

Four solar panels, each of which can put out 4.7 amps at a nominal 12 volts.

A home-build wind generator also provides up to 5 amps of current

These are connected to a set of deep-cycle, heavy-plate batteries with a capacity of 600 amp-hours.

240 volt AC power is provided by a Jaymac 2000 inverter.

vide Sam with the power he needs, even in winter. Sam recognises that wind would be more appropriate in the country, or in a more exposed, less built-up area.

In setting up his system, Sam was motivated to save money by using a clean, renewable source of energy that was self contained. The system requires little maintenance, except the occasional checking of the battery water levels.

Sam's home-made wind generator produces power using an old DC motor.

His neighbours have expressed interest in the strange machinery perched above Sam's workshop, but so far have not followed his example. It seems it is still easier for many people to simply plug in and switch on power from the mains grid.☼

Sam (SJV Engineering) makes high-carbon-steel components to order. He can be contacted on ph:(03)9383 7888.

Building smart houses

GABRIELLE BAXTER introduces a 'crazy' architect who is travelling NSW, and the world, in search of sustainable housing design

It isn't always easy being 'green', and Nigel Bell should know. As an architect, he's been involved with buildings designed to be ecologically sustainable and environmentally friendly for nearly two decades, and found the going so hard, he has abandoned his practice – temporarily – to try another tack. Under the auspices of an Environmental Education Trust grant to the Master Builders Association of New South Wales, he has undertaken educational work with builders on a program called the Smart, Clean and Green Building.

The term 'Green' is used advisedly however because, as Nigel points out, 'greenie' has been a dirty word on building sites over the years in this country, giving rise to bumper stickers urging 'Mulch a Greenie a Day'. He is also very aware of the different shades of Green, not all of them good, reflecting levels of commitment.

'Grudging Greens, Nurturing Greens – Living Greens!' he says, trying the terms for effect. 'Lip-Service Greens – "Light Greens battle Brown Bombers"!' – adding with a wicked grin: 'I like that!'

Why build smart?

The philosophy behind the 'Smart Building' initiative comes from the idea of everyone taking responsibility for the environment. Eliminating a lot of the bad practice still common on building sites by education of its consequences is a high priority.

'We're selling the message of health,' says Nigel. 'And looking at the ecological, natural and environmental consequences of building. I'm the crazy architect and I'm running these workshops round the State. I say 'Hey! We need to do these things for our health – your health – my health.' OK?'

This self-styled 'crazy' architect is no stranger to controversy, and tackling problems arising out of projects he is committed to in the course of practising his profession. In fact he thrives on it, particularly if he believes it will further the acceptance of the importance of ecologically sustainable design in buildings.

Principle of the firm EcoDesign Architects, he has many such projects to

Nigel Bell in the Conservation Hut at Wentworth Falls. As with all the materials used in the construction, the straw board ceiling panels, held in place by galvanised wire, demonstrate best ecological practice, as the straw is a waste product which would normally have been burnt after grain is harvested. Its soundproofing and thermal regulation qualities are well utilised here.

his credit, among them the Conservation Hut at Wentworth Falls, Jemby-Rinjah Lodge and Conference Centre, which is a 'Mecca' for eco-tourists, and the cabin development at Porcupine Hill. Situated in the Blue Mountains, they are all acclaimed as prime examples of structures following the principles of environmental sustainability.

In pursuit of knowledge

Nigel is so committed to these principles that last year he travelled through Britain, the USA and Canada as recipient of a Churchill Fellowship, researching the topic of *Placemaking: Ecological Design with Sensitive Environments*. Now, armed with what he describes as 'a lovely library of stuff' from his travels, he has undertaken a PhD in Social Ecology at the University of Western Sydney.

He felt that this approach could be more effective in the long run than practising as an architect where he might do only the occasional one-off project which would demonstrate the principles and lead the way. His experience with some of those projects was that the concepts themselves proved too challenging to the regulating authorities, causing frustrating and costly delays and the need for energetic persistence which itself comes at a price.

'It's like the frustration of reinventing the wheel – endlessly.' he says. 'And it costs, you know – it costs the client, and it costs, obviously, also myself, and my company.'

Now concentrating his energy and enthusiasm on the new scheme, Nigel describes his approach: 'The lovely headline I came across that I hold up while I'm talking to all these builders and sub-contractors says: "The next Species Extinction: that's US!" – and I say "Look – it's not just something out there. These are the latest hard facts on Australia. We are going down the tube – and these are some of the reasons why".

'And then I say: "As people involved in the building industry – what do we do about it? What do you do on a building site? OK – You cut down the trees. What does that do to the birds? OK – You clear the vegetation. What does that do to the soil?" I start off with the broad issues and then get down to standard practice what we commonly do on building sites – how we affect air, water, soil, biodiversity. And then I say, "It's not just airy-fairy it's not just for the Greenies – and these are the reasons why."'

With plans to develop the half-day awareness seminars and follow them up with specific workshops to do with such issues as erosion and siltation control, toxicity of building materials, and smart practice on recycling, Nigel hopes the educational campaign will build up its own momentum.

Measuring success

'Given a year or two,' he says, 'I hope that we'll be able to develop a really good marketing program where builders will have the 'Green Builder/Smart Builder' logo on their letter head. And if they get this logo with the green ticks on it, that will become a marketing plus, as the consumer wants a builder who will not only build cheaply and well, but if you've got the extra tick – here's one that's responsible as well.'

One thing he finds fascinating is that builders attending the awareness workshops held so far admit it's their kids who tell them about the environment and the need to protect it, and a big part of his message is about considering future generations.

'That's the basis of this Smart Building campaign,' he says, 'To take the big issues which everybody says is "Oh – nothing to do with me!" and say "We are all responsible for our little bit in the total equation". And then you can also sleep easy at night – and tell your kids you've done the right thing.' ✲

The walkways at Jemby Rinjah Lodge limit movement through the bush, while still allowing viewing access and the feeling of being a part of it, and also keep all the human traffic above the ground so that plant-life and fauna is not disturbed.

CONTACTS

The **Smart, Clean and Green Builder** program is available to builders in NSW. Contact Cinzia at the Master Builders Association of NSW on (02) 9281 3511.

The **Churchill Fellowship** that Nigel received is an annual award available to any Australian who wants to go overseas to improve skills or undertake study which is not available locally. The fellowships usually involve three months overseas, and cover airfares, fees and a living allowance. For application forms for the 1998 fellowships (there are over 100 available), send a stamped, self-addressed envelope to:

Application forms
The Winston Churchill Memorial Trust
218 Northbourne Ave
Braddon ACT 2612

Information is available on the internet at http://cibc.anutech.com.au/new/134

Keeping your cool in summer
a beginner's guide to air conditioning

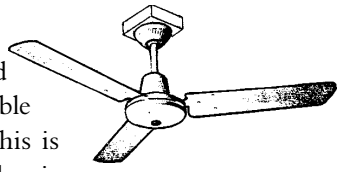
Summer is upon us, and for many people that means going to the beach, holidays, going to the pub…in fact anything to get out of a stinking hot house or flat. Unfortunately, the average Australian home is not well designed for comfortable living in either the hot or cold months.

Keeping the heat out

But there are ways you can make your house more livable in the summer months. The first thing you should think about is insulation. This can be in the roof, in the external wall cavities, or both. Most new homes are fitted with insulation in both these areas, but often the quality and quantity of insulation leave a lot to be desired. In older homes, insulation is often non-existent.

There are various types of insulation, including batts made from wool, polyester, and also glass fibre. The latter type, while often the cheapest, requires special handling and insulation to protect against small glass fibres from irritating skin and lungs. There is more information on the types and uses of insulation in Soft Technology #51.

You should also make sure that all window and door gaps are sealed, to prevent hot air from entering the house. There are many products on the market for this purpose which are relatively cheap and easy to install.



You should consider double glazing, as this is an effective barrier against heat transfer. If you are thinking of building a new home, this should be high on the list of priorities.

Other ways to block heat include using deciduous trees on north- and east-facing walls. Retractable blinds or awnings are another option. You could even investigate extending the eaves or installing verandahs on the north-facing walls of the house.

Ventilation

Another area which is often overlooked is ventilation, particularly of the space

between the ceiling and the roof. Temperatures can reach up to 70°C here, making it difficult for even the best insulation to do its job.

The simplest solution is to fit an exhaust fan of some sort to remove the hot air from the roof cavity. It could be a wind-powered model, such as a Whirlybird, which are available from most hardware stores for less than $100. These mount on the roof and use the power of the wind to extract hot air from the cavity. There are several other options, including mains-powered and solar-electric fans.

Fans

Natural cooling by evaporation was invented by Mother nature a few billion years ago, and it is still one of the best ways to keep your cool in summer.

The simplest and cheapest option here is the electric fan. Reasonable relief can be provided by even the smallest of fans, with the larger models being able to circulate air around an entire room. Ceiling fans are a great alternative to the floor-standing variety, and can also be used in winter to keep the warm air down near the floor where it can provide the most comfort.

Whatever type of fan you use, you can be sure that it will use a whole lot less power than any form of air-conditioning–and won't require regular maintenance and servicing either.

Air conditioning

If there are simply no more cheap retro-fittings you can do to help cool your house (or if none are possible because you are renting), a form of air conditioning may be necessary to survive the summer.

There are two main forms of air-conditioning; evaporative and refrigerated. The evaporative system works by blowing large quantities of air through a filter through which water is also flowing. This causes the water to evaporate, cooling the air in the process. As the humidity of the air increases during this process, evaporative air-conditioners work best in dryer areas. There would probably not be much use installing one if you lived in Darwin!

Refrigerated air-conditioners work by moving heat from one place to another, ie by taking heat from inside the house and dumping it outside. As they also remove moisture, they can cause the air to dry out, and some people they find this irritating to their eyes and throat. Some models, called reverse cycle air-conditioners, can also be used in winter, moving heat from the outside air to inside the house.

Both evaporative and refrigerated air conditioners come in many forms, from small portable units right up to huge ducted systems that will cool an entire house. However, in general, refrigerated air-conditioning costs more to both install and run than evaporative air-conditioning. ✲

Remote area power system (RAPS) rebate schemes

Rebate schemes act as an incentive for people in isolated areas to choose renewable energy over grid connection. RAY PROWSE, Executive Officer of the Solar Energy Industries Association of Australia (SEIAA) explains the current schemes.

Remote-area customers are often faced with grid connection costs in the order of thousands of dollars. A well designed and installed RAPS system will typically cost from $10,000 up to $25,000, depending on the load that it is required to power.

A rebate often brings this RAPS system cost back to something which is affordable and is competitive with the cost to connect to the grid.

The interesting thing about rebate schemes is that they actually save the electricity distributors money. For example, in Queensland the $7,500 maximum rebate under HRAPS (household remote area power system) matched the distributor's average annual rural grid connection maintenance cost. In spite of this fact the Coalition Government, in its wisdom, has cancelled the scheme and is prepared to spend the average $7,500 every year.

Rebate schemes are not viewed by the industry as being the final answer to greater use of renewables. Whilst rebate schemes are operating, there is growth in the industry; when they cease, industry slows down dramatically. This has happened in both NSW and Queensland where the significant growth has fallen away now that the schemes have finished.

Rebate schemes are viewed by industry as a short term way of addressing some of the inequities in the provision of electricity services to rural customers. These inequities include falsely low quotations for grid extensions (for example, in Tasmania the HEC is effectively giving away grid extensions in some areas), heavily subsidised electricity prices (customers living in the shadows of power stations pay the same price for electricity as those hundreds of kilometres away) and an ethos of encouragement for grid extensions because we have abundant supplies of coal.

If these barriers are overcome we simply may not need rebate schemes. Privatisation of electricity utilities is leading towards true cost reflective pricing in all of their activities and we should see more realistic prices charged for grid connections and for each unit of electricity.

Until such activities lead to a 'level playing field,' rebate schemes will play a vital role in ensuring greater use of renewable energy technologies for those people for whom it is too expensive to take electricity from the grid.

For further details of SEIAA accreditation contact the Association on Ph:(03) 9866 8977, Fax:(03) 9866 8922, email: seiaa@ozemail.com.au

RAPS (remote area power system) rebate schemes in Australia

WESTERN AUSTRALIA

Status ..... Commenced in late September 1996.

Eligibility ..... Quote to connect to the grid must be at least $50,000. Rebate is on the renewable energy components of the system. System must be designed and installed by SEIAA accredited person or another approved by the Office of Energy.

Max rebate $8,000

QUEENSLAND

Status ..... Household (HRAPS) scheme for whole state has finished. Daintree (DRAPS) scheme likely to continue until at least February 1997.

Eligibility ..... Quote to connect must be at least $30,000. Rebate is on renewable energy components of the system. System must be designed and installed by an SEIAA accredited person or an Association member.

