SOLAR AND WIND POWER REGULATOR BUYER'S GUIDE

ReNew

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DIY water powered pump

Veggie Van: swapping diesel for vegetable oil

Keeping compost toilets fly-free

Portland's wind farm proposal

Make a solar herb drier

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Issue 65
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FLOODED							
7G	6	190	210	26.9	260	181	276
9G	6	215	239	28.8	260	181	276
8C6V	6	330	366	44.2	298	178	365
8L16	6	370	420	51.2	298	178	419
8KFS	12	135	150	35.8	346	171	292
9C12	12	228	253	57.5	394	178	362
GELTECH							
8G27	12	86.4	98	28.9	324	171	251
8G31OT	12	97.6	108	32.0	329	171	240
8G4D	12	183	210	58.9	527	216	254
8G8D	12	225	265	72.9	527	279	254
8GGC2	6	180	198	31	260	181	276

* NOMINAL

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

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

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Email: contact@federalbatteries.com.au

Also available from selected Solar shops and specialist battery outlets.

Contents

Issue 65
Oct-Dec '98

features

Photo: Courtesy Paul Gipe

California paved the way for modern wind farms, but not without learning a lot of things the hard way.
Story page 30.

John Hermans shows you how to make a waterwheel that can pump over 2000 litres per day.

Fuel cells are here! The first fuel cell systems have arrived on the Australian market. Read about them in *Products*, page 77

regulars

Photo: Courtesy Solar Sailor

The cover: Sailing will never be the same again! The Marjorie K, one of the most spectacular vessels to cruise Sydney Harbour, could be a sign of bigger things to come. Find out how it uses wind and solar together to create the water craft of the future, and about its larger cousin, a passenger carrier to be built for the year 2000 Olympics.

Photo: Courtesy PLAN International

Which bank? Flying in the face of banking orthodoxy, the Grameen Bank loans only to the world's poor, and has better repayment rates than conventional western-style banks.

About ReNew

Formerly titled *Soft Technology*, *ReNew* is published by the (Australian) Alternative Technology Association, a non-profit community group involved in promoting and using appropriate technology. *ReNew* features solar, wind, micro-hydro and other renewable energy sources. It provides practical information to people who live with these energy sources, and demonstrates real-life applications to those who would like to.

ReNew also deals with sustainable transportation and housing, conserving resources, recycling and broader environmental issues.

ReNew is available from newsagencies, by subscription, and as part of ATA membership. ATA membership costs $40 per year, and offers a range of other benefits.

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Technical Editor: Lance Turner
Associate Editor: Suelette Dreyfus
Advertising: Libby Anthony
System diagrams: Chris Mueller

Editorial and production assistance: Cable Daniel-Dreyfus, Erika Maksem, Ross Blair, Fiona Negrin, Elenor Rayner, Richard Turner.

Advertising is available for products and services relevant to our audience. We reserve the right to refuse advertising at our discretion. Direct advertising enquiries to:

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

Contributions are welcome, guidelines available on request.

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editorial

A slice of life at *ReNew*

It's a typical day in our office. The noise of construction work is constant, so loud that we have to raise our voices to communicate. There are five of us here today in this pigeon hole office, nestled in with half a dozen filing cabinets, bookshelves and a whole lot of what we fondly call 'debris'.

Lance Turner the technical editor is out at lunch, he has had his non-leather shoes re-soled and is picking them up. I've just remembered that we haven't contacted Chris Mueller, the guy who does our system diagrams, to let him know we need one for the regulator buyer's guide. Chris lives up in the hills with his expanding new family, and sends us the diagrams by email. We're always lumbering him with last minute jobs, and he's quite patient with us, but just this once I think we should get something to him early. I have written Lance a post-it note to remind him.

Libby Anthony, the Alternative Technology Association's General Manager and *ReNew*'s advertising sales person is sitting at her desk, writing a letter. We all think she works too hard, but she hasn't slowed down her pace the whole time she has been here. Erika Maksem, a volunteer who walked into the office for the first time a few months ago is working on a feature story about a residential development in South Australia. She tells me it's starting to come together, but she hasn't got any photos for it yet. It sounds interesting, and from what she has told me it goes some way beyond the bells and whistles of 'sustainability'. On the page-plan it's down as starting on page 22. Erika is working at the computer we use to receive faxes, so one of her jobs is to filter out the important ones and commit them to paper. 'Do we want this one from Robert Hill?' Our beloved federal environment minister sends us a propaganda fax every couple of days, telling us what a good job the government is doing of managing our forests. It's comforting to know that we don't have to waste any trees on him with our fax set-up, they just go straight into the virtual rubbish bin.

Cable Daniel-Dreyfus is out to lunch. She's switched off her computer monitor to save energy—she has become indoctrinated since she started volunteering with us early this year. She's finished writing her story about the lessons that Australia can learn from the California wind farms that were installed in the early 1980s, and has just started the equally challenging job of laying it all out in the computer layout program.

The rest of the team that have made this issue possible are scattered across Australia, and even the globe. Our international contribution for this issue comes from Joshua and Kaia Tickell, care of Home Power magazine in the US. This remarkable duo have travelled across America in a van powered largely by vegetable oil from fast food fryers! Their story of commitment to promoting renewable energy starts on page 14.

This may well be the last issue of *ReNew* that we produce from our current office in the centre of Melbourne. We're hoping to move to a passive solar, solar electric-powered office at the CERES environment park by the next issue, but more on that next time. Oh, and if you were wondering, the plans for the strawbale extension that appeared in the last issue are still at the building permit stage—it's a long, slow process!

Happy reading.

Michael Linke

Another great *ReNew* *subscriber prize*

Adtech AC/DC control panel

valued at $1300

A renewable energy system can be a beautiful thing: solar panels glistening in the sun, a wind turbine spinning in the breeze. But too often the 'brains' of the system are a mess: a control shed with wires running everywhere, meters hanging in mid air and alligator clips holding it all together is a common sight. An untidy looking system can give uninitiated visitors a low opinion of renewable energy systems, and can be downright dangerous.

But there's no reason why a control shed can't be beautiful too. The Adtech AC/DC controller can go a long way to making this possible. It incorporates several key system components in one attractive, powder-coated box. It includes fusing for a battery bank and two DC inputs (wind and solar or a battery charger, for example), input for a 240 V AC inverter, 240 V AC fused output terminals, and a range of optional extras, including an automatic generator changeover switch and a BP Solar regulator.

ReNew subscribers and ATA members who join or renew their subscriptions or memberships before 1 February 1999 will go into the draw to win an Adtech AC/DC control panel, valued at $1300. See the conditions below, and get your subscription in today!

Features of the Adtech AC/DC control panel

Standard components

- 200 amp main battery fuse/isolator
- 2x40 amp fuse/isolators for solar/wind/hydro/battery charger or low voltage equipment (pumps, lights etc.)
- 240V AC inverter input
- 240V AC backup generator input
- 240V AC output fuse
- 240V AC output terminals

Extras included with prize

- BP Solar Regulator, 30 amp, 12 V or 24 V
- Automatic 240V AC generator changeover switch, switches loads automatically between the inverter and the generator.

Conditions and how to enter

(1) The competition is open to anyone who subscribes to ReNew or joins the Alternative Technology Association (ATA) during the competition period, including existing subscribers and ATA members who renew their subscription/membership during the competition period.

(2) A subscriber/ATA member who has purchased an Adtech AC/DC control panel during the course of the promotion will receive a refund for the landed value of the control panel if they choose, instead of receiving a control panel.

(3) In all cases except for that outlined in condition (2), the prize is not redeemable for cash.

(4) Paid ATA staff, members of the ATA executive committee and members of their immediate families are ineligible to enter.

(5) The competition runs from 25 August 1998 to 14 January 1999. Subscriptions/memberships must be paid by 5pm on 1 February 1999 to be eligible.

(6) The competition is open to individuals only, corporate entities, collectives and organisations are ineligible.

(7) ReNew subscriptions cost $20 per year, ATA membership costs $40 per year ($30 concession). Overseas subscriptions cost AUD$25 in NZ and PNG, AUD$32 elsewhere. Two year subscriptions and memberships are also eligible.

(8) To subscribe or join the ATA, use the subscription form on page 61 of this magazine (or a copy of it), or call the ATA on (03) 9650 7883 to pay by credit card.

(9) The competition is open to ReNew readers in any country, though a delivery surcharge may apply in countries outside Australia.