Max rebate ..... DRAPS - $15,000

NSW

Status ..... RAPAS scheme finished June 30 1996.

Eligibility ..... Quote to connect at least $30,000. Rebate on renewable energy components of the system. System must be designed by an SEIAA accredited person and installed by a licensed electrician.

Max rebate $8,000

VICTORIA

Status ..... REAP scheme will continue until the end of 1996.

Eligibility ..... Quote to connect must be at least $20,000. Rebate on renewable energy components of the system. System must be designed by an SEIAA accredited person and installed or inspected by an accredited person.

Max rebate $3,000

No other states currently have schemes operating.

NSW gears up for its first wind farm

New South Wales is at the fore of renewable energy developments in Australia, and Pacific Power's recently announced wind farm will put NSW further ahead of coal-fixated states like Victoria.

On Monday 28 October the NSW Minister for Energy, Mr Egan announced that Pacific Power plans to install a 5 megawatt wind farm on the Great Dividing Range about 32 km northwest of Goulburn. The announcement was a high profile media event: a high-tech video simulation of the wind farm got good coverage on that evening's national television news bulletins. The story also featured in the print media the next day, and the Sydney Morning Herald even put the story on their Internet site. Subsequent interest was so intense that Pacific Power quickly ran out of information kits and press releases. It would seem that mainstream Australia is finally taking an interest in renewable energy technologies.

The ten million dollar project will consist of eight turbines each of about 600 kilowatts rated capacity, giving a full power output of a nominal 4.8 megawatts. It would regularly peak at 5 megawatts in a gale. The turbines' hub height will be 40 metres (possibly more). It is believed they will be sited on a ridge on a sheep farm known as Wharekarori (a Maori word some translate as 'house of good luck'). This part of the Great Dividing Range is known as the Cullarin Hills, with an elevation of about 600-700 metres at the proposed site. It is definitely not a coastal location, being 130 km inland from the mouth of the Shoalhaven River. Power will be fed into a nearby 66 kV feeder which supplies the town of Crookwell (1000 houses) about 10 kilometres further inland. In strong winds power will flow 'backwards' and supplement Goulburn's electricity supply. The development will be handled in-house by Pacific Power, a generation company currently under state ownership of the New South Wales Government.

An artist's impression of a wind turbine in Pacific Power's recently announced wind farm in NSW.

Good winds?

Pacific Power has been monitoring at Wharekarori for 5 years with a battery powered (later solar powered) data logger collecting windspeed data from an anemometer atop a 40 metre tower. The wind data has not been publicly released, but the published estimate of 9000 tonnes/year greenhouse gas savings can be applied to the known performance characteristics of a typical European wind turbine to derive an estimated average annual windspeed of a modest 6.4 metres/sec. It is somewhat sad to relate that this would be regarded as a low-grade site on the Victorian coastline, where several good sites in the 7 to 8 metre/sec range were identified in the two year long SECV/VSEC wind monitoring study in the 1980's. Toora, Kilcunda, Apollo Bay and Cape Bridgewater for example are sites with winds over 7 metres/sec, and that was measured only 10 metres off the ground! The NSW windfarm transplanted to any of these Victorian locations would produce at least twice the power output.

One might well ask why the Victorian coastline still has no wind farms: the answer is certainly political/commercial rather than technical. Come to think of it, there is hardly any difference between political and commercial in Victoria these days.

You'll pay more

Energy from the wind farm will be retailed by Great Southern Energy, and it is proposed that customers can elect to pay a 5-10 percent premium on their electricity bills for the privilege of using renewable electricity. This is really a bit rich when one considers that the distribution companies are buying coal-fired power dirt cheap on the wholesale market and selling it at a huge mark-up to customers. Surely these windfall profits could be used to cross-subsidise all the clean renewable power ever likely to be integrated into the system?

Michael Gunter is the owner and manager of the Breamlea wind generator in Victoria.

Build your own

Solar-powered water feature

LANCE TURNER

A solar-powered water wheel makes a novel water feature, much more interesting than a plain old pump – and cheaper too!

With summer on the way, there is nothing more relaxing than sitting under a shady tree, sipping your favorite drink, and listening to the sounds of water trickling over rocks nearby.

For these and other reasons, water features have become very popular, but most of them seem to be pretty much the same, consisting of a mains electricity powered pump forcing water through a plastic fountain head or something similar. Boring!

When I decided to put a water feature in at my place, I knew I had to come up with something different. What's more, the budget for this project was limited, and most pond pumps cost upwards of $200. As the friendly staff at Going Solar explained, the cheap marine bilge pumps that some people use for their ponds are not rated for continuous use and won't last too long.

After a bit of thought, I decided on the idea of a solar-powered waterwheel. So instead of water moving the wheel, the wheel was moving the water! I also decided to make use of an old cast-iron bath tub that had been sitting around for some time.

Construction

The waterwheel itself is made from wood, much of which was recycled. The different sections can be seen in figure 1. The main body of the wheel consists of eight identical pieces, cut as per figure one (b). By assembling them as shown in Figure 1 (a), you can see that these pieces not only form the perimeter of the wheel, but the bottom of the buckets as well!

I made these eight pieces out of wood taken from a recycled pallet, which was about 75mm wide and 25mm thick. On one end of each piece I cut an angle of 45°. I did all my cutting with a circular saw, but you could use a mitre box and hand saw. A 5mm hole was drilled 95mm in from the end of each one. These holes were then countersunk on the shorter face of the wood. This is the hole for the screw used to hold the spoke in place.

Once all eight pieces were finished, they were sanded to remove splinters and loose dirt and given two coats of polyurethane varnish for waterproofing.

Once this was dry, I assembled these pieces of wood into the shape of the waterwheel, using nail plates, bent in the middle at an angle of 45°, to join them together. Nail plates are available from virtually all hardware stores, and are simply flat metal plates with spikes punched out of them that stick out at right angles. You use them by positioning them on the wood to be joined, and hammering in all of the little spikes. You could also use some plain metal plates, bent at 45°, with some holes in them for screwing them to the wood.

After this was done, I layed the wheel flat and adjusted the sides until all of the pairs of opposing sides were the same distance apart, about 460mm. This ensured that the wheel was fairly round (or octagonal, if you want to be picky). I then cut a spoke 460mm long, drilled a 3mm diameter hole about 25mm deep into each end of it, and fastened it in place between two of the sides using 45mm plasterboard screws. I chose this type of screw for their deep thread, which is important when screwing into the endgrain of wood.

The next step was to measure the distance between the two sides of the wheel that run parallel with the spoke, cut short spokes for each one, and drill

and screw them into place. The rest of the spokes were completed in the same way.

The hubs were the next thing to be made, and were cut from 10mm thick five-ply, as per the template in Figure 1 (c). The 4mm diameter holes were also drilled and countersunk to allow the woodscrews to sit flush with the surface of the hub. These were then positioned on each side of the wheel and, after drilling 2mm pilot holes in each spoke, temporarily screwed into place with 20mm countersunk woodscrews.

By now, the wheel was starting to take shape and had become quite solid and rigid. I then measured and marked the centre of each hub, and drilled a 6mm pilot hole through each hub and halfway through the long spoke. Amazingly, both pilot holes met in the middle! The next step was to bore the 1" (excuse the reversion to imperial units, I used 1" waterpipe for the axle) hole right through the centre of the wheel, cutting from both sides and again meeting in the middle of the wheel. This hole was made with a 1" holesaw, but a spade bit is the cheaper option if you don't already have one.

I then removed the hub plates and spokes from the wheel, carefully marking all of the pieces with a pencil so that they would all go back in the same places. Next, I lightly sanded the spokes and hub plates, and gave them all two coats of polyurethane varnish.

The final wooden components to be made were the side panels. There were sixteen of these, eight for each side of the wheel. The shape for these can be seen in Figure 1 (d). These were cut from 5mm thick three-ply, sanded, and also given two coats of varnish.

When everything was dry, the wheel was reassembled and the side plates

Parts list

- 8 pieces of wood, 75 x 25 x 325mm
- 2 wooden broom handles, at least 1200mm long and 22mm in diameter
- 1 piece of 10mm thick 5-ply, at least 320 x 160mm
- 1 sheet 5mm thick 3-ply, at least 900 x 600mm
- a length of 1" galvanised waterpipe
- 2 hardwood blocks, 75mm wide, 150mm long and 50mm thick
- an old bicycle, or two sprockets, hubs and chain
- a windscreen-wiper motor
- a 500ml can of polyurethane or other suitable outdoor laquer
- 8 plasterboard screws, 45mm long
- 32 wood screws, 20mm long
- 4 bolts, 5mm x 60mm long, with nuts
- a piece of round steel rod, 10mm round x 120mm long

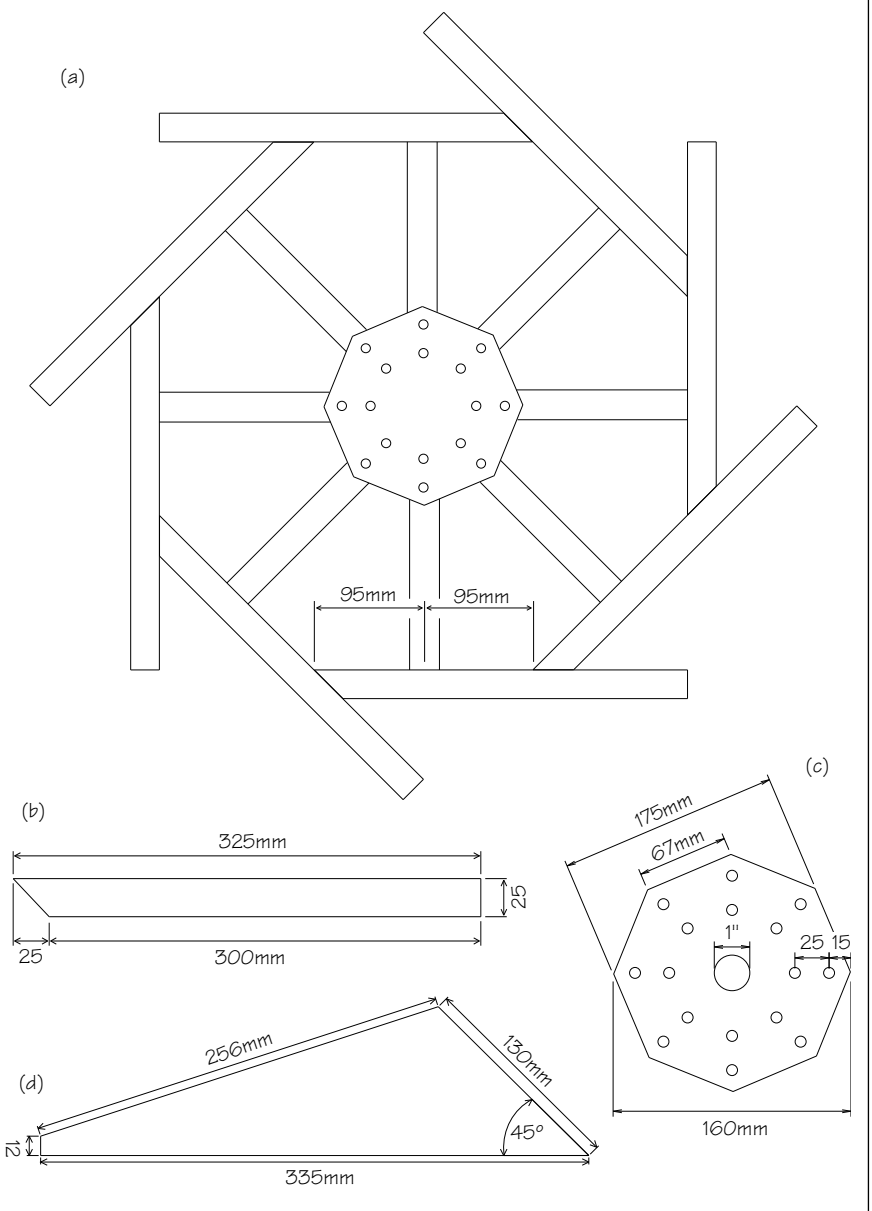


Figure 1. These are the various components for the waterwheel.

nailed into place using 20mm bullet-head nails. The whole wheel was then given a third coat of varnish, just to make sure.

The drive system

The shaft for the waterwheel was a length of 1" galvanised waterpipe about 800mm long. This was fastened to the wheel by a 10mm diameter steel pin about 120mm long that passed through a hole in the waterpipe and was held to the wheel by two small clamps made from 12 x 3mm aluminium flatbar, bent to the appropriate shape. These clamps were bolted to one of the hub plates with four 5mm x 60mm bolts.

The shaft was supported in two bearings made of hardwood, with 1" holes drilled through them.