The *ReNew*—Adtech AC/DC control panel subscriber competition is proudly sponsored by ADTECH AUSTRALASIA, distributors and installers of Bergey wind turbines and charge controllers, Adtech tilting towers and the Adtech system interface panel. Phone: (03) 9532 0682 Fax: (03) 9555 8142.

The ReNew-Cleantec limerick competition

Last issue we asked readers to put pen to paper to come up with limericks that related to waste-water recycling and other sustainable technology ideas. The prize was three sets of Cleantec ceramic laundry disks.

We were swamped with limericks, and many of our bards contributed multiple entries. Many were good, some were bizarre, and quite a few were, well, baudy (you'll have to wait for our special sealed section before these are published). But a few gems shone through, and we have published the winners here—congratulations to Fiona White, Allan Wood and Heather Baker, your disks are on the way!

The winners

I live without tele or phones
I do without bankcard or loans
But I have to confess
My clothes are a mess
So please give me two washing stones
Fiona White, Herberton, Qld.

Cleantec has a product, a ripsnorter
A boon it is to greywater
It leaves washing 'n clothes
Pert near fresh as a rose
Aint got em? Well you bloody well oughta!
Allan Wood, Traralgon Sth, Vic.

There was a young woman from Yark
Whose teeth made a feature of plaque
Said she, 'what the heck,
I'll just suck two Cleantec'
Now her teeth almost shine in the dark
Heather Baker, Croydon, Vic.

Utility failing on solar

Alan Pears' penetrating analysis 'A sustainable energy future is on our hands' prompts me to respond as a consumer with my own grid-connected power system.

As readers may recall, I wrote about my home in issue 63, but I didn't elaborate on the PV system because things were not going so well at the time. Now, after several months of interchange with the local supplier, the importer and finally the manufacturer, I have an inverter which seems to be operating consistently. I cannot say I am impressed with the manufacturer's ideas of customer service, in that it seems that as a consumer one has to take inordinate lengths sometimes to get what one has paid for: a functional system. If it were a washing machine or oven, there would be at the least a consumer help line, and from there, advice or fault rectification is normally within days, not several months as was the case with our system. But herein lies the problem. The industry is new and it does not yet deal with its customers in the expected way.

Incidentally, I cannot fault the Australian industry, it was the imported component that caused the problem and delays in fixing things.

But I want to make a more general observation about the way Western Power (the wholly government owned electricity utility in WA) approaches its Renewable Energy Buyback Scheme. From personal experience I want to acknowledge the fact that within the organisation there are those who recognise and strongly support the customers that join the scheme (there are two of us so far). But regretably there is no corporate support. The financial men are able to do some remarkable verbal twists to show why they don't support the scheme, but I know it comes back 'no interest'.

I'll make allowances for a bit of overkill from the engineers who assessed the system, but I cannot let pass the buyback rates. In the contract I have with the utility the wording includes the phrase 'Western Power wishes to encourage the use of alternative and environmentally-friendly methods of electricity generation...' Fine, but what about a realistic buyback rate? At this time of year if I have excess electricity, Western Power will buy it at a measly 6.9 cents per kilowatt-hour. At best they offer a top rate of 9.9 cents per kilowatt-hour. Meanwhile, if I cannot produce enough to meet my needs (say for example between 7am and 11am on a cloudy weekday) and I start buying from the grid I pay a premium rate of 18.5 cents per kilowatt-hour.

And that is substantially above the rates that normal domestic residences pay. I am obliged by the agreement to buy at so-called 'Smartpower' rates. (Smartpower is a scheme designed to shift loads to the night rather than reduce overall consumption). So, far from encouraging anyone to join the renewable energy buyback scheme, Western Power seem to be sending out market signals that say 'we are just not interested'. I understand that Western Australia has one of the world's worst buyback schemes.

Western Power gets electricity generating capacity entirely free of charge, apart from the supply of two smart power meters. They pay miserable rates for what I supply and penalise me virtually every winter day for having the interest

in putting up what by any standards is an expensive system.

After six months I am seriously wondering why I bothered, and it should come as no surprise to Western Power that if they want to see more consumers join the scheme they are going to have to get serious about buyback rates. Net billing is a minimum I would demand.

Alan Pears is right, the utilities have failed miserably to come to grips with a community that does not want more coal-fired power generation, and as judged by the number of phone calls I get, a lot would invest in roof top PV, but they need genuine financial encouragement, not a PR exercise.

Dr Bill Parker
East Perth, WA

Gas fridges and CO2

In *ReNew* issue 64, Peter Pedals claimed in his article *Gas, 240 or 12 volt fridges, which is the best option?* that the LPG fridge quoted in the article when consuming 4.1 x 45kg of LPG per annum would only produce about 2.6kg of carbon dioxide (CO_2) per annum.

The formula for the combustion of LPG, considering that it is mostly propane with a small proportion of butane, is as follows:

$$C_3H_8 + 5O_2 > 3CO_2 + 4H_2O$$
(propane) (oxygen) (carbon dioxide) (water)

Consulting the Periodic Table shows that 44kgs of propane would use 160kg of oxygen to combust and produce 132kg of CO_2 and 72kgs of water. Therefore the fridge above would produce 553.5kg of CO_2 per annum.

If we considered some of the gas as butane, the figure is slightly higher. How did Peter come up with his figure of 2.6kg of CO_2?

Our fridge does not produce any pollution or CO_2 and costs us nothing to run. It is the ultimate in power reduction and savings. We have lived for nine years without a fridge! Try it, it can be very liberating. We have never had any food poisoning incidences and have watched our health improve over the years!

Robin Paine, Yankalilla SA

Peter responds:
We hired someone to do a lot of the number crunching and he obviously got this one wrong, even though he did get all the figures for carbon dioxide emissions for LPG. We were more interested in the electrical details and missed this error, although it is so obviously wrong.

—Peter Pedals

Not so noisy wind turbines

I am writing in response to the letter from Chris Harris in ReNew issue 64, page seven, titled *A fix for noisy wind turbines.*

As with most manufacturers, the manufacturers of the Air 303 are constantly looking to upgrade and improve their product wherever possible. This has brought about several changes over the years. The early turbines were indeed noisy at higher wind speeds and the four dot blades were a significant improvement. However, we have now upgraded to the five dot blade, somewhere around mark three. These blades are not only significantly quieter but I have reports coming in that they deliver a little more power in low wind speeds.

If anyone has a noisy Air 303 or Air Marine and would like to change the blades they can contact me on 0411 224 807.

Marty Still,
Precision Wind Technology,
PO Box 147, Tugun Qld, 4224

Haybox cooking

A few years ago I read an article on straw box cooking, where the saucepan is heated on a burner until boiling and then transferred to a box tightly filled with straw. The straw-insulated lid is put on the box and the cooking continues without using any additional fuel.

At the time I thought it was a radical new idea, but recently, on searching through some old cook books, I found the following article. It was in the 1945 issue of the *Coronation Cooking Book* compiled by the *Country Womens Association of NSW*. It seems that these energy saving ideas have been around for a long time.

A fireless cooker

'One butter box, sufficient floral cretonne to make two pillows to fit in box nicely, fill pillows with chaff. Paint butter box to match your kitchen, stand on four legs, now put a pillow of chaff into the box. Bring to a boil anything such as stews, curries etc, or anything that needs cooking for hours, put in box, making a hole in pillow with saucepan. Put the other pillow on top, making the box full in all. Put on the lid and it will remain at boiling point for hours and hours. Excellent for preparing baby's food, and very handy if going out for the afternoon and putting on a hot tea.'

Bob Carveth, Bredbo NSW

A Zeppelin turbine

I read the article *Choosing the right tower for your wind turbine* in issue 63. It is clear from the article that a major challenge in setting up a wind-powered independent power system is getting the turbine as high as possible, safely and cheaply.

Do you know if anyone has tried hanging one from a tethered balloon? I can see advantages in such a concept (no need for a large footprint, easy erection, and great heights possible) and some disadvantages (may require constant maintenance and might not weather storms well).

I am currently considering experimenting with this idea. If somebody has already tried it or has knowledge I might find useful I would be pleased to hear from them.

John Walker
10 Peppermint Grove,
Esperance WA 6450

Letter of the month

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

Happy with a small system

I have come from a typical background of electricity over-consumption—so much so that my father regularly complained of our supposed shares in the state electricity board—to my life now of not being connected to the electricity grid.

After 20 years plus of living unconnected I don't feel a sense of loss at all. In fact, where I live is a 320 member share property and nobody is connected. We chose not to, and are making use of solar technology which powers many of our everyday electrical goods. For example, I run, through a 600 watt inverter, a juicer, blender, electric drill, sander, sewing machine, overlocker, as well as a 12 volt converted twin tub washing machine directly off the same batteries.

On sunny days, which is most days here on the mid north coast of NSW, there is ample power for my needs and I only have two 45 watt, 59 watt and 80 watt solar panels. The only time it lets me down is on consecutive overcast days lasting over a week—then I start thinking I will save up for a wind generator and I'll be set.

When we have large electricity needs, the community has two large community buildings and several years ago we were granted the now defunct RAPAS NSW scheme which supplies us with 240 volts of solar power.

For my on-tap hot water, I took advantage of the energy card scheme that enables rural dwellers to take home an energy-saver hot water system the very day you apply for it and then slowly pay back the loan of the amount fixed at nine per cent over two years. That suited me as I was fed up with making hot water over the fire place for years to bathe my five children.

Life has become as easy as a flick of the switch to unlimited sun power, which is a long way from the early days when we headed to the bush and we lived by the flickering of a bare candle flame.

Leonie Hughes, Repton NSW

Renewable resistance

I found *ReNew* quite by accident and have been purchasing it since issue 59. Congratulations on such an excellent magazine, as I have been searching for something like it for years.

I too have found a great resistance to sustainable technology. With basic things like trying to find *ReNew* in shops or having to remind my house mates four times a day to put compost into the compost bin instead of the rubbish bin that's right next to it.

I have just moved to Queensland, but back in Western Australia at my parents' house I have revegetated their suburban home with native plants, 90 per cent of them being local to the immediate area, with over 200 species and rising. To kill the weeds I used layers of newspaper with mulch on top with a little organic fertiliser (manure). In a few years it will look awesome, provide habitat and require little or no maintenance and water.

My parents own a nursery with a river bordering it which would be ideal for a micro hydro system. There are also many sites for solar and wind power, but there is the usual resistance from my parents, being 'non-renewablists'. Hopefully, one day I will convert them.

When buying a renewable energy system, would it be possible to start with a few solar panels and batteries to power lights? Then gradually integrate more solar panels, batteries and a wind turbine for the rest of the appliances as my budget allows?

I would also like to know some costs on double glazing, even if it has to be transported to Western Australia from Victoria. I have got many ignorant responses when asking local Western Australian glaziers about double glazing costs, for example, 'It costs too much; they only used it in England, because heating costs in Australia are so cheap.'

I also have many ideas for renewable technology, some may have already been discovered. One is pumping water onto the roof to heat it up and back into the floor to heat the house in winter. In summer, pump cool water from an underground reservoir on the shady side of the house into pipes in the roof cavity for cooling.

Some of my ideas seem a bit eccentric to my peers, but I am sure fellow 'renewablists' can see my point of view. I look forward to your next issues with great anticipation.

Simon Letts, Cornubia QLD

Glad you like ReNew, Simon. Positive feedback really means a lot to us. Keep working on your parents, especially with the micro-hydro. If the river is suitable, it would probably be the cheapest renewable energy they could generate.

You're right when you say most of your ideas have already been thought of. All my flashes of genius have turned out to be ideas that someone else already had at least 300 years ago. But that doesn't make them any less satisfying to implement.

As far as incremental upgrades to independent power systems goes, it is a less-than-ideal approach. New batteries don't like old batteries, undersized inverters need to be replaced, and wiring quickly gets messy if it is constantly

being added to. Nonetheless, a small system with a few lights can be a good way to get started without breaking the bank.

—Michael Linke

The ceramic disk debate

I found your response to Rob Hills' thoughfully worded letter regarding the *Choice* test of the ceramic disks (*ReNew* issue 64) somewhat ridiculous.

Choice didn't say your washing wouldn't be clean, only that it would be no better than washing in fresh water. Why don't you try washing in plain water for the next six months and 'adding detergent on a few occasions'. You may be amazed, and much of the deodorising may actually happen in the drying phase.

And milk paint? I tried Biopaint's wall paint and I honestly can't recommend it to anyone. It went moldy after about a year (I live in Brisbane) and it's impossible to clean. I suspect milk paint would be the same or worse.

I'd like nothing better that for these things to be true but you're doing the whole alternative technology field a disservice by promoting them as if they were just as good as the standard products. When people find out the hard way, they may be

Continued on page 82

Australia's greenhouse record set to worsen

Australia is on the way to becoming the world's worst per-capita greenhouse gas polluter, according to a report from the Australia Institute. The report says that we will accomplish the task within 12 years.

Per capita emissions from energy consumption and industry are currently at 21 tons per head, and set to rise to 26 tons by 2010. The Institute, a liberal think tank, was also highly critical of the Australian government's position at the Kyoto Climate Convention. Executive Director Clive Hamilton said the government had jeopardised efforts to involve developing countries in climate change agreements.

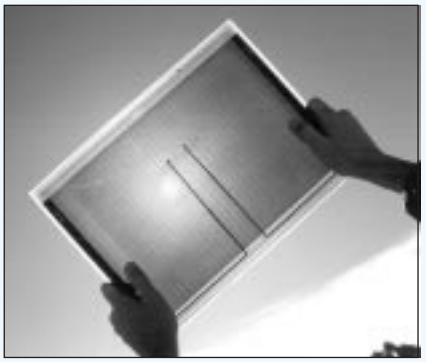
'If they had been aware of the facts, other nations would not have agreed to Australia's demand for an increase in emissions but would have required us to cut our emissions by more than other countries,' Hamilton said.

Dow Jones Newswires, 1 June 1998.

Greenhouse grants

The Australian Government made some murmurs just before the Kyoto summit about Australia supplying 2 per cent of its electricity from renewables by 2010. At the same time, $60 million was committed to renewable energy projects over the next five years.

The money will be allocated through three projects. The Renewable Energy Showcase will provide grants to projects with large scale commercial potential. The Renewable Energy Commercialisation Program aims to support 'the demonstration and commercialisation of innovative renewable energy equipment, technologies and processes'. The Renewable Energy Equity Fund will provide venture capital to small renewable energy companies on a 2:1 basis.



Australian company Pacific Solar is on the way to producing its first commercial solar cells in the year 2000. The cell pictured is the world's largest thin-film crystalline silicon photovoltaic module on glass. It was made on Pacific Solar's production line in Sydney.

The deadline for applications to the Renewable energy Showcase was 28 August, however the Renewable energy Commercialisation Program will invite grant applicants on 25 September this year, and each March and September for the next three years. No deadline is specified for the Renewable Energy Equity Fund.

Anyone interested in applying for grants or equity finance can contact the Program Manager at the Australian Greenhouse Office on ph (02) 6274 1880, fax (02) 6274 1920, email: renewable@ea.gov.au or visit the AGO website at http://www.greenhouse.gov.au. Grant application forms are available on the website or can be mailed out.

Australian Greenhouse Office pamphlet.

Solahart wins grants

Solahart has been awarded two grants under the federal government's renewable energy grants program.

The first will see a 25 kilowatt photovoltaic power station built near Perth. The station, developed in conjunction with Western Power and the Australian National University, will use reflective parabolic troughs to concentrate sunlight on photovoltaic cells. The station will use parabolic mirrors to concentrate sunlight onto high-efficiency photovolatic cells, increasing its intensity by 20-30 times.

Solahart has also won a grant to develop and produce solar collector panels for European solar hot water systems.

Solahart media release, July 1998.

Carbon Trading is here

The idea of carbon trading has been talked about a lot in recent years as a possible solution to reducing or negating greenhouse gas emissions. It is already being practised in some countries, and has now come to Australia. Carbon Trading is where companies or countries that produce large amounts of greenhouse gas buy credits from companies or countries that are reducing their emissions.

Pacific Power, a New South Wales electricity utility, has announced that it will be buying carbon credits from a 1,000 hectare New South Wales State Forests hardwood eucalypt plantation. It will purchase the credits for the 250,000 over 10 years

Pacific Power media release.

A solar baseload

Any economically rational coal or nuclear energy enthusiast will tell you that solar is not the electricity source of the future: it can't be stored for baseload power generation in large grids. A research team at the Australian National University could be on the way to solving this problem.