The waterwheel was driven with an old windscreen-wiper motor via a pair of bicycle sprockets and chain. The larger of the two sprockets, which had 60 teeth, was attached to the waterwheel shaft. This was done by welding the original crank shaft from the bike into the end of the waterwheel shaft and, after cutting the pedal crank off with a hacksaw, bolting the sprocket onto the crank shaft.

I have my own arc welder, which made the job quite simple, but if you don't have one, you could easily get the welding done in a few minutes at your local garage or crash repairer.

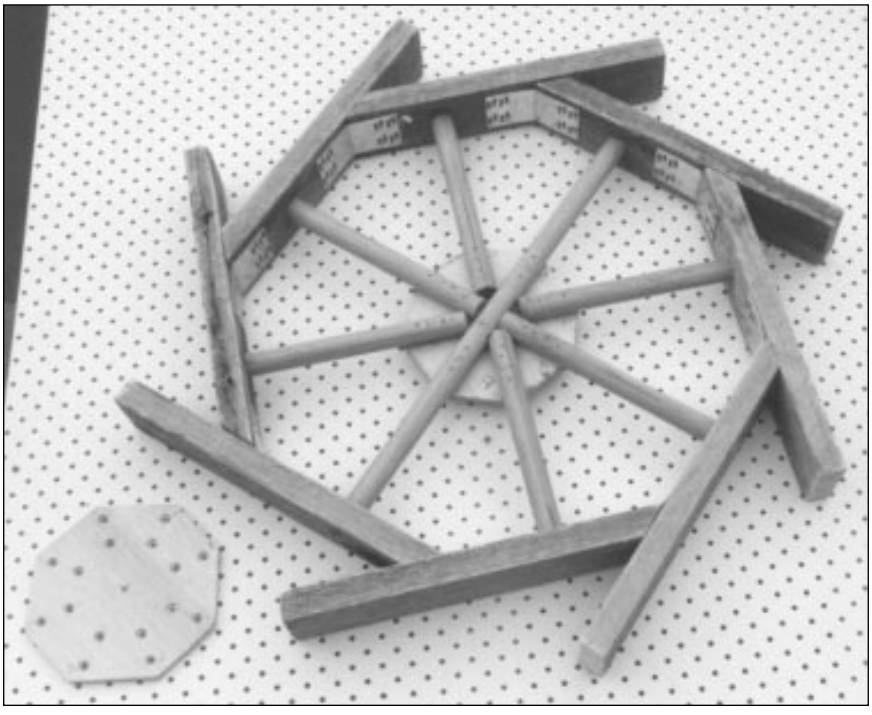
The wiper motor I used was from a Holden Shuttle, but you could use just about any wiper motor, so long as you have a way of attaching the sprocket to the shaft. I tested two motors, the other being the rear window wiper motor from a Mazda bus. While the bus motor drew a mere 0.25 amps with no load compared to the Shuttle motors 1.5 amps, I decided to use the Shuttle motor due to its heavier construction and greater power. By the way, these motors are readily available from any motor wreckers, and usually only cost five to ten dollars. Just buy the cheapest one that suits your needs.

On my motor, the wires from the motor itself were connected to a plastic terminal block on the back of the gear case. This terminal block also houses the 'park' contacts, which cause the motor to park the wiper blades at the bottom of the windscreen. Obviously, this was not required for my purposes, so I just cut the wires at the back of the terminal block, leaving the block in place. As there were three wires, I had to test them in pairs to find which two ran the motor at the lowest speed and with least power draw.

The small sprocket I used had fourteen teeth. I used the rear hub of the bike, including the ratchet setup, to hold the sprocket. I cut off the unwanted axle tube from the hub and pressed an 8mm nut into the hole where the tube had been. However, as a precaution, I also welded the nut in place for extra strength. As the thread on the wiper motor was 8mm, the whole bike hub assembly simply screwed onto the motor. It couldn't have been easier!

Mounting the wheel

The wooden bearings for the waterwheel were mounted each side of a cast-iron bathtub in the back yard that was to become the centre of the water feature. Two holes were drilled in each flange of the tub and the blocks held in place with two screws in each.



Here you can see the frame and spokes before the side panels were attached.

If you are not using a bathtub, but a fibreglass pond or something similar, you could use short posts for the bearings and set them into the ground. How you do it will depend on the design of your water feature.

Once the wheel was mounted, the motor was also mounted on the edge of the tub. I did this by making a bracket out of 20 x 5mm mild steel flatbar, but how you do it will depend on which motor you use, and how the rest of the water feature is set up (again, this job could be done at your local garage).

The next step was to connect the two sprockets together with the bicycle chain, which was shortened to the appropriate length. You will need a chain tool to do this, which are available from bike shops.

With all this together, I oiled the chain and then hooked up the motor to a 12 volt battery to see if everything worked. And work it did, quite well in fact, with very little noise from the drive system.

Here you can see a close-up of the motor and sprockets. Note the maximiser attached to the back of the motor with double-sided tape and glue.

The only problem was that the waterwheel shaft tended to creep in one direction in its bearings until the sprockets were missaligned enough for the chain to come off. This was fixed by fitting a 1" flat washer over the shaft and holding it in place against one of the bearings with four screws in the shaft. This worked fine, a test run of an hour or so confirming that everything was staying where it should.

Maximising your power

The water feature was now ready to be connected to its power source. This took the form of an English-made 12 volt, 11 watt amorphous solar panel from Solarcorp in NSW. While it was capable of driving the motor directly when in full sun, it was a little on the slow side, so I chose to improve things with a home-built version of the mini maximiser, available from the ATA and as described in Soft Technology #43.

A maximiser is an electronic device that effectively matches the load, in this case the wiper motor, to the solar panel, so that you can obtain maximum power from the panel. Without one, you may get far less power from your panel than you should, and in some cases, virtually none at all!

Once this was hooked up between the motor and the solar panel, things improved greatly, with the motor running at about twice the speed and with much greater power than before.

The solar panel was mounted on the top of a bungalow, not far from the water feature, and the wires buried in a length of conduit. It is important that a reasonably heavy cable be used here so that not too much power is lost on its way to the motor. Standard 2.5mm^2 builders cable is ideal, as it is rugged and cheap.

Finishing touches

As can be seen from the photos, the water feature is not quite finished. I need to build up the ground around the bath tub and get some more green things growing. As the wheel tends to throw water out of the end of the bath, I will be building a mound there with some rocks for the water to cascade back down to the bath over. The final effect should be quite nice, but for now the concrete bird bath will have to suffice.

I also need to build a proper cover for the electrics, which will be made from the left-over plyboard and polyurethane laquer.

What did it cost?

All up, the waterwheel itself cost less than $25 dollars. The most expensive part was the polyurethane laquer, which cost $16. The nail plates cost a mere $1.60, and the screws just a few dollars. The spokes were made from two broom handles, bought from the supermarket for $1 each.

The rest of the wood, the metal pipe and the flatbar were all recycled from various sources, and cost nothing. Wiper motors are available from motor wreckers for around $10. The most expensive part of the whole project was the solar panel, which is worth $155. The cable cost less than $20, and the maximiser I assembled myself for a few dollars worth of components.

All in all, this project cost me around $200, about the price of a pond pump. But while it does the same thing as a pump, (aerate the water and make nice sounds), it is much more interesting to watch, and was a whole lot more fun to build and install. What's more, it will outlast any cheap pump, won't need to be cleaned out all the time, and will be cheap to fix if it ever dies – the availability of motors and bike bits is almost unlimited!

Other thoughts

While I was playing with this design, it occurred to me that this design might make a reasonable overshot waterwheel for producing power. While I was installing the wheel, I took the opportunity to squirt water into the buckets with the garden hose. The power output from the wheel seemed quite good, with the shaft requiring a reasonable amount of force to stop it, despite the small wheel size and low water volume.

So, there you go, another use for this design! Of course, you would need to scale it up three or four times to get really usable power out of it, but it would be simple enough to do.☼

The mini-maximiser is available in kit form from the ATA, 247 Flinders Lane, Melbourne 3000. It costs $30 plus $3 postage. You can also order it in built form, ready to use, for $45 plus $3 postage.

Build your own

Wind speed meter

LANCE TURNER tells you how to make a meter that can store wind speeds over an extended period, for less than $50

A while ago I built myself a Savonius rotor wind turbine, with the hope of providing some power to my home, when and if I ever got out of the city. Unfortunately, I'm still here, so I thought it was about time I put the machine to good use. A couple of questions needed to be answered first, though. I needed to know whether there was enough wind to justify setting it up at all, and where the best position on my block was.

What I really needed was a wind speed meter with a data logger attached to allow me to collect wind speed data for a while, moving it from site to site until I found the best place. But these things are expensive at best, and totally unaffordable at worst, so I thought I would make my own instead.

A simple anemometer (wind speed meter) is easy to make, but it will generally only tell you the speed of the wind at the time you read it. Just knowing how fast the wind is going at any one time, while undoubtedly helpful, is not adequate information to make the important decision of choosing the site. You really need to be able to record the wind speed over a period of time, as well as recording maximum wind gusts, as these can damage a wind generator if they are strong enough.

The resulting design was a simple electronic wind speed meter that can not only monitor instantaneous speed, but also record maximum wind speeds and provide an average speed for the monitoring period. This design was inspired by a reader who described to me how he was monitoring the actual RPM of his wind generator using a bike computer.

Computer cycling?

A bicycle computer is a small electronic device that measures the speed and distance of a bicycle by counting how often a magnet on the spokes passes a sensor attached near the wheel. It also records the maximum speed attained, as well as providing average speeds for the recording period.

All this information is provided by an LCD display, and the various functions are operated by a couple of buttons on the front of the device. The whole gadget is usually no larger than a matchbox.

The computer I chose to use was bought from Oatley Electronics in Sydney for just $32. This unit is not only water resistant, but solar powered too!

Building the anemometer

Of course, you can't get much information from the bicycle computer unless it is attached to an appropriate sensor of some kind. Most people have seen anemometers on top of weather stations, these consisting of three or four cups mounted on arms which rotate around a central hub.

The sensor for my datalogger is similar to this, and was made from a brush-type DC motor mounted inside a watertight enclosure, with the familiar cup and arm arrangement attached to the shaft of the motor. Using an old motor was a cheap way of providing a shaft already mounted in its own bearings.

The motor I used is commonly found in remote-control model cars and boats. There are many types of these motors available. The RS-540 type are good for this purpose, but the ball-raced LE-MANS motors from Kyosho produce an anemometer with very low friction. Other types that could be used include the cheap and simple 'hobby motors' available from electronics component stores. Costs of these motors vary, from about $2 for the cheap hobby motors, up to $100 or

The anemometer section of the wind data logger is easy to built and costs jsut a few dollars.

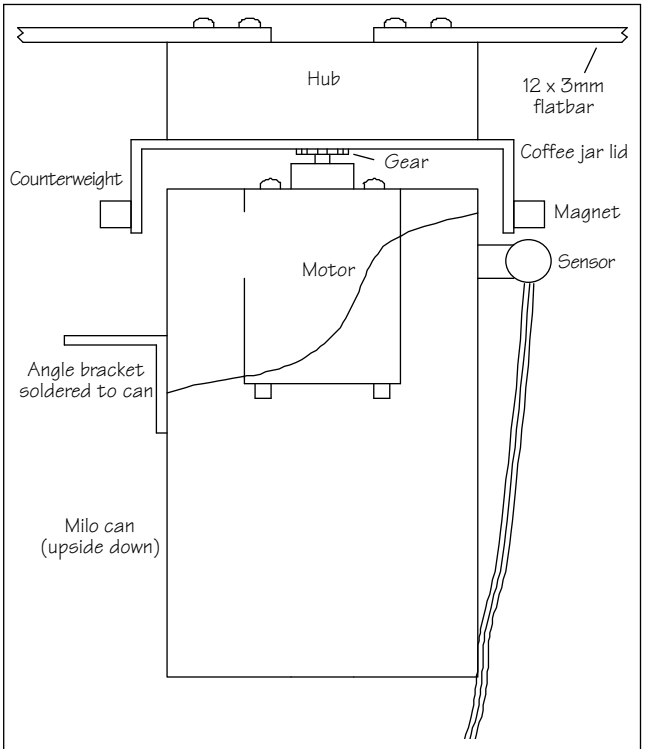


Figure 1. The anemometer for the wind speed data logger.

more for a ball-raced model. You may be able to buy a motor second hand at model shop, or reuse one from an otherwise disfunctional model car.

The standard sensor that comes with the bike computer, an encapsulated reed switch, is used to provide the pulses to the computer.

I started by pulling the back end of the motor and removed the armature (the bit that turns) from the case. This can take a bit of force in some motors, as the magnets inside them are very strong.