The team are working on the commercialisation of a solar thermal process that 'dissociates' ammonia into nitrogen and hydrogen. These two gases can then be stored, to be recombined at

a later stage. When recombined to reform into ammonia, they produce heat which can be used to turn water to steam, which in turn drives a turbine to generate electricity.

Research to date suggests that a 'hypothetical' 10 megawatt plant would cost $180 million and that electricity could be profitably sold for around 25 cents per kilowatt hour (this is on par with the cost of base-load electricity from diesel generators in remote areas).

The researchers have based their estimate on the use of solar collector dishes, but a new catalyst that allows the ammonia dissociation to occur at a lower temperature could allow them to use much cheaper solar troughs. This would bring the profitable sale price down to between 12 and 15c/kWh.

Australian Energy News, June 1998.

Solahart have won a federal government grant to research concentrating troughs for electricity generation. The troughs focus the sun's energy on special photovoltaic panels. Solahart technical manager, Mal Hayes, is pictured with Dr Adele Milne, the project manager from industry partner, Western Power.

Solar sales booming

The US based Worldwatch Institute reported an increase in solar cell sales of 40 per cent worldwide last year. Solar energy is now the second fastest-growing energy source, behind wind energy, with an average 16 per cent annual sales growth each year since 1990.

Huge solar plant for Sydney

In some late-breaking news as *ReNew* goes to print, BP Solar Australia have announced that they will be building a $57 million plant in the Sydney suburb of Belrose. It will manufacture 20 megawatts per year of Saturn photovoltaic cells, and is due to come on line in October 1999. It is expected to generate around $100 million in export earnings by 2000 and will employ 200 people.

BP Solar Media release, 11 August.

Sydney's powerful garbage

An electricity generation plant using methane gas from buried waste in a Sydney landfill tip will provide enough electricity for 13,000 households over the next 25 years. The plant is located at Lucas Heights, and was developed by Waste Service NSW and Energy Developments Limited.

Waste Service NSW media release.

Saving energy with showerheads

The NSW Sustainable Energy Development Authority (SEDA) may be pushing many of Australia's big renewable energy projects along, but it is also pushing along simple energy efficiency measures. In partnership with Sydney Water, Integral Energy and showerhead manufacturers, SEDA is giving NSW residents the opportunity to save $10 on water-saving shower heads.

Showers are the main users of hot water in the home, and account for around 20 per cent of the greenhouse gas emissions from the average house. Water efficient showerheads reduce energy use, and also save around 25,000 litres of water per year in the average house.

Gift vouchers will be distributed by Sydney water, and will be redeemable at selected retailers.

SEDA media release.

Green power leaps ahead

Around 13 million Australians will have the choice of supporting renewable energy with the expansion of SEDA's Green Power Scheme.

Six retailers are involved, with Energex in Queensland and CitiPower from Victoria gaining Green Power accreditation for their new renewable energy products. ETSA Power of South Australia, United Power, Powercor and AGL from Victoria are seeking accreditation for products now under development.

SEDA claims that Green Power's success is reflected by $43 million of new investments in renewable energy infrastructure now under construction or operational since the year-old scheme's inception.

SEDA media release.

On the smell of an oily french fry

Josh and Kaia Tickell have an obsession. They collect used oil from fast food joints, cook it up with some special ingredients, and pour it into their diesel 'Veggie Van.' They have toured the US on vegetable oil, and are spreading the word about this clean, renewable and great smelling fuel

Powered by vegetable oil, the Veggie Van took us 16,000 kilometres across the United States. The van visited 20 major cities and 25 states where people smelled the clean, french fry-like exhaust. Over 40 million people saw the multicoloured Veggie Van drive across their television screens. Thousands attended presentations about it, and hundreds of thousands more read about the van in their local newspapers and on the internet at the Veggie Van website.

What began as a college project culminated during the summer of 1997 in a massive public awareness campaign. We knew that we had reached people from almost every walk of life when a person begging on the street shouted to us, 'Hey, isn't that the van that runs on that used restaurant oil?' We nodded in response and as we drove away the man shouted, 'That's incredible, good luck!'

Fields of fuel in Germany

Luck had once taken us to a traditional farm in picturesque southern Germany where we had seen vehicles fuelled by vegetable oil. While studying organic agriculture and living on this farm, we noticed that the farmers were continuously hauling tanks full of yellow liquid. The farmers told us, 'This is fuel from the canola plants which grow on our farm and on Jorg's farm up the road. We put it in the diesels and they smell good.' To our amazement, the farmers poured the yellow liquid into their car and tractor, which then emitted a pleasant smelling exhaust.

What you didn't know about the diesel engine

More than 100 years ago, a brilliant inventor named Rudolph Diesel designed the original diesel engine to run on vegetable oil. Over time, the diesel engine was modified to run on a cheap, dirty by-product of gasoline production, labelled 'diesel fuel.' Straight vegetable oil is too thick to run in most modern diesel engines, but biodiesel, a biodegradable, nontoxic fuel made from vegetable oil, works in any unmodified diesel engine. Not only does biodiesel require zero modifications to the engine, but this fuel works either by itself or blended with petroleum diesel. The process of converting vegetable oil into biodiesel fuel is called transesterification and is far less complex than it sounds. In fact, the process is so simple that it can be done in a blender!

A simple reaction

The chemicals needed to make biodiesel are cheap and easy to find. Any vegetable oil (such as used restaurant cooking oil), methanol (a clear alcohol used as racing fuel), and caustic soda (a white powdery substance used as drain cleaner) are the basic components. During the conversion process, the ingredients are heated and mixed, and biodiesel and glycerin are created. The glycerin can be used to make soap or any one of thousands of other products. Biodiesel fuel can be used directly in an unmodified diesel engine and it can burn up to 75 per cent cleaner than petroleum diesel fuel. Since biodiesel can be made from used cooking oil, we decided that it was time for us to take this idea on the road.

How it all began

Enamored with the idea of transforming the fast food restaurant fryers of America into a network of low-cost gas stations, we decided to build a portable fuel processor, buy a motor home with a diesel engine, and travel across the country. Sitting on a local used car lot was a 1986 Winnebago LeSharo with a 2.1 litre Renault diesel engine that would soon become the 'Veggie Van.' The small, white van had the perfect engine and it got 25 miles to the gallon.

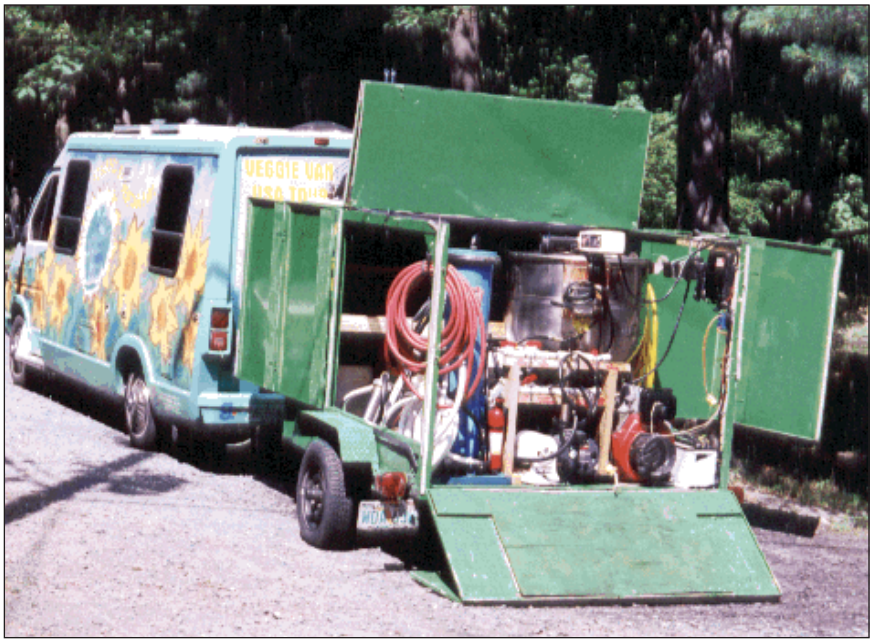
Two purple, gleaming photovoltaic panels soon adorned its roof line. The panels allowed us to stay 'off the grid' because they powered the van's refrigerator, lights, computer, power tools, and video equipment. Fuelled by soft drinks and pizza, a rag-tag group of volunteer art students painted sunflowers and earth symbols on the van. The Van Gogh-esque graphics and some well placed lettering told any onlooker that this Veggie Van was 'Powered by Vegetable Oil,' got '1,300 Miles Per Acre' and was on the 'Veggie Van USA Tour.' The exterior of the van hinted of the mechanical magic occurring inside the engine, which remained totally unmodified.

The Green Grease Machine

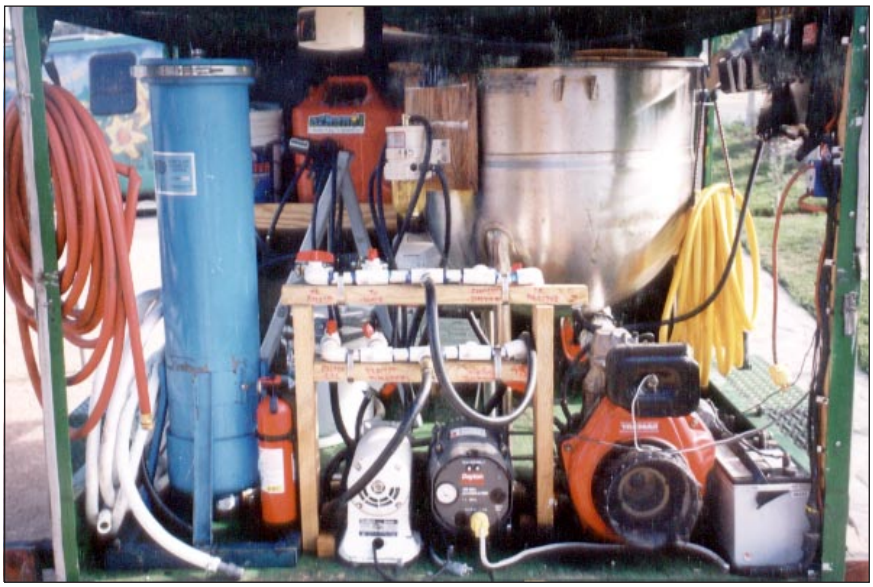
The 'Green Grease Machine' was created when we mixed salvaged parts from scrap yards, boat marinas, and hardware store plumbing supplies with our blood, sweat, and used cooking oil. This trailer-mounted work of art makes clean burning biodiesel out of used restaurant vegetable oil. First, an old Champion juicer motor sucks vegetable oil from a restaurant fryer, then a converted tug boat fuel filter strains the french fries and other bits of food out of the oil, and lastly the oil moves into a converted 1976 military steam kettle where an outboard boat motor swirls the ingredients together.

The first run

Some interesting experiments with vegetable oil and fryer grease gave way to our first large batch of biodiesel fuel. Covered in grease, we watched as the dark fuel was poured into a secondary tank of our test vehicle, a diesel VW. As soon as the tank's valve was opened, the fuel began to gurgle, the engine changed



Josh and Kaia used the 'Green Grease Machine' trailer to convert used cooking oil into biodiesel on their trip across the US.



A closer look at the Green Grease Machine. The large mixing vat can be seen on the right with the outboard motor hanging horizontally above it.

pitch, and the air was filled with the odour of super-fried vegetable oil. Our experimental fuel actually worked! For months, we experimented with various blends of vegetable oil, succeeding to run our VW Jetta on up to 80 per cent straight fryer grease for over 5,000 miles.

Life on the road

Phone calls and emails poured in from around the country as we planned the 1997 Veggie Van USA Tour. We talked to reporters, environmental organisations, music festival managers, and school teachers as we scheduled tour events and planned our route. The trip itinerary filled quickly. We had the Veggie Van, the Green Grease Machine, and an almost endless supply of grease. Thus began the 1997 Veggie Van USA Tour.

We ran the Veggie Van on 100 per cent biodiesel for 10,000 miles from coast to coast. The Veggie Van towed the Green Grease Machine in a trailer and together they weighed almost 5 tons! The biodiesel fuel gave at least a 10 per cent power gain over petroleum diesel and we felt every bit of it on the mountains.

Life on the road in the Veggie Van was a non-stop, colourful adventure. At least one out of every four people who passed us on the highway waved, honked, or gave us a big smile. We often turned our heads to absent-mindedly look at a passing vehicle only to see a camera flash from the passenger's side. In rest areas and parking lots, people gathered around the van, reading its messages, taking pictures of family members next to it, and including it in their summer vacation home movies. The first question people asked us was, 'Does it really run on vegetable oil?' One whiff of the exhaust was enough to convince most skeptics. Believe it or not, it does smell like french fries.

That summer, we talked with farmers who want to run their equipment on oil from the crops that they grow. We found that urban dwellers want public transport without the asphyxiating pollution. We met with CEOs, environmental organisations, and people of all ages and backgrounds. We talked to 'snowbirds' in campgrounds, truckers in truck stops, and young men in fast red cars in traffic jams. We talked to students of all ages who want to study clean technologies. We heard the voices of a proud, caring people who still love their country, their land, and their air. They want to use clean fuels in their cars and renewable energies in their homes.

The public responds

When the 1997 Veggie Van USA Tour officially ended in Hopland, California, the Veggie Van had been on the Today Show, Dateline NBC, Nightshift, and many other news broadcasts across the country. The Associated Press circulated an article about the Veggie Van to hundreds of newspapers around the country. Wherever we arrived people said they just read about us in the paper. The Veggie Van website logged over half a million hits that summer and continues to receive hundreds of visits a day. The website was featured in Yahoo's weekly picks and in Internet Life Magazine.

Power to the people

The 1997 Veggie Van USA Tour gave us proof that there are better ways to run cars and ultimately better ways to run our society. Every time we turned grease into clean fuel, we proved that we can create clean energy resources using our current technology. Our goal is empowerment of ourselves and others through education and information. We wrote the book, *From the Fryer to the Fuel Tank: How to Make Cheap, Clean Fuel from Free Vegetable Oil*, in response to the hundreds of emails, letters, and phone calls we received requesting more information about the amazing fuel made from fryer grease. This first book about biodiesel available to the general public gives simple, easy-to-follow instructions for making fuel from vegetable oil. Everyone aged six to one hundred and six will find this book a

humorous and insightful look into vegetable oil power, renewable energy, and how to make cheap, clean fuel from free fryer grease.

The Veggie Van rides again!

The Veggie Van is currently voyaging to schools to show young people that renewable energy such as biodiesel fuel and solar power are easy to use and good for the environment. The response from kids of all ages has been a big 'thumbs-up' for the plant-powered vehicle.

Meanwhile, preparations for this year's 'Veggie Van Grease'n'Go USA Tour' are underway. Starting in June, the fryer grease hits the Veggie Van fuel tank and the tires hit the road in another exciting cross-country adventure. This year's tour goals are to have fun, make tons of fryer fuel, and show up in unexpected locations to talk to people about renewable energy.

While the Veggie Van makes its way through the highways, bi-ways, and fast-food restaurants of America this summer, the cyber-tour will be occurring online at www.veggievan.org. Events will be announced a few days ahead of time (so you have time to tell your friends that the Veggie Van is coming to your town). You can follow the adventures, trials, and tribulations of the Veggie Van by watching the site for our daily digital updates. The Cyber-Grease'n'Go Tour will feature stories, press, and, of course, pictures of the clean-burning odyssey as it unfolds. ✲

Josh and Kaia Tickell hold samples of the veggie oil they use and the fuel they make from it.