I now removed the magnets from the motor case to allow the armature to rotate easily when it was all reassembled. This is done by removing a spring clip between the two magnets and prising them out with a screwdriver. This motor also had them glued in, and a bit of persuasion was required. By the way, these magnets make excellent fridge magnets, their curved shape making them easy to get a grip on. Once I'd done this, I washed the case in a detergent solution, using a paint brush to remove the accumulated gunge, rinsed it and put it in the sun to dry.

The final step required removing the brushes on the inside of the motor end cap. These are the little carbon blocks that rub on the copper section of the armature, and are usually mounted on bits of springy metal and can just be snipped off.

I should mention here about the other type of brush that is found in the more expensive racing motors such as the LE-MANS series. These have a brush/spring system similar to larger motors, with the brush sliding in a square tube with a spring pressing on the back of it. By removing the springs and cutting the brush leads first, the brushes can just be slid out of their holders.

Once this was done, I re-assembled the motor and placed a single drop of light machine oil on the bearing at each end of the motor.

Making the rotor

Next, I installed the motor in a waterproof case, for which I used a Milo can. You could use just about any waterproof sealed enclosure for this purpose, but I found the can the right size and shape, and it was free! Three holes were drilled in the end of the can, one large one in the centre and one smaller one each side of it for the motor mounting screws (most of these motors have threaded holes in the front end which accept 3mm metric screws). A mounting bracket was also soldered to the can and the whole thing primed and painted for weatherproofing. The anemometer assembly can be seen in Figure 1.

The rotor of the anemometer was made from a small gear that fitted the motor shaft (these are usually available for little cost), glued into a painted wooden hub about 60mm in diameter. The gear was used as a strong and reliable way of attaching the rotor hub to the motor shaft.

Attached to this were four arms made from 150mm lengths of 3 x 13mm aluminium flatbar. The end of each arm was twisted 90 degrees along its length so that the end was verticle (see Figure 2). On the bottom of the hub I mounted a coffee jar lid that was used to protect the top of the motor from the weather.

The cups were made from 2mm thick clear PVC sheet heated and (carefully) moulded around a light bulb to get the shape. You could cut two plastic toy balls in half to provide the cups. One cup was then attached to the end of each arm by a small bolt and nut.

Parts List

- 1 programmable bicycle computer
- 1 small electric hobby motor, with metal or plastic gear to suit
- 1 steel can or similar sutable case
- 4 pieces of aluminium flatbar, 13 x 3 x 150mm
- 4 plastic spherical 'cups', or two plastic toy balls cut in half
- a length of twin-core insulated hookup wire
- insulating tape or 'heatshrink tubing'
- solder and a soldering iron, or some suitable wire connectors
- paint suitable for outdoor use
- assorted small screws, nuts and bolts

The bicycle computer used to record the wind data.

Mounting the sensor

As mentioned earlier, the bicycle computer's original sensor provides the pulses to the computer. The sensor was mounted on the outside of the can on a small block of wood to set it at the correct height. The sensor had a small flat on one side, which needed to be the side closest to the passing magnet.

The magnet (also supplied with the computer) was attached to the coffee jar lid with a couple of short self-tapping screws. A counterweight was attached to the opposite side of the lid for balance. A small bolt is ideal for this purpose, although I used a small flat piece of metal.

I then extended the length of the wires from the sensor by cutting them and joining in an appropriate length of wire. I soldered the wires, but you could use one of the many types of connectors and splices made for this purpose. These are readily available from electronic component shops. You could even use automotive 'bullet' connectors, available from many hardware stores and auto shops.

Calibrating the computer

There was not much else left to do to finish the project. All I had to do was connect the sensor to the bike computer and calibrate the computer.

While this sounds like something Mr Spock would ordinarily do, it is really quite simple once you understand what you have to do. The number required by the computer is actually the circumference of the wheel, in millimeters, or more accurately, the distance the bike would cover between pulses. This is calculated by multiplying the wheel diameter by p (3.14). To calibrate the computer, you need to reset it by pressing the small reset button on the back, and then enter in the wheel circumference.

There are several options for calibrating your data logger. If you have access to a calibrated anemometer (you don't need the data-logging type, just one that gives an accurate instantaneous wind speed), the calibration will be easy. Just program a number, say 1000, into the computer and compare the speed it shows with the other anemometer. If it reads, say, twenty percent low, then increase the number by that figure (giving 1200 in this example) and program it in. The data logger will now be calibrated.

Another way is to reset and then program the computer with, say 1000, and then move it through still air at a known speed. The easiest way to do this is to hold it away from you and run at the same speed for a known distance, say 100 metres, stopping the anemometer the instant you get to the 'finish' line. You get someone to time you, and divide the distance by that time to find your speed in m/s. You then multiply this by 3.6 to get the real speed in km/h. You would then check what the computer reads for an average speed, and work out the adjustment to the programmed number accordingly.

As this sounds a bit complicated, we will look at an example. If you took 22 seconds to cover the 100 metres, then your average speed would be 4.55m/s, or 16.4km/h. If your anemometer read 12km/h, then the increase would be (16.4-12)/12 = 0.367 or, multiplying by 100 to get a percentage, 36.7 percent. So, if the original number programmed into the computer was 1000, then the correct number you need would be 1000 + (1000 x 0.367), or 1367.

But if, say, your meter was reading 36.7 percent high instead of low, then you would swap the '+' sign for a '-' in the above final calculation to get 633.

Yet another way

There is a simpler alternative to these methods, although it is less accurate but will still allow you to get a good relative indication of the wind speeds at one site compared to another, thus allowing you to find the best available site on your block.

This method involves simply calculating the circumference of the anemometer rotor. You do this by measuring the distance between the centers of opposite cups on the rotor and multipliying by the constant p. As an example, my anemometer had a diameter of 320mm, giving a result of 1005.

I then programmed this number into the computer, mounted the anemometer on a long pole, and attached it to the side of my shed for the first set of measurements. The readings were reasonable, but were lower than the actual wind speed due to friction and air drag on the sensor. I then adjusted the number up a bit from there, to make

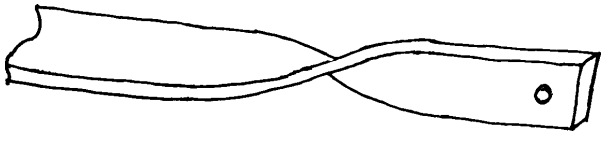


Figure 2. This is how the rotor arms are twisted along their length.

the readings a bit closer to what they probably should have been.

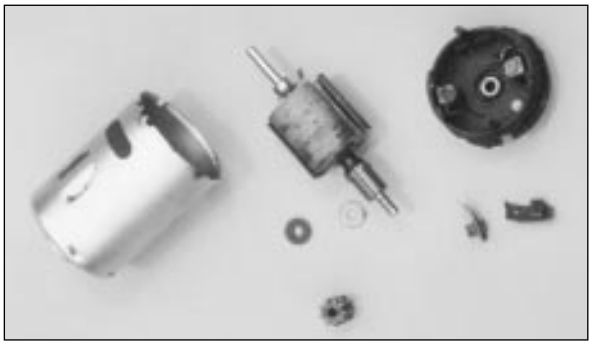
While this doesn't sound very scientific, the numbers shouldn't be too far out, and all the readings at different sites will be out by the same percentage and will therefore give an accurate relative comparison of the different sites.

Calculations

There are a few of points that need to be addressed concerning the calculations and the numbers provided by the bike computer. The maximum wind speed recorded will be accurate (well, as accurate as your calibration of the computer, at least), but the average wind speed will need to be recalculated. This is because the computer only averages the speed for the period that it receives input, not for the whole time period. But fortunately, the computer also records the distance travelled by the air passing the anemometer, so the actual average speed can be easily calculated.

An example would go as follows. If the computer recorded a distance of, say 138 kilometers passing the anemometer, and this distance was recorded over a time period of 24 hours, then the average speed is simply the distance divided by the time, or 138/24, which equates to 5.75km/h. Dividing this by 3.6 gives you 1.6m/s – you would need to find another site if every day was this bad!

How the sensor is mounted on the side of the anemometer case.



The motor components. Note the armature in the middle of the photo.

We should also note here that it is probably best to record the data and reset the computer each week or so, as it only counts up to 9999 kilometers and then clocks over to zero again. But apart from these limitations, this device should allow you to log wind speed data over extended periods, without the cost of buying a commercial logger.☼

ATA news

Find out what's happening at the Alternative Technology Association

A 'new' Web site

The Alternative Technology Association's world-wide web site has a new address. There is now a mirror for the site, stored on a Sydney server with a faster link to the internet than our Melbourne server. The new address for the site is: <http:/www.ata.org.au/~ata>.

Our old site was often difficult to access, though in spite of this it was averaging around 1,000 visits from around the world each month. The new site, which includes animated footage of the Breamlea wind generator and downloadable articles from ReNew, should do even better. The site is updated every four weeks.

ATA sponsor teams with big Australian

Sustainable Technologies Australia (formerly known as Silicon Technologies) has signed an agreement with BHP which will allow them to use their patented titanium solar cell technology (the formation of thin ceramic films from solution) to develop solar roofing tiles in Australia. It has been estimated that there is sufficient roof space in Australia to meet our total electricity requirements.

Scientists are predicting that 'roof top power' will be a commercial reality within the next five to ten years.

New look solar shuttle

The Resource Recycling and Recovery Council has granted the Alternative Technology Association over $19,000 to build a new mobile display. The display will demonstrate recyclable materials, how they are collected and processed, and show end-uses for recycled materials. Aimed at primary and secondary school students, the 'Recycle Runabout' will be the third of the ATA's mobile educational displays, joining the Energymobile and Solar Shuttle. The Runabout will actually be constructed in modular, detachable units, using the body of the existing Solar Shuttle, and will begin visiting schools in early 1997.

ATA loses Queensland sponsor

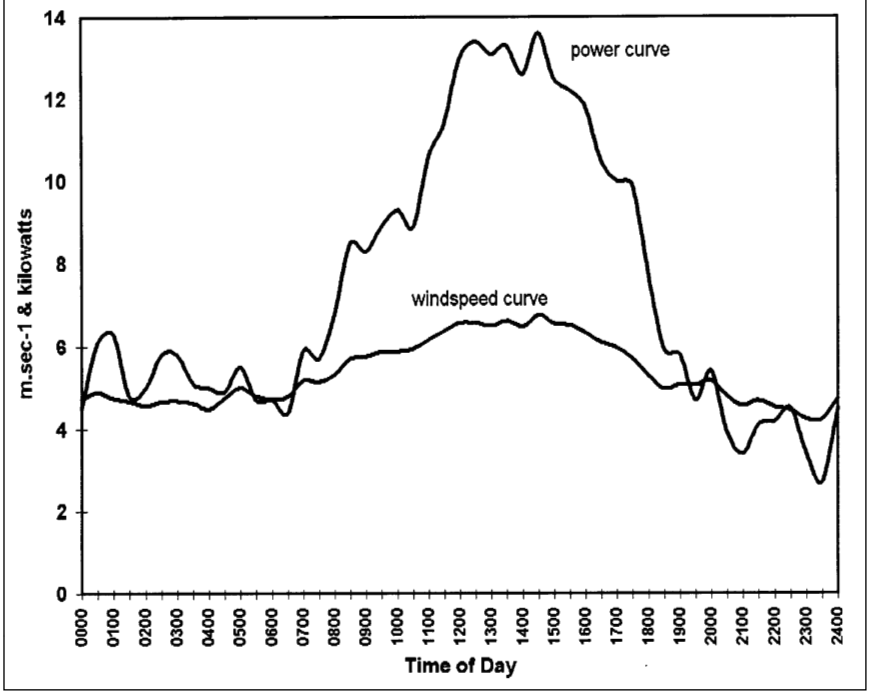
The Queensland Energywise Advisory Centre, which sponsored the ATA's Queensland Solar Shuttle Tour in 1996, has been closed down. The State Government body, which provided valuable information to Queenslanders about low energy appliances, renewable energy and saving on power bills, had funding withdrawn late in 1996. Besides losing a valuable sponsor, the ATA marks the closure as a regrettable loss of a kindred organisation.

A spokesperson from the Queensland Department of Mines and Energy told the ATA that funding for the Centre was withdrawn, as educating the public about energy conservation was no longer considered a 'core business' of the department.

The ATA's Solar Shuttle, with its renewable energy message, gained exposure to over 12,000 people at the Great Australian Science Show in Brisbane, and visited numerous Queensland country shows with financial assistance from the centre.

Breamlea wind generator

The ATA helps maintain a 64 kilowatt (peak output) Westwind wind generator at Breamlea, near Torquay, on the Victorian coast. Michael Gunter (who appears on this issue's cover at Breamlea with his son, Conrad) owns the generator, which feeds electricity into the grid. The electricity is purchased by CitiPower, a Melbourne-based electricity utility.
The graph below shows windspeed and energy production for the month of October 1996. Total energy production for October was 5554.1 kilowatt-hours. Average windspeed was 5.3 metres per second. An estimated 1870 kilowatt-hours of lost production occurred between October 20 to 27, when the airbrakes were overhauled.
Open Days are on the third Sunday of each month from 1pm to 3pm – visitors welcome. See Melway Key Map E between Barwon Heads and Torquay. Updates on the generator's performance are available on the ATA's web site, or by request from our national office.