Story by Josh and Kaia Tickell, GreenTeach, 15 Paradise Plaza, Suite 311, Sarasota, FL 34239, Fax:+ 1 813-354-2377, van@veggievan.org, www.veggievan.org

***From the Fryer to the Fuel Tank* is available through the web site or by calling +1 800-266-5564. There will be a review of this book in the next issue of *ReNew*.**

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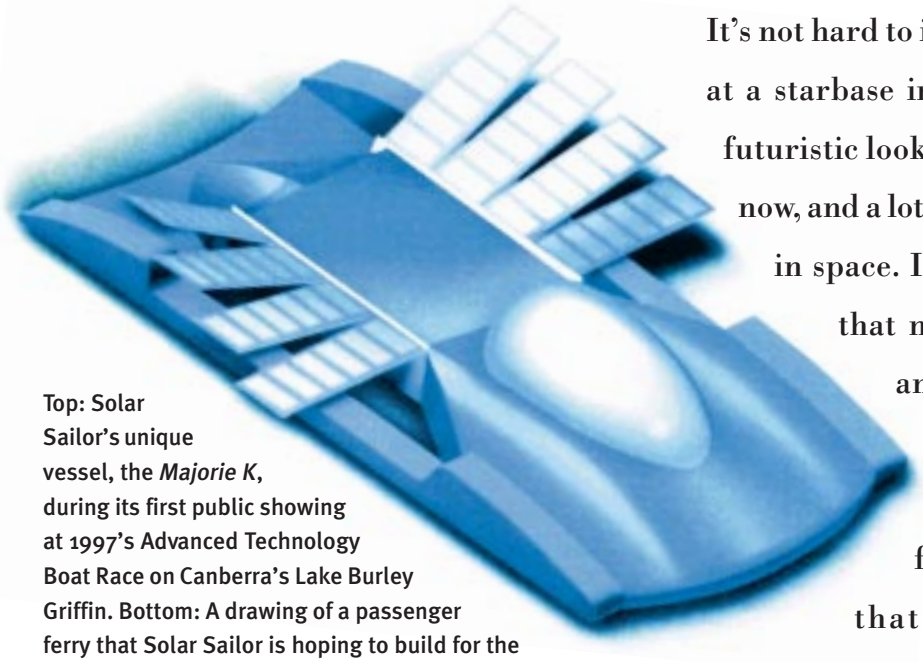
cover story

Solar sailing



Top: Solar Sailor's unique vessel, the *Majorie K*, during its first public showing at 1997's Advanced Technology Boat Race on Canberra's Lake Burley Griffin. Bottom: A drawing of a passenger ferry that Solar Sailor is hoping to build for the Sydney Olympics.

It's not hard to imagine the *Marjorie K* docking at a starbase in a Star Wars movie. But this futuristic looking vessel is very much with us now, and a lot more at home on the water than in space. It uses wind and solar in a way that no watercraft ever has before, and was conceived, designed and built in Australia. As Michael Linke discovers, it is also the first in a fleet of Solar Sailors that will soon be ferrying passengers all over the world

Robert Dane is something of a Renaissance man. He is a doctor by training, with a practice in the coastal NSW town of Ulladulla. He has spent hours on the water, sailing and windsurfing, and it was the synergy of his knowledge of anatomy and his love of sailing that led him to imagine a water craft that could use both solar and wind energy to propel it.

The first solar sailing boat, the *Marjorie K*, is a catamaran with two aeroplane wing-like attachments. These 'wings' can be moved up and down from parallel to the water to fully upright, and use the same principles that traditional sails do to catch the wind and drive the boat along.

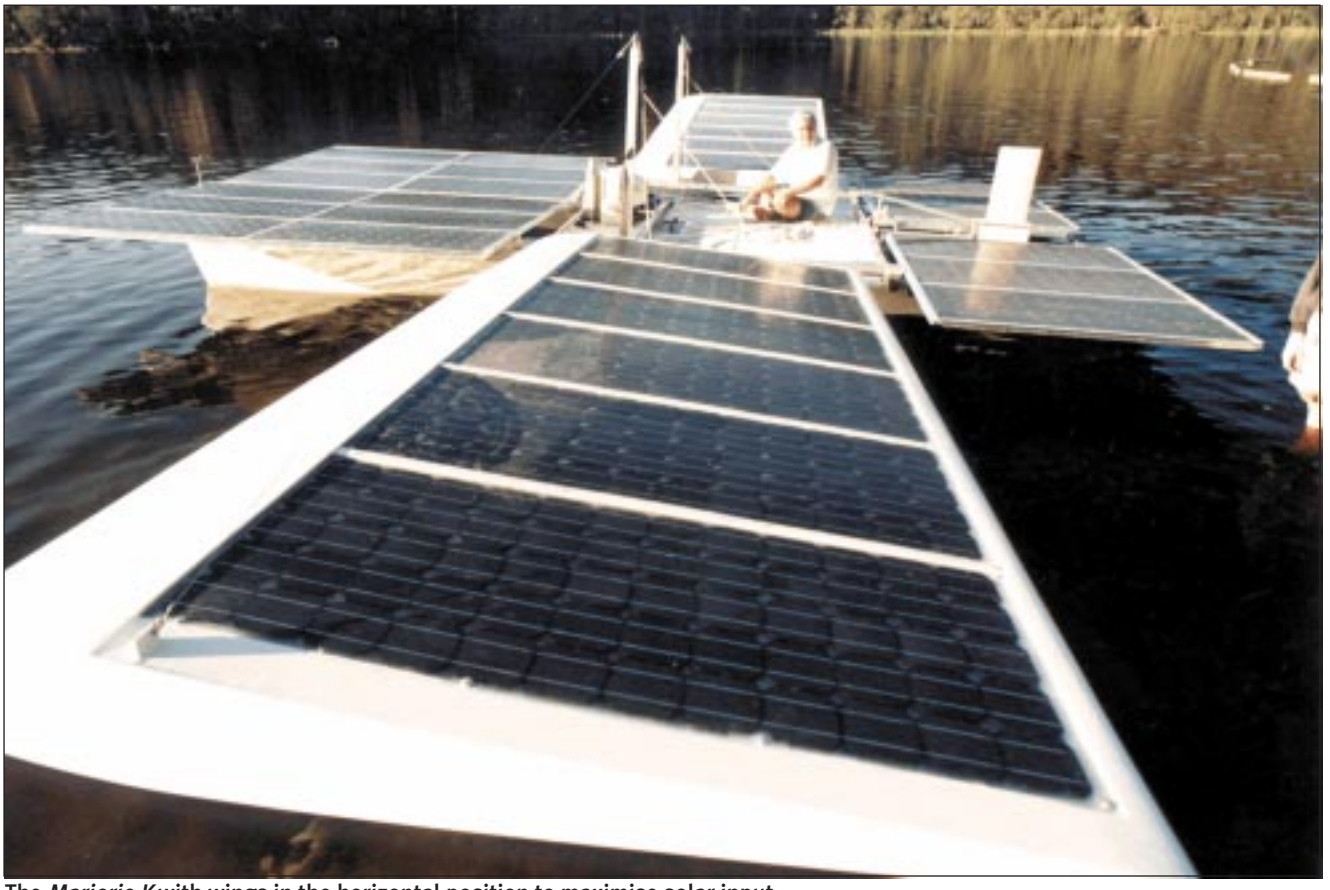
The wings are also instrumental in collecting the boat's other power source: solar energy. Each wing is covered with 650 watts of photovoltaic solar cells. Along with a 650 watt array on the stern (rear), and a 1300 watt array on the bow (front), the Marjorie K has a total of 3,250 watts of solar electric generating capacity. This electric output can be used to drive an eight horsepower, 48 volt electric motor, or stored in batteries below deck for later use.

The design of the solar sailing boat's wing pivots was inspired by the human shoulder joint. In order to simultaneously catch the wind and utilise solar energy, the wings need to pivot in two directions, just like a shoulder does. This allows the *Marjorie K* to sail at speeds close to the speed of the wind.

The addition of the solar cells to the wings was an idea inspired by the anatomy of insects. In particular, the idea that insects' wings first evolved as a way for them to raise their body temperature with the sun's energy—perhaps the first ever solar collectors. Once Robert Dane had put together these quirks of science and made the first model with pipe cleaners and Leggo blocks, the first solar sailing boat, and Solar Sailor Pty Ltd, were well on their way.

The *Marjorie K* takes its name from an Ulladulla local, Marjorie Kendall, who was so inspired by the solar sail boat concept that she invested half of the $130,000 cost of building the prototype. With a collection of friends, Robert Dane built the first solar sailing boat in just 82 days. It was finished in time for Canberra's second Advanced Technology Boat Race on Lake Burley Griffin in April 1997. Only twelve months before, Dane had watched the race and been inspired to follow through his ideas.

A penalty against the *Marjorie K* meant that it didn't win the race, but the



The *Marjorie K* with wings in the horizontal position to maximise solar input.

Marjorie K technical specifications

Total photovoltaic output: 3,250 watts
- **Bow array:** 1,300 watts
- **Stern array:** 650 watts
- **Wing arrays:** 650 watts each

Solar maximisers: Four AERL1200B mazimisers

Batteries: 16 Genesis 38 Ah sealed lead acid batteries, wired for 48 volts

Outboard motor: Solz 8 hp 48 volt electric motor.

Instrumentation: Input current for each maximiser, output current and voltage for each maximiser, output current for each array, battery bank voltage, battery bank charge or discharge current, Battery bank amp hours used, motor temperature, speed log.

The *Marjorie K* on an early trial run, without stern or bow solar arrays

Wing construction: Hollow, high density foam sandwich construction with carbon fibre reinforcement.

Wing pivot mechanism: Composite joint using steel and aluminium tubing and PVC bearings for movement in two planes. Lever and pulley mechanism for positioning wings.

Wing weight: 50kg each

Hull: Hobie 20 hull with one metre fibreglass extension for extra stability.

judges were able to see its potential and awarded it the $10,000 prize for Most Innovative Vessel. Although the race organisers have now ruled the competition open only to purely solar powered vehicles, the race was a launching pad for Solar Sailor, and helped it generate commercial interest.

For Robert Dane, the commercial interest is crucial to his vision. He would like to see both large passenger carriers and smaller recreational solar sailing vessels cruising the lakes, rivers and harbours of the world. But he is both patient and practical. He wants the technology and its development to stay in Australia, and Solar Sailor's first step toward realising that vision is to build a passenger ferry service to take spectators for the Sydney 2000 Olympics from Circular Quay to Homebush Bay.

The ferry is not mere bells and whistles for a 'green' Olympic Games. It has some serious economic advantages over traditional ferries. Solar Sailor estimates that it can build the passenger ferries, including a backup power system running on a fuel such as natural gas, for around the same cost as a diesel-only equivalent. The biggest cost difference will be between the fuel required for a conventional ferry and a Solar Sailor ferry: around 80 per cent less for the Solar Sailor.

Talking to Robert Dane, you get the impression that the vision will be realised. Solar Sailor already has some big names behind it, like former Liberal Party leader, John Hewson, whose company is seeking venture capital to build the first ferries. There is also growing interest from overseas, including an article in a recent issue of *Technology Review* magazine, published by US University, MIT. This kind of interest will snowball, and as Robert Dane explains, 'Since the MIT article, things have really gone crazy!' But there's nothing crazy about his idea, and it probably won't be too long before a solar sailing boat comes to a waterway near you. ☆

To find out more about Solar Sailor, visit the website at http//:www.solarsailor.com.au, or write to PO Box 336, Ulladulla, NSW 2539.

A village for the future

A housing development in the Adelaide suburb of North Haven has utilised several sustainable technologies, and is serving as a test-site for larger developments.

by Erika Maksem

The call for sustainable development in the housing construction industry has never been louder. A 1996 Australian Bureau of Statistics report called *Australians and the Environment* showed that the number of dwellings in Australia more then trebled from 2 million in 1947 to 6.7 million in 1994. Moreover, residential energy consumption has increased by 16 per cent per capita in the last 20 years, depleting fossil fuels which contribute to greenhouse gas emissions and global warming.

In South Australia, the public housing authority, the South Australian Housing Trust, in conjunction with various public and private sector organisations and individuals, have answered this call by establishing New Haven Village, a residential development of 65 energy-efficient homes in Adelaide's northeast.

The Village is located on a two hectare site on Victoria Road, North Haven, 5km from Port Adelaide's shopping district and 20km from Adelaide's central business district. The technologies unveiled at the Village, which officially opened in 1995, demonstrates how households can maximise savings with minimum impact on natural resources and the environment.

Heat pump geothermal

In-ground heat exchange technology, or heat pump geothermal heating and cooling were installed in the first homes at the Village. The system comprises of a refrigerative heat pump that uses the earth's temperature (approximately 17°C in Adelaide) as a heat transfer mechanism. A flexible pipe allows a non-toxic refrigerant to be pumped into the unit's compressor, and this either sheds or absorbs heat from the house, depending on the season and whether the home needs to be heated or cooled.

Geothermal is more efficient than reverse cycle air conditioning which relies on air-to-air heat transfer, as opposed to air-to-ground. While one unit of electricity supplied to the compressor in a reverse air system can pump the equivalent of two or three units of heat, geothermal can produce over four units. This means geothermal can provide heating and cooling at running costs between 30 to 50 per cent of its air-to-air counterpart.

A geothermal system for domestic water heating was also trialed but whereas the provision of heating and cooling worked well, there have been problems with the hot water system. Furthermore, worked well, there have been problems with the hot water system. Furthermore, it is believed that the high capital and installation cost is likely to discourage the average person from adopting the technology.

Waste not, want not

New Haven's waste water treatment plant captures, treats and recycles all waste water, stormwater runoff and sewage. Installed by Aeroflo, the completely automatic plant treats water for use in toilet cisterns and for sub-surface irrigation of household gardens, road verges and reserves, which is expected to reduce average household water consumption by 30 per cent.

The treated sewage sludge has not gone to waste but has instead been added to clay by Hallett Nubrick to make bricks. The sewage sludge was found to produce a fantastic range of textures and earthy tones in the bricks, some of which have been used in the Village.

The Central Board of Health approved the treatment plant which is located under a reserve adjacent to the Village, with stringent conditions applying to the quality of treated effluent, monitoring equipment, testing and operations of the plant. The City of Port

Adelaide Enfield is responsible for its on-going maintenance.

Village people

Enid and Charles Loughlin have been living at New Haven for two years. The couple heard about the Village through the Trust and decided to make the move to be closer to their daughter and grandchildren who also live in North Haven.

The Loughlin's energy saving home was built by Ian Woods Homes, and its features include full insulation, northern orientation and geothermal heating and cooling.

While Enid believes geothermal heating and cooling is a good idea, the couple have been experiencing problems with their system for the past year. As the exact problem cannot be identified, a new unit is being flown out from the US to replace their existing one.

Despite this, Enid is pleased with the other features of the home, including access to recycled water, the use of which has already reaped savings. Enid says that reduced demand on mains water, which is only used for bathing, drinking and in the kitchen, has saved the couple around $100 a year.

New Haven has been strategically located close to existing infrastructure, such as schools, shopping centres, public transport and recreational facilities to promote communal interaction and the enjoyment and comfort of residents.

'I like living here. It's a very friendly community and I'm close to amenities. The North Haven shops behind the Village are about two minutes away, so is the train station, and the beach is about five minutes away. It's very convenient,' said Enid.

SolarSense home

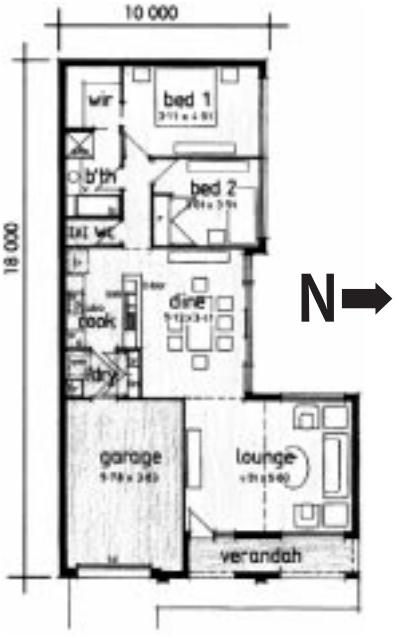
A special project located at New Haven is the SolarSense home, a two-storey house that utilises all the technologies at the Village, and many others. The objective of the SolarSense home, which recently sold for around $135,000, is to reduce household energy use by 50 per cent, leading to savings of about $400 per year.

Solar Energy Roof

The home's main feature is the Solar Energy Roof, which integrates a photovoltaic (PV) array, a skylight and solar water heating panels into one panel set into the roof . The Roof is believed to be an Australian first, with the solar componentry being housed in a polycarbonate tray that was installed before the Colourbond roof.

The low profile panel was designed and manufactured by Menzel Plastics in conjunction with ETSA Corporation (formerly the Electricity Trust of South Australia) and architects Hector Urizar & Partners through federal funding from the now defunct Energy Research and Development Corporation.

The PV system was designed by Solaris Technology, and comprises of 12x80W Solarex panels, for a total array size of 960W, and a 1.3kW CSA inverter. Solahart donated an electric boosted hot water system, and also modified its close water heater to enable installation of a water tank at ground level for easy maintenance access and aesthetics. The Solahart system is valued at around $3,000, while the installed cost of the PV was approximately $12,000. The array will save about 20 per cent of the home's energy needs, and the water heater another 25 per cent.