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ATA

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Membership also helps us to spread the word about renewable energy and appropriate technology through our publications, information seminars and mobile educational displays. So why not join today, or call (03) 9650 7883 for more information about the ATA.

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Back issues and subscriptions

Available back issues of ReNew (formerly Soft Technology)

Soft Tech Issue 41 $5
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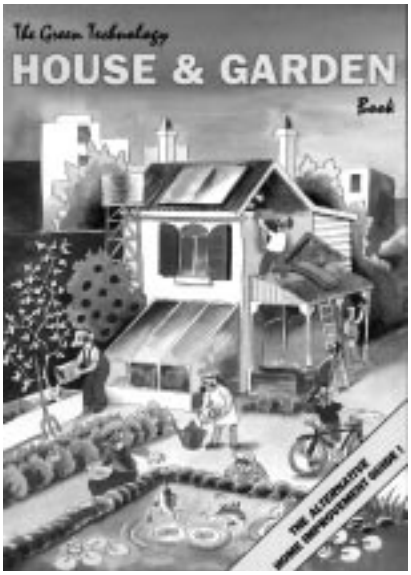

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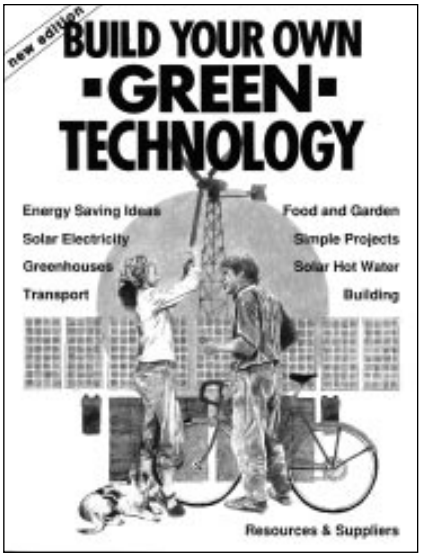

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Filled with ideas and inspiration for anyone interested in environmentally friendly technology and energy self-sufficiency. Includes practical projects involving solar, wind and water power.

Item code: BYOGT

Getting in touch

ATA state contacts

For membership enquiries, please contact the national office.

ACT
Ron Tito
Ph: (06) 235 9172 bh, Fax (06) 235 9036

NSW
Bob Jones
Ph: (02) 235 5790 bh, (02) 498 5001 ah.
Fax: (02) 498 3170
email: bobjones@triode.apana.org.au

TASMANIA
Mark Mather
PO Box 37, Snug 7054
Ph: (018) 123 890 bh, (003) 6267 4141 ah

VICTORIA
Chris Moss Ph: 9885 2108 ah

QUEENSLAND
Daryl Douglas
Ph: (074) 3280 3445 bh, (074) 612 042
Fax: (074) 612 188.

NATIONAL
Libby Anthony (General Manager)
Level 2, 247 Flinders Lane
Melbourne 3000
Ph: (03) 9650 7883. Fax: (03) 9650 8574
email: ata@ata.org.au

NORTHERN QUEENSLAND
John and Suzy Watson
Lot 12, Community Mail Bag,
Great Keppel Island Qld 4701
Ph: (079) 39 5555 Fax: (079) 395 395

NEW ZEALAND
Ian Dorward
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Takapuna
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❑Saving money
❑Preserving the environment
❑Enjoy technical projects

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❑Designer
❑Retailer
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❑Other (please specify)
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.....

Return completed surveys to: ReNew, 247 Flinders Lane, Melbourne 3000 or Fax to (03) 9650 7883

book reviews

You Can Have Your Permaculture And Eat It Too

Robin Clayfield, Earthcare Education, Queensland,1996.

254 pp., ISBN 0 646 28784 2.

Available by mail from 58 Crystal Waters MS 16, Maleny, QLD, 4552.

The typography for the title of this book emphasises the word 'permaculture', but a glance at the blurb on the back cover gives a more accurate overview, describing the book as 'a cookbook for gardeners; a gardening book for cooks.'

The author has spent thirteen years practising permaculture in numerous ways, including running courses on gardening and cooking, and she's written the book with a spirit of generosity in regards to passing on the knowledge that she's acquired from friends, classes and practice.

The permaculture ethos of recycling rather than sinking energy provides a constant focus throughout the diverse range of topics, which covers establishing your own garden through to cooking your home-grown goodies, making cosmetics, kitchen crafts, bush tucker, edible flowers, handy pets to have around the yard, innovative and cheap fertilisers, and much more.

The first section of the book concentrates on setting up and maintaining a garden based on permaculture principles, looking at the ethics (care of the earth, resources and people) as well as the practice (energy efficiency, location, irrigation, recycling, diversity and harmony).

The writing is conversational in tone and all subjects are accompanied by illustrations and clear headings, however, as a relative newcomer to the joys of organic gardening, the information provided in this section was too succinct for my liking. Suggestions were brought up but not expanded upon, which might be enough for anyone with sufficient prior knowledge but was too brief to enable me to hold the information or feel that I was really learning something. There are copious handy hints, particularly in regard to fertilising and mulching, but if you're looking for an in-depth guide to starting your own garden this probably isn't the ideal book to help you do it.

On the other hand, the book isn't setting out to be the definitive guide to permaculture: it's also a cookbook, and in this regard it's got something for everyone. From raw foods to decadent desserts, vegans to fruitarians, cooking for four people or forty, it's all here.

There's ample space given over to foods not often covered in cookbooks, such as fruit, bush tucker, seaweed and edible flowers. Bog Vegie Delight accompanied by elderflower champagne, anyone? There's no shortage of creative and delectable meals to choose from; I've tried a couple of dips and mains so far and they went down well with the housemates. Your garden may well be overflowing with plants and flowers which you had never considered eating, and reading the recipes herein may well change your attitude to that strange bush crouching by the shed.

Reviewed by Fiona Negrin

Bike Culture Quarterly and Encycleopedia

Both publications are only available by subscription or through participating bicycle shops. The Australian representative is *Greenspeed*, who can tell you which shops are stocking them–Ph: (03) 9758 5541 Fax: (03) 9752 4115. Both are available by mailorder from the Bicycle New South Wales bookshop Ph: (02) 9283 5200.

Also check out Open Road's web page at http://bikeculture.com/home/ Price for each publication is $10 plus postage.

The flavour of Bike Culture Quarterly (BCQ) is well described by the cover of the latest (10th) edition, which has Moses standing on his mountain under a fiery firmament holding a bike prophetically above his head in one hand and in the other, a tablet with the number '10' chiselled into it. His gaze is cast over a valley of people who for the most part have been wooed by the lightning emblazoned spectre of an automobile perched atop a towering rock. Only a few faithful followers take heed of Moses who represents truth, justice and the bicycling way.

BCQ could hardly be described as a magazine in the ordinary sense – if your average cycling magazine could be likened to commercial television then Bike Culture Quarterly is the ABC. There is no advertising to interfere with your ingestion of interesting, well

written material. Aimed fairly and squarely at the more purist cyclophiles of the non-racing variety, the publication is a dedicated forum for the global cycling community.

You'll always find a feature on some aspect of the rich history of cycling; in *BCQ 10* a look into the sexual politics of saddles made fascinating reading. In fact, aside from presenting excellent commentary on the current social and political issues in the cycling world, the publication delights in quirky items. There are always lots of interesting articles on some of the world's more weird cycling contrivances and paraphernalia, as well as a good coverage of the most recent and ingenious technical innovations.

The publishers, *Open Road*, also produce a yearbook called *Encycleopedia* which showcases innovative products and ideas from all over the world including recumbents, trikes, fold-ups, portables, tandems, unusual racing bikes and child-carriers.

Reviewed by Adrian Braun

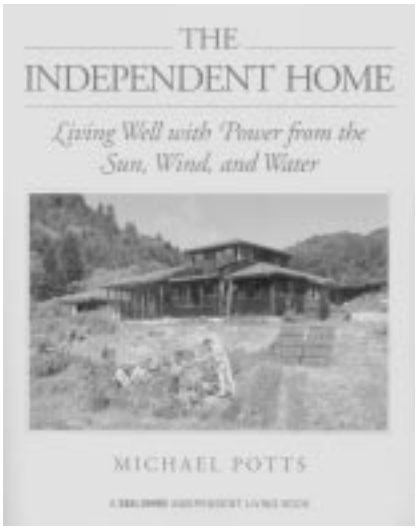
The Independent Home

Michael Potts

A Real Goods Independent Living Book, Chelsea Green Publishing Company, PO Box 428, White River Junction, Vermont, USA 05001, 1993.

300 pp., ISBN: 0 930031 65 2 US$19.95

If I had to choose one book with which to learn the skills, lore and craft of living independently with renewable resources, this would be it. *The Independent Home: Living Well with Power from the Sun, Wind, and Water* has all the information you may need to start to seriously look at setting up a home and powering it from the elements. This book covers everything from choosing a site, to the type of building materials to use. The language is easy to understand, yet comprehensive enough to



give the reader an understanding of the principles of energy conservation and generation.

Michael Potts, who has been building his own independent home for many years, has brought together the theory and practice of using renewable resources with examples from pioneers of independent living across all the climates of the United States of America (from Alaska to Hawaii). He shows how to research, plan and build a home using the successes and mistakes of the people who have developed the techniques needed to utilise renewable energy, as well as the maintenance of the technology once it is installed.

The Independent Home is a good introduction to independent living, leaving the reader with enough understanding to go on and research the subject with greater confidence. The glossary, bibliography and resource lists are a great starting point for those who are just starting out or for those who wish to further their understanding of independent living. There is something here for everyone.

Reviewed by Neil Blenkiron

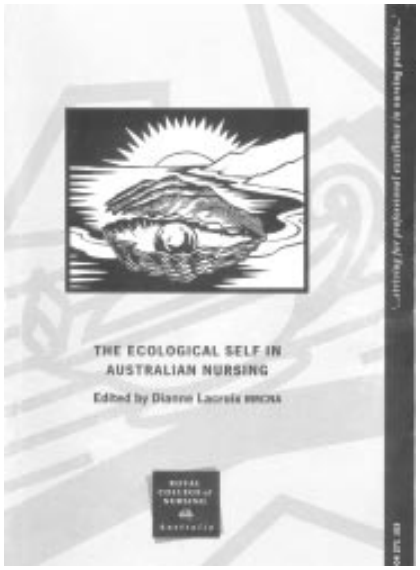
The Ecological Self In Australian Nursing

Edited by Dianne Lacroix, Royal College of Nursing, 1996.

144 pp., ISBN 0 909449 88 0

The central theme of this new Australian book is that nursing must expand beyond its traditional parameters to care for and identify with the natural environment. In support of this idea, the writers propose that in order to gain a more accurate perception of human health, people must be considered in a broader ecological context.

We are feeling the negative environmental effects of our highly disposable modern culture in many areas of our lives, and hospitals are no exception. Hospital owners and employees, argues *The Ecological Self*, cannot deny their responsibility to increase their environmental consciousness, given the large volume of non-biodegradable waste that they produce. Ironically, if they ignore



this responsibility they may end up perpetuating and contributing to the pollution which affects individual health.

The authors are critical of the dualistic and divisive approach upon which mainstream medicine is based. They call for a reassertion of the value of the feminine principle as exemplified in caring, empathy and understanding in regard to healing. The writers point out that the dominance of the empirical approach, which they attribute to a patriarchal world view, has meant an undervaluing of other important ways of knowing and assessing in nursing practice. They call our attention to the need for a reassessment of the world view which regards man as the only measure of value.

It was refreshing to find the writers acknowledging that science cannot justify empirical methods as a means to discovering absolute truth. The appreciation of the whole being as emphasised in this book suggests the exciting possibility for holistic and natural therapies gaining proper recognition by mainstream medicine.

The writers are wise in realising the power of simplicity in alleviating many problems in the individual and the environment. They are genuinely interested in gaining a more accurate perception of human health in a sustainable way; one which recognises the need for more holistic approaches and interdisciplinary efforts.

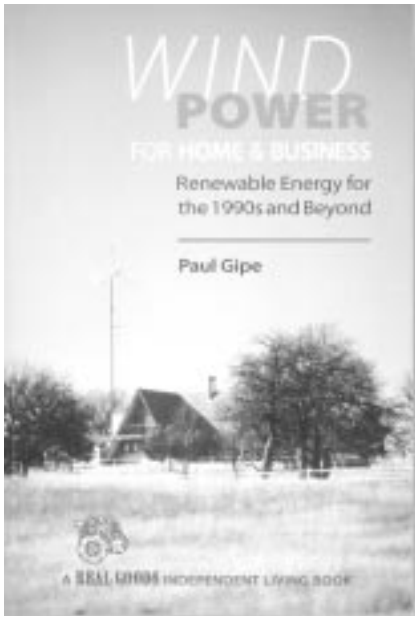
Reviewed by Tania Birmingham

Wind Power for Home and Business

Paul Gipe, Chelsea Green Publishing Company, 1993.

414 pp., ISBN 0-930031-64-4.

Distributed in Australia by Adtech, available for $44.95 plus $5 p&h. Ph.(03) 9532 0682.



Wind Power for Home and Business is yet another addition to the Real Goods renewable energy library, and it maintains the high standard that this series is known for. It provides a comprehensive overview of the wind energy business for anyone interested in wind power, either as a user, installer or general admirer of wind systems.

Paul Gipe, who has been involved in the wind energy field for over 25 years, conveys his experience in an engaging and readable way. His experience includes repair and assembly of machines, installations both small and large, as well as many years as president of the influential American Wind Energy Association.

His book is a guide written to assist people in understanding the design, philosophy and requirements for a good working wind energy system.

Unlike many books from the U.S., the information in this book translates well for use in other countries. It includes Battelle wind maps of each populated continent, so that you can judge for yourself approximately what amount of wind power you can expect at a given location.

Gipe's use of anecdotes makes the often complex technical information more digestible. His descriptions of interconnecting wind power generators with power utilities are particularly amusing, if not a little disheartening, though always presented in a balanced way. Indeed, for someone who has so obviously invested much of his life in the subject matter, Gipe is always honest and realistic about wind power's potential.

Wind Power is essentially a text book, but it is one that leaves the reader feeling optimistic and enthused.

Products

Standing guard

In this world of steadily shrinking forests and barren, eroded landscapes, seedlings need all the help they can get.

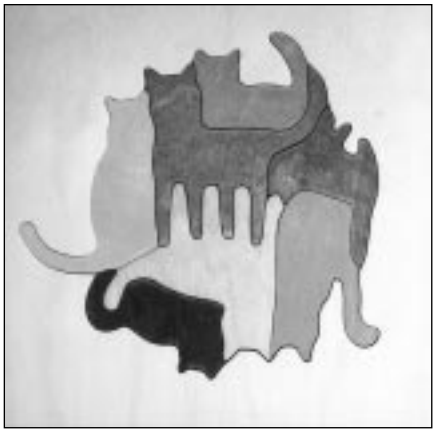
Of major importance is protection of the seedling from physical damage, either from animals or the elements.

Sure Gro have a range of seedling protectors for just this use. Sure Gro say that these protectors are capable of protecting plants from excessive UV exposure while still allowing through the light frequencies needed for proper plant growth.

According to Sure Gro, having a guard around the seedling promotes increased trunk diameter and strong root structure through protection from high winds. High temperature burning problems are also eliminated. Sure-Gro recommend their product be used in conjunction with weed control, fencing, ground preparation and seedling selection.

rrp 0.32c each or $300 per 1000.
for further information, contact E&RT Sure-Gro, 2 Plane Tree Ave, Dingley, VIC 3172, ph:(03)9558 1060 fax: (03)9558 0505.

Fitting the pieces together



Jigsaw puzzles can be fun for kids of all ages. But cheap cardboard puzzles don't often last long in the hands of most children.

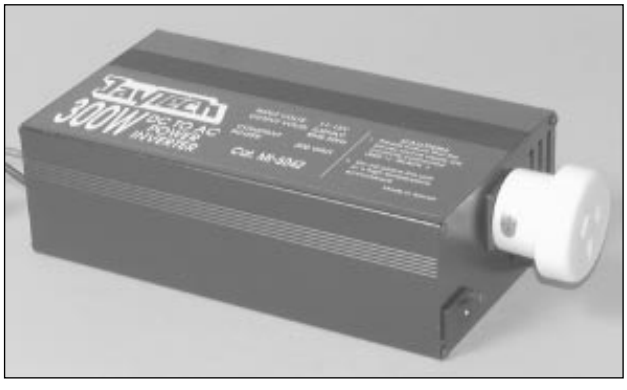
The Pacific Puzzle Company sells a range of durable wooden puzzles with many different themes, including dinosaurs, birds, people, and world maps. The puzzles are mostly the flat jigsaw puzzle style, but there are also two 3D puzzles that assemble into solid objects – an apple and a sandwich!

These hardwood puzzles are cleverly designed to be more difficult than they look. Pacific Puzzle say that their puzzles are painted in non-toxic paints, and that the company itself uses renewable energy to produce them. The puzzles range in size from the palm-sized apple puzzle, right up to the large world puzzle that measures 68.5 x 48cm.

Credit card facilities are available, and Pacific Puzzle will ship to just about anywhere in the world. They also have a web site at http://www.pacificpuzzle.com.

rrp depends on puzzle ordered.
for further information, contact Pacific Puzzle Company, 378 Guemes Island Rd, Anacortes WA 98221, USA, ph:1800 467 0242 (inside USA) or email:ppc@pacificpuzzle.com

Compact power



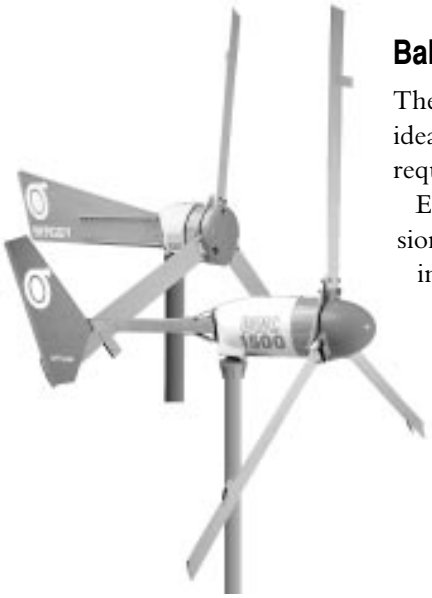
It seems inverters just keep getting smaller and smarter all the time, and the new Jaytech 300 from Jaycar Electronics is no exception.

This inverter has all the usual features, such as low-voltage cutout, overload, temperature, short-circuit and reverse-polarity protection.

The Jaytech 300 has a continuous output of 300 watts, with a very useful 800 watt surge rating. This should allow it to power most appliances with a rating of 300 watts or so, and even run some of the more efficient fridges on the market.

The inverter is quite compact for its power output capacity, being 205mm x 115mm x 65mm high, and weighing in at 1.5kg. Jaycar state that efficiency figures are typically around 85 percent, with the output frequency (50Hz) being accurate to +/– 1 percent.

rrp $229.50
for further information, contact: Jaycar Electronics, (02)9743 5222, fax (02)9743 2066. Jaycar also have stores in most capital cities.



Baby Bergeys

The latest models from Bergey Windpower, the BWC1500 and the BWC850, are ideal for independant and remote area power systems. Bergey says these machines require no maintenance and yet still provide reliable power.

Each model is available in both battery charging, marine, and water-pumping versions. The battery charging models are all supplied with their own regulator included in the price, and don't require load dumps for proper operation.

Each machine comes with a two-year guarantee, which covers them in speeds up to 190km/hr.

rrp from $4,500 for the basic BWC850 setup.

for further details, contact Adtech Australasia, 37 Isabella St, Moorabbin, VIC 3189, ph:(03)9532 0682, fax:(03)9555 8142, email: Adtech,100354,1757@compuserve.com

Fuzzy washing

We first heard of Fuzzy Logic in relation to a noodle cooker from Japan, but it seems that this curious concept has now infiltrated the world of washing machines. The machine in question is the beautifully named WFK2400AU, from Bosch.

According to the manufacturers, the WFK has the ablility to make decisions concerning load and cycle and adjust itself to individual washing needs. This means less water wasted on smaller washes and an energy usage of 0.65kWhrs for a 40°C wash temperature. The WFK has a five star energy rating, as well as an AAA water use rating.

Other features include foam suppression, a nineteen-hour time delay, interval spinning, a quick-wash button, variable spin speeds, and fuzzy-logic controlled out-of-balance spinning.

rrp $2,150.

for further information, contact: Robert Bosch (Australia) Pty Ltd, ph:1800 802 888.

Slow-combustion cookery

Slow-combustion wood heaters have become quite popular in recent years. One of the reasons for this is that they make far better use of fuel than a conventional open fire.

Biomass Energy Services and Technology (BEST) have made use of that fact in producing the Eco-cooker. According to BEST, the Eco-cooker is a realistic option as an alternative to conventional gas or electric stoves, and can be fueled on either wood or charcoal.

Features of the hand-made Eco-cooker include high levels of insulation, a cast-iron hotplate, a large-sized oven and separate large warming oven, and a built-in water jacket.

The oven is coated in a matt-black finish, with stainless-steel handles and oven top for easier cleaning.

rrp $4,200.

for further information, contact: Biomass Energy Services and Technology Pty Ltd, 1 Davids Close, Somersby NSW 2250, ph:(043)40 4911, fax:(043)404 878.

Products

Friendly fly trap

The Ivegotcha fly trap is simple, effective and safe to the user and the environment. It turns a used plastic soft drink bottle into an effective fly-killing device without the use of pesticides or other chemicals.

You use the trap by placing a lure, consisting of a piece of raw meat or fish, along with a little water or softdrink, into the bottle. The black plastic stopper is then pushed into the neck of the bottle, and the bottle hung up in an appropriate place (preferably as far from the house as possible!).

Flies are attracted by the odour and fly through the holes at the top of the stopper, but will not leave the bottle because the exit looks black – eventually they fall into the liquid and drown.

The trap can work for months at a time, and the bottle need only be checked occasionally for moisture and bait. When desired, the stopper is removed to allow disposal of the flies, and the trap reset with a new lure.

rrp $2.95 for a pack of two units.
for further information contact Vic Fedorow on ph/fax:(07)554 52875 or write to 65 Guanaba Road, Mt. Tamborine QLD 4272.

Energy-efficient windows

There are many areas of a home that can be altered to improve energy efficiency, but one often-overlooked area are the windows.

Rylock have now released their Victoria series windows, which, according to Rylock, combine aluminium and timber to produce a window that is low in maintenance yet still looks good.

The insulating properties of wood on the inside of the window have also contributed to them gaining a five star window energy rating from the Australasian Window Council.

rrp depends on application.
For further information, contact: Rylock Australia, 47 Shearson Cresent, Mentone, VIC 3194, ph:(03)9583 9222, fax:(03)9583 1487, or Rylock New Zealand, 30 Bowden Rd, Mt Wellington, Auckland, ph:(09)573 0531, fax:(09)573 0539.

Compact compact fluorescents

There are many compact fluorescent lamps (CFLs) on the market, but many have bases (the ballast) that are too big to fit into some lamp fittings.

Nelson Lamps have come up with a new range of compact fluoros with much smaller ballasts than most other lamps. The base of these lamps are not much larger than the width of the tubes, and the overall lamps are shorter than many other CFLs on the market, with lengths ranging from 125mm for the 7 watt unit, to 175mm for the 75 watt lamp.

The tubes in this range of lamps are of the conventional 'long' style of CFL, and are not removable from the bases. These CFLs range in size from 7 to 15 watts, being equivalent to 40 to 75 watt incandescant bulbs.

Nelson state that these lamps have a life expectance of around 8000 hours. The Nelson lamps are available in both bayonet and Edison screw fittings.

rrp approx $20.

for more information, contact: Absolutely Solar, 16 Arcadia Way, Eltham Nth, VIC 3095, ph:(03)9439 4829, or Nelson Lamps, 37-39 Kolora Rd West Heidelberg, VIC 3081, ph:(03)9457 5544, fax:(03)9457 5934.

Dateless again?

Wouldn't it be great to see wonderful Australian landscapes and cute Aussie animals whenever you opened up your diary? Well, this is what you'll see if you use either the Wilderness Diary or Natural Desk Diary from the Australian Conservation Foundation (ACF).

These diaries contain many full-colour photos as well as maps and biographical profiles on some of the photographers. The Wilderness Diary has one photo for each week of the year, while the Natural Desk Diary has a new photo every second or fourth week.

The pages in each diary are made up of 50 percent recycled oxygen-bleached pulp (15 percent post consumer and 35 percent pre-consumer waste) and 50 percent plantation pulp.

rrp $18.95 for the Wilderness Diary, $29.95 for the Natural Desk Diary.
for more information, contact: the Australian Conservation Foundation, 340 Gore St, Fitzroy, VIC 3065, ph:(03)9416 1166, fax:(03)9416 0767.

Oil spill absorbents

One of the largest threats to marine environments comes from oil spills. However, oil is a problem wherever it isn't properly contained, and can cause all sorts of damage to land and property.

According to Enretech Australasia, their oil-spill absorbent, Enretech-2, can soak up oil spills and bio-remediate the oil into usable compost.

This product, a natural absorbent cellulose material made from a waste product of the cotton industry, can encapsulate oil while it is still on the water surface. The result is said to be a solid mass that be simply scooped up for disposal. The oil will then be broken down by the naturally occuring micro-organisms in the cellulose.

Enretech say that their product is non-toxic, non-carcinogenic, non-abrasive, non-volatile and an effective vapour suppressant. Enretech products can also be used on land spills to decontaminate soils, as well as for containing garage floor spills.

rrp $25.95 for a 14 litre bag.
for more information, contact: Enretech Australasia P/L, 403/200 Pacific Highway, Crow's Nest NSW 2065, ph:(02)9964 0588, fax:(02)9964 9175.

Radiant heating system

Radiant heating systems have the benefits of being silent, safe and invisible. Radiant heat travels in a straight line, like standing in the sun on a cool day, so that you feel warm even when the air is cool.

The Safe-t-heat system is a radiant heating system that comprises Safe-t-flex flexible carbon-ink elements which are cut to any length and are installed above the ceiling between the joists. They are then covered with insulation to improve efficiency. As each room, or group of rooms, can have its own thermostat, the temperature of each room can be regulated separately. Safe-t-heat say that thermostats can be set four or five degrees lower than for conventional sytems and for every degree celcius the system is lowered, a six percent energy saving can be achieved. This system is also suitable for plant propagation to reduce cold damage to seedlings.

rrp depends on the application.
for further information contact Safe-t-heat Products P/L, ph:(09)240 1833, fax:(09)240 1696 or ph:(03)9437 0455, fax (03)9437 0149.

Australian Home Greenhouse Scorecard software

Available for Windows and Macintosh (Windows version tested).

The enhanced greenhouse effect arises from the global of the earth's atmosphere caused by the burning of fossil fuels, farming and clearing of forests. Scientific evidence suggests that the subsequent rise in temperature will have an adverse effect on humans, animals, and vegetation because of the alteration of weather patterns and rise in the sea level.

The Australian Home Greenhouse Scorecard is a computer software kit incorporating a comprehensive hardcopy manual. The manual provides detailed information about the greenhouse effect, describing what it is, what greenhouse gases are and how they are created, how to reduce greenhouse gas emissions from households, and solar radiation, infra-red radiation and the greenhouse effect.

The major advantage of the software is its interactive nature. It can be used by professional advisers (engineers, architects, designers, and builders), schools (secondary schools and the higher grades of primary schools), and concerned members of the general public.

The manual contains useful suggestions for how individuals and groups can best utilise the software. And to reinforce learning about the greenhouse effect, it also contains a set of activity sheets covering topics like data collection, observations and calculations and comparisons of household appliance usage.

The aims of the kit are three-fold: to provide a means of estimating the annual greenhouse gas emissions from a

household; to contrast emission levels with other households, in particular a 'green' home; and to reduce gas emission levels by discovering and then adopting new forms of behaviour, including using alternative appliances and modes of transport.

The kit's graphical interface means that it is easy to use (online help is readily available if needed). The main window of the application displays a pictorial representation of a typical household. Greenhouse gas contributors depicted here include a refrigerator, stove, bath, heater, air conditioner, car/bus stop (transport) and television. By pointing to and clicking on these objects, it is possible to create your own home greenhouse scorecard. Once compiled, your results can then be compared to other scorecards, with one of the most interesting comparisons being against the scorecard of a green home.

The Australian Home Greenhouse Scorecard is an innovative use of modern computer technology which can be effectively used to help people lessen the greenhouse effect (and to save some money in the process).

Reviewed by Tony Stevenson, MKD Software Consulting
email: acsmls@acslink.net.au

RRP: Single ($89); Site ($199)

System Requirements

This computer kit can be installed on either a PC or a Macintosh computer.

The Windows version needs an IBM or compatible computer (386 or higher), Windows 3.x or Windows 95, 4 MB RAM (8 MB recommended for Windows 95), 6 MB hard disk space, VGA (or better) monitor, and a mouse.

The Macintosh version needs System 7, 6 MB RAM, 15 MB hard disk space, and a 680x0 processor or Power Macintosh.

Distributor: Edsoft.
Phone: (03) 9878 4899
Freecall: 1800 338 873

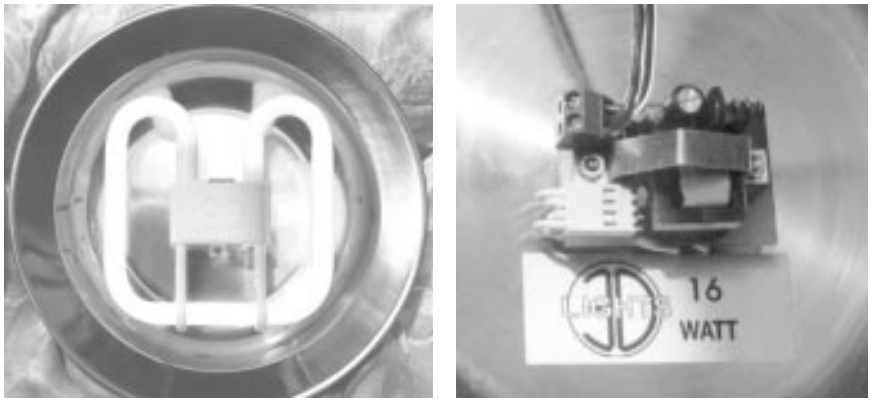
3D 12V fluorescent light

Lights are probably the most used household electrical appliance, and for many people who start their own renewable energy system, lights are often the first piece of hardware installed.

There are only a few sensible lighting options for independent power systems: fluorescent, halogen and high brightness LED arrays. A Victorian-based company, 3D lights, is manufacturing and distributing an interesting 12V fluorescent option at an affordable price.

The 3D 12V light comprises a 2D fluorescent tube fastened to a polished stainless steel reflector dish (about the same diameter as a dinner plate), with ballast and electrical connection point attached on top.

We used the 3D light with a small solar setup (11W Solarcorp panel charging two 6V, 10ah sealed lead-acid batteries, with a simple shunt regulator) over a two month period, and found that it performed very well. Although the power system was a little under-sized for the requirements, we



The 3D light with 2D tube (left) and inverter/ballast and connection point (right).

were able to use the 3D for several hours every evening to light a large living area.

The light cast by the 3D was considerable, both in terms of brightness and light spread (the instructions say it reaches 1,000 lumens after about 10 minutes). It is also simple to install, with a single hook in the roof sufficient to suspend it. The two clearly marked power terminals make the electrical connection easy, and a great feature is that the unit can not be harmed by incorrect connection polarity.

We had only two concerns with the 3D light. One was that the ballast does not have a casing, though as the light is suspended out of the reach of wandering fingers, this should not cause any problems. The other concern was an occasional, very slight flicker in the tube. While this did not cause any serious problems like blacking out the room, it was a little disconcerting. This problem may have been caused by a fault in the ballast/inverter, though I was somewhat reassured by the 12 month inverter guarantee.

The 3D light is a fairly attractive, compact and easy to install unit. At $50, it is also good value, and is made all the more attractive by the guarantee on the ballast.

Reviewed by Michael Linke

RRP: $50 (includes postage)

Ballast: Consumes 1 amp at 12V, producing 1050 lumens of light.

Tube: 2D 16 W fluorescent, lifetime expectancy 8,000 hours.

Distributor: Distributed by manufacturer, 3D lights, RSD Goongerah, Victoria 3888. Ph: (03) 5154 0151.

Noel's treasures from trash

fun things for clever kids to make

To make these simple syphons and pumps you will need:

- a 500ml plastic bottle with a screw-on top
- two drinking straws or tubes about 6mm in diameter
- a drill bit the same size as the straws
- some waterproof glue
- a thin plastic bag
- two rubber bands

When it comes to moving large amounts of water, such as emptying a fish tank or a broken washing machine, the bucket method can be slow and labourious. A better alternative is to let a syphon or pump do the hard work.

A simple syphon

A syphon can be made from something as simple as a piece of garden hose. It works by submerging the entire length of tube in the water, so that the hose fills completely. You then place your thumb over one end and withdraw the hose so that the other end is still submerged.

By holding the sealed end lower than the water level in the tank and removing your thumb, the weight of water in the hose will cause water to be drawn from the tank. Gravity does all the work for you! This simple device will keep drawing water until either the water level in the tank goes below the end of the pipe outside the tank, or air gets into the pipe from inside the tank.

This type of syphon has been used for many years, but there is a more spectacular type of syphon which you can build from a few simple materials.

Making the syphon

Drill two holes in the bottle lid, making sure they are separated by about 4mm. Push one of the straws about 30mm into one hole, and the other straw about halfway through the other hole. Seal the straws into place with the glue, making sure not to get any on the threads of the bottle cap.

Believe it or not, that is all there is to this syphon. To make it work, fill the bottle about one-third full and screw the cap on. Turn the bottle upside down and place the shorter straw into a container of water, with the long straw pointing into an empty container to catch the water being pumped.

Once the syphon starts working, you should be able to see the water spurting up out of one straw inside the bottle.

The syphon becomes a pump

This simple syphon can easily be converted into a self-priming pump. All you need are a couple of small pieces of plastic and two rubber bands.

Start by cutting two pieces of plastic from the plastic bag, about 70mm x 40mm. Wrap a piece of plastic around the end of the straw that hangs lowest in the bottle with the bottle on its base. You will need to have about 25mm of the 40mm width of the plastic sticking out the end of the straw. Hold this in place using one of the rubber bands. Repeat this on the straw that sticks up the highest outside the bottle.

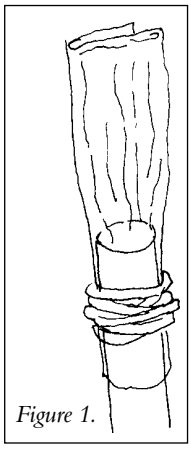


Figure 1.

The pieces of plastic act as one-way valves so that water will only flow in one direction. This can be seen in Figure 1. Now screw the top back on the bottle and your pump is finished.

Place the shorter straw into a container of water, and squeeze the bottle gently and release it. The outer valve closes and the lower pressure inside the bottle sucks water into the bottle. When you squeeze the bottle again, the inner valve closes and the water is squeezed out of the other straw. ⋆

The syphon is on the right, while the pump is on the left.

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what's on

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Info Days

☼ **Saturday 14 December**
Going Solar, Victoria Pde Nth Melbourne (opp. Vic markets)
Issues such as choosing the right system, living with solar hot water and understanding system operation will be discussed. Other info days for 1997 are listed below:

- 11 January – Food dehydrators, water purifiers and WonderWash
- 8 February – Non-toxic paints and varnishes
- 8 March – Gas refrigeration/Earth Garden magazine
- 12 April – Wood heating and hot water
- 10 May – Battery chargers and batteries
- 14 June – Owner Builder magazine
- 12 July – Wind generators/ReNew magazine
- 9 August – Worm farms/Grass Roots magazine
- 13 September – Beekeeping
- 11 October – Introduction to solar
- 8 November – Composting toilets
- 13 December – Solar hot water

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

Solar Cooker Conference

☼ **6-10 January, 1997**
Tamil Nadu, India
This third international conference is aimed at promoting the use of solar cookers in both Third- and Western-World countries.
Contact: Solar Cookers International, 1724 Eleventh St, Sacramento, CA 95814 USA, ph: +1 916 444 5379, fax: +1 916 444 6616, email: SBCI@igc.apc.org

Earthlinks '97

☼ **13-17 January**
University of Tasmania. Hobart
Aimed at bringing together environmental educators to explore ways of reconnecting with the Earth, while giving participants the chance to experience Tasmania's unique environment.
Contact: Contact: Nel Smit, Education programs, Dept. of Education, GPO Box 919, Hobart TAS 7001, ph:(002)33 7726 fax:(002)33 6980, email:cs_nel@ecc.tased edu.au.

Great Southern Sunrace

☼ **24-28 January, 1997**
Adelaide to Melbourne
First annual solar car race from Adelaide to Melbourne via Elizabeth, Peterborough, Broken Hill Mildura and Bendigo
Contact: Sustainable Energy Enterprise Developments, phone:(03)9820 9032, fax:(03)9820 2027.

Cleaner Production Showcase

☼ **29 & 30 January, 1997**
Hilton Hotel, Sydney NSW
This conference is designed to provide information on cleaner production techniques using a series of case studies from various industries. Cost $1495 for the two days, or $1595 including the pre-conference workshop.
Contact: Jill Owen, PO Box 2133, North Sydney, NSW 2059, ph:(02)9929 5366, email: iir@ozemail.com.au

Small Hydro Conference

☼ ***3-7 February, 1997***
Hyderabad, India
First international conference on small hydro aimed at providing a forum for exchange of information and hydro and related technology between countries.
Contact: Organising Secretary, First International Conference on 'Renewable Energy – Small Hydro', CBIP Building, Malcha Marg, Chanakyapuri, New Delhi-110021, India, ph:+91 011 301 5984, fax:+91 011 301 6347, email:cbip@cbipdel.uunet.in.

Seymour Alternative Farmvision Expo

☼ **14- 16 February, 1997**
Kings Park Complex, Seymour, VIC
This annual event provides information and displays on alternative methods of farming and agriculture.
Contact: Seymour Alternative Farming Expo, PO Box 158, Seymour VIC 3661, ph:(057)99 1211, fax:(057)99 1311.

Moora Moora Festival

☼ **Saturday 22 February, 1997**
Moora Moora Community, near Healesville, VIC
The theme of this year's festival is 'Living in the bush on Mt Toolebewong', demonstrating a range of lifestyles that allow people to live in harmony with the land.
The festival will feature music and dancing, craft markets and talks, demonstrations and workshops on topics such as renewable energy, building techniques, health and conservation.
There will also be tours of the owner-built houses and a short story competition.
Entry is $20 for families ($15 concession) and $12 for adults ($10 concession). Contact: Dr Bob Rich, PO Box 214, Healesville 3777, ph:(059)62 3875 or ph:(059)62 4104.

Environmental living show

☼ **29 March–26 April, 1997**
Melbourne Exhibition Centre, VIC
This year's Home Ideas Show will include a section on environmental living. The ATA's Energymobile will also feature at the show.
Contact: Australian Trade Exhibitions, PO Box 192, Camberwell, VIC 3124, ph:(03)9819 0211, fax:(03)9818 8558.

Solar Boat Challenge

☼ **12 April, 1997**
Lake Burley Griffin, Canberra
Five different classes in this years solar/advanced technology boat challenge will see competitors ranging from large commercial businesses to hobbiest boating enthusiasts.
Contact: Mary-Anne Waldren on ph:(06)205 0588, or write to PO Box 193 Civic Square, Canberra ACT 2608.

Alternative Farmvision Expo

☼ **2–4 May, 1997**
Geelong Showgrounds, VIC
Combines traditional and alternative agricultural methods with interesting and entertaining displays and presentations.
Contact: John Jackson, PO Box 1656, Geelong VIC 3220, ph:(052)21 1966, fax:(052) 21 1904.

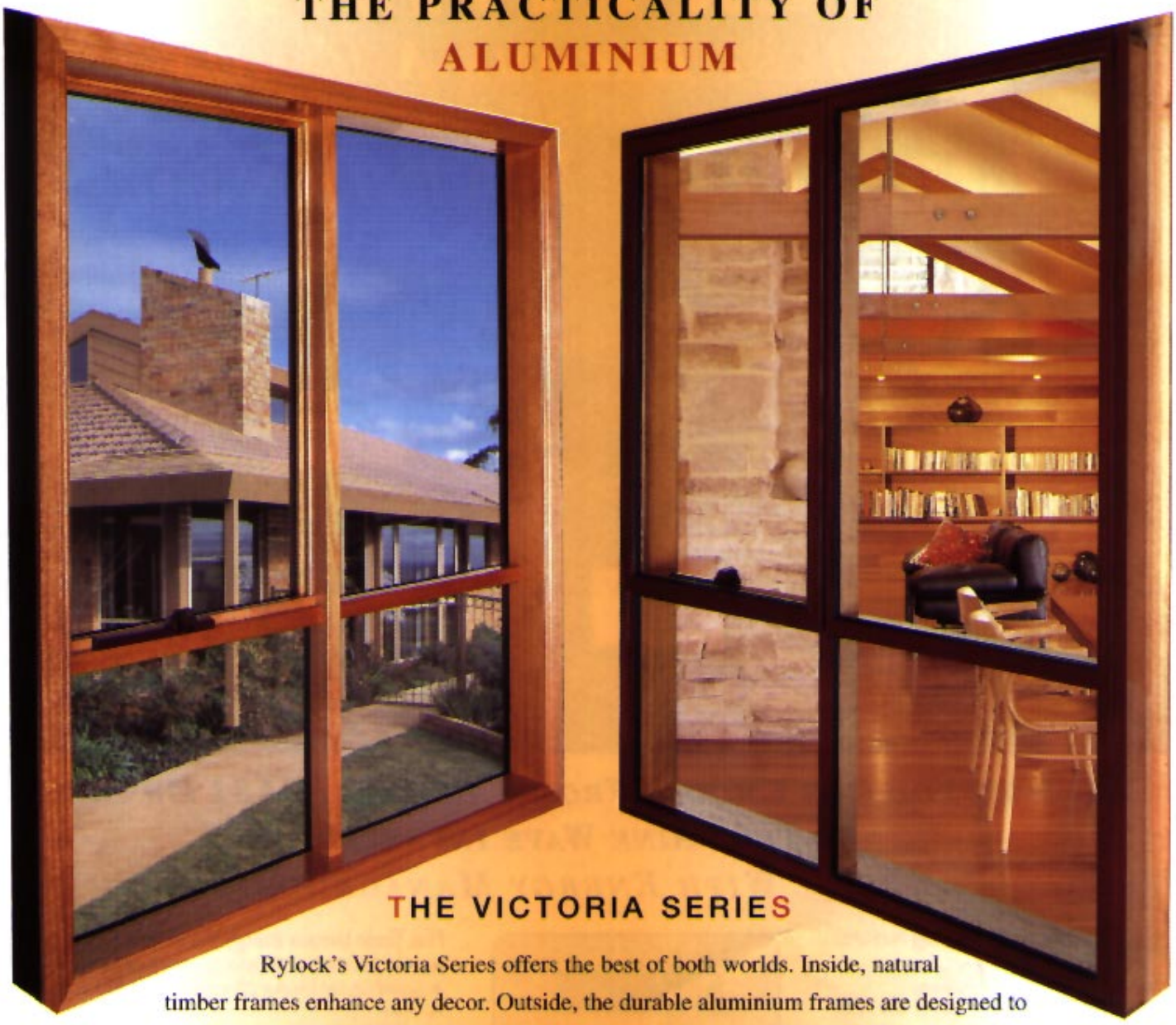
World Sustainable Energy Trade Fair

☼ **27–29 May, 1997**
Amsterdam, Holland
This exhibition aims to show that sustainable sources of energy can compete with traditional power generation on an economic basis.
The fair will be divided into three sections: Renewable energy, Waste to energy and Sustainable transport.
Contact: European Media Marketing Ltd, 6th floor, 22-26 Albert Embankment, London SE17TJ, ph:+44 171 582 7278, email:sustain@emml.demon.co.uk.

Pathways to Sustainability

☼ **2–6 June, 1997**
Newcastle, NSW
Final phase in an international review of Local Agenda 21, with the outcomes presented to a special session of the UN in late June
Contact: Conference Secretariat, Pathways to Sustainability, PO Box 489, Newcastle NSW 2300.

ENJOY THE BEAUTY AND WARMTH OF NATURAL TIMBER WITH THE PRACTICALITY OF ALUMINIUM



THE VICTORIA SERIES

Rylock's Victoria Series offers the best of both worlds. Inside, natural timber frames enhance any decor. Outside, the durable aluminium frames are designed to last. The series is available in both single and the comfortable energy efficiency of double glazing, in a wide range of colours, styles and size. Rylock's advanced design features include maximum strength, multiple weatherseals and secure locking devices. Every window in the Victoria Series is designed and manufactured for a long, low-maintenance life.

The Rylock Victoria Series Window has won the National Energy Efficiency Award – Master Builders Australia, and has recently gained a 5 Star Window Energy Rating from the Australasian Window Council Inc.

Whether building or renovating, the Victoria Series is a stunning new range from Rylock – Australia's leading custom window company.

Rylock WINDOWS & DOORS®
VICTORIA SERIES

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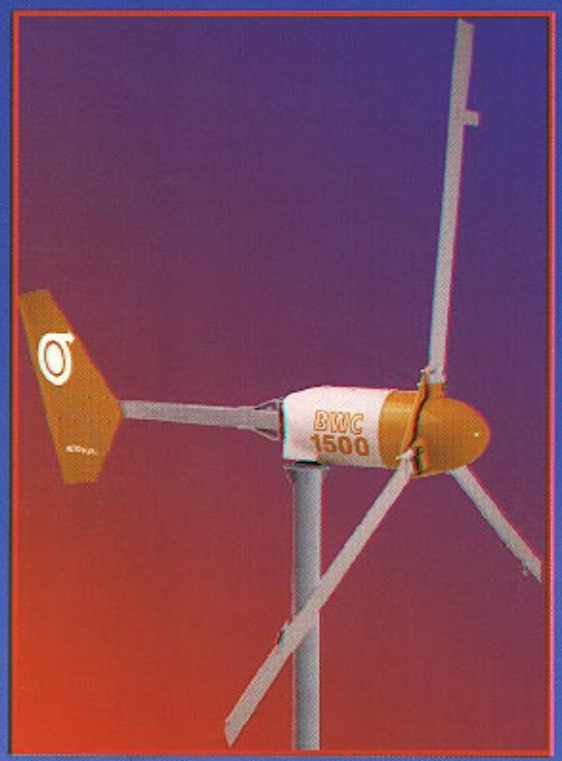
ADELAIDE: 3 Deacon Avenue, Richmond 5033 **Ph: (08) 8234 8999** Fax: (08) 8234 0020
HOBART: 23 Derwent Park Road, Derwent Park 7009 **Ph: (03) 6272 0088** Fax: (03) 6273 9139

The maintenance instructions for a wind machine should simply read: *"Once each year, on a windy day, walk out to the base of the tower and look at the turbine. If the turbine is turning ... it's OK."*

-Prof. Karl Bergey.

(Professor of Aeronautical Engineering, Oklahoma State University, designer of the Piper Cherokee family of aircraft, and designer of Bergey wind generators.)

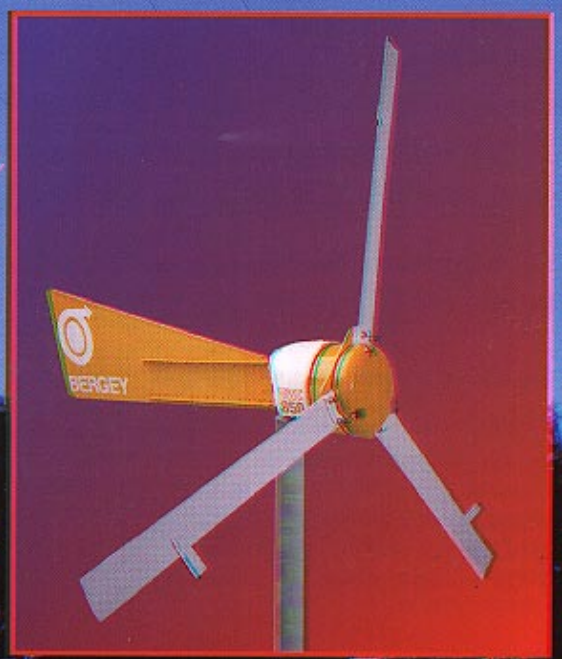


BWC 1500

The BWC 1500 is a modern 1500 watt (1750 Watt max.) wind turbine designed for high reliability, low maintenance, and automatic operation in adverse weather conditions. It is available in both battery charging and water-pumping versions.

All BWC machines come complete with their own dedicated battery charging control units. The BWC 1500 controller is a sophisticated and rugged taper charge controller which guarantees fully automatic operation for maximum battery life. BWC turbines don't require messy 'dump loads' for proper regulation or turbine speed control; however, excess energy can be diverted once batteries are charged. For example excess power can be used for water heating etc. This is the ideal unit to supply the needs of a normal family.

"With over 45 million operational hours in some of the harshest locations on earth, and requiring no scheduled maintenance, Bergey wind turbines set the standard against which other windpower systems are judged ...."



BWC 850

The BWC 850 is a modern 850 watt (1100 watt max.) wind turbine designed for high reliability, low maintenance, and automatic operation in adverse weather conditions. It is available in battery charging versions with outputs of 12 volts, 24 volts or 48 volts. A marine version for oil rigs, reporting buoys etc. is also available.

The BWC 850 is well suited for rural homes, monitoring stations, and telecommunication sites. It uses the same patented POWERFLEX™ rotor system used on the BWC 1500 & 10,000 Watt BWC Excel - the system that makes Bergey one of only two manufacturers able to meet U.S. Telecommunications industry requirements for reliability & low maintenance.

For more details on Bergey Wind Turbines (850 W-10,000 W), Adtech Quality Tilting Towers , and complete windpower based home, farm & village power systems, fully installed, contact the windpower professionals:

ADTECH AUSTRALASIA

"No ... it's not just about wind"

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