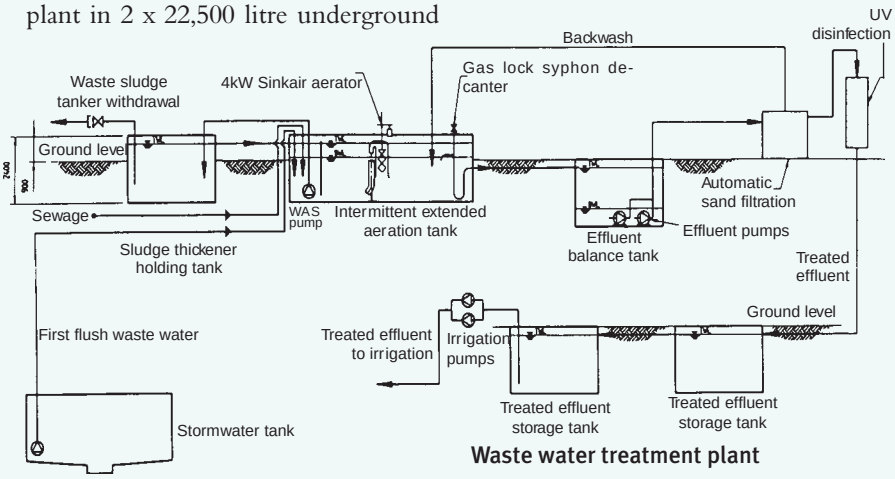
Left: The Loughlin's energy saving home Right: The floor plan

How the waste water treatment plant works

An underground concrete stormwater tank collects the first 40,000 litres of a particular rainfall, and each night, 8,000 litres are delivered to the treatment plant. At the plant, combines waste is fed into an intermittent extended aeration tank containing aerobic (oxygen using) micro-organisms which eat organic pollutants and convert them to harmless end products like water and nitrogen gas. The oxygen used in the process is supplied by aerating the tank's contents using a 4kW Sinkair aerator, developed by Aeration and Allied Technology. Following aeration, the aerator is stopped and the micro-organisms settle to the bottom of the tank. This leaves a layer of clean water on top, which is decanted using a gas lock syphon decanter. The aerator is restarted and the cycle repeated.

The decanted effluent is discharged to an effluent balance tank before being filtered by two Ultra Violet Technology of Australia (UVTA) automatic 'tri-media' filters that are backwashed with fresh water. The filtered effluent then flows at 1 to 2 litres per second to an UVTA UV 521 disinfection unit comprising of six germicidal UV lamps.

The treated effluent is stored at the plant in 2 x 22,500 litre underground concrete tanks, ready for daily distribution. Supply of the treated water is on demand from twin irrigation pumps and a pressure vessel, and prior to reuse, it is filtered by two 'Spin-klin' filters to ensure no blockages occur in the drip emitters of the irrigation systems. Sludge is disposed to a sludge thickener holding tank to reduce the frequency of sludge removal.



Waste water treatment plant

Low energy materials

Low embodied energy wall materials have been used as they require less energy, and hence fewer fossil fuels, in their manufacture. One of the products used was Rapidwall wall panels manufactured by Rapid Building Systems.

The panels are made from rendered, fibreglass-reinforced gypsum and measure 12m x 2.7m. They are about 100mm thick, and have a 97mm cavity which is filled with Tontine insulation of around R2.5 rating, which adds to the walls' own insulating value of 0.6. As the manufacturer's name suggests, the panels can be quickly erected, helping to reduce construction time from an average of 16 to 12 weeks.

ETSA is using lounge and living area sensors to monitor heating and cooling to see how effective the panels are, and will compare the results with homes made of traditional building materials.

Radiant ceiling heating

Radiant ceiling heating works by radiating heat through the ceiling to living areas as required, using a thin, electrically resistant film located above the plaster of the ground floor ceiling under the insulation. Set at a comfortable living temperature and carefully positioned, radiant ceiling heating is effective with low installation and running costs.

The Village is also trialing net metering for PV generated electricity. Households pay 12.4 cents per kilowatt hour for electricity, and receive the same amount when they export back to the grid. This is monitored by a bi-directional electricity meter. Data loggers have been installed in 16 homes including the SolarSense home to monitor household energy savings.

Passive solar features

Passive solar design features include northern orientation to maximise winter sunshine and exclude summer sun; overhanging eaves on windows to allow low angle winter sunlight in, while providing shade against high angle summer sunlight; and window shading to trap the sun's warmth when it is needed, and exclude it when it is not.

Shared street

Through an amendment to the Road Traffic Act, all public roads in New Haven are shared 10km per hour zones where pedestrians and cyclists have legal priority over motorists. It is hoped that this will encourage residents to walk, cycle or use the nearby public

Left: The SolarSense home complete with Solar Energy Roof. Right: The Roof integrates photovoltaic cells, a skylight and solar water heating panels into one panel. The solar componentry is fitted into a plastic tray that is laid on battens before the colourbond roof. Note the 'shoe' to the drain for the solar heater.

transport facilities instead of their vehicles.

It's easy being green

A 'Green Mortgage' purchasing scheme was suggested for the first time in Australia through an arrangement with BankSA. The scheme allows homebuyers to marginally increase their borrowing to finance five and six star energy rating appliances such as washing machines and fridges, and other energy efficient practices.

On the right track

New Haven and the SolarSense home are together steps toward the realisation of the South Australian government's goal to derive 20 per cent of the State's energy from renewable sources by the year 2004. According to Brooke Hill, Environment Manager at the Land Management Corporation, New Haven is a test and trial site for the Mawson Lakes development in Adelaide's northeastern suburbs where 4,000 homes will be built over 10 years. On a smaller scale though, John Keipert, Strategic Planner of Maintenance at the Trust, believes the Village illustrates the merits of sustainable housing to the average person. 'We [the Trust] are trying to demonstrate to homeowners and to builders, generally, what can be done with ecologically sustainable development,' he said.

Monica Oliphant, ETSA's Principle Research Scientist, hopes that, in particular, the SolarSense home will encourage homeowners to use renewable energy.

'People who have installed solar water heating are already helping to reduce greenhouse gases—the SolarSense home technology may encourage more South Australian homeowners to join them,' she said.

Dennis Mitchell, Engineering Co-ordinator at the Trust, said that while working on New Haven was difficult, it was a tremendous experience. 'One of the things we found was that you had nothing to refer back to. Everything you did was new, and so it was a very, very challenging project, which involved a huge amount of co-operation from government, local council, builders and many others,' he said.

This innovation and co-operation obviously paid off, with New Haven being awarded in 1995 both the state and national Royal Australian Planning Institute Award for Planning and Development, and the MBA-ETSA Building Excellence Award for Excellence in Research and Development.

While New Haven has its shortcomings, including the absence of gas supply (a more greenhouse friendly fuel for space heating and solar hot water boosting than electricity) and energy efficient appliances, as well as problems associated with the geothermal systems, the Village is nevertheless an important advance in the delivery of sustainable development in the housing construction industry.

But for Dennis, projects such as New Haven can only work if the 'five C's'—courage, communication, co-operation and critique—are observed, the last of which is particularly important.

'There's no point in trying to do these projects unless you constructively critique them at the end to ensure that the next project is an improvement,' he said.

For further information contact:

John Keipert, South Australian Housing Trust, Ph (08) 8207 0625.

Monica Oliphant, ETSA Corporation, Ph (08) 8404 4391.

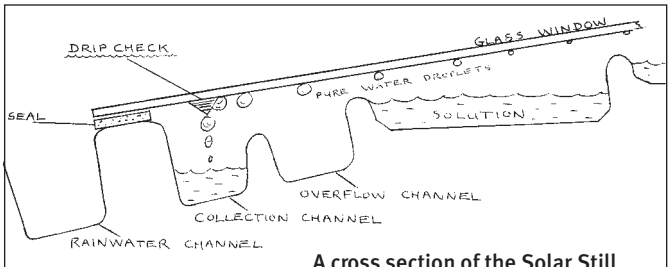
Brooke Hill, Land Management Corporation, Ph (08) 8207 0848.

A solar solution to clean water

Introducing an Australian invention with big potential in developing countries

Sydney residents recently had a taste of what more than two billion of the world's human population experience every day: contaminated drinking water. Fortunately for Sydney residents, clean water was only as far away as the supermarket. But for people in the developing world, water-borne viruses, bacteria, chemicals and even radiation are a continual health threat, killing 25 million people each year.

There are a number of options for water purification in developing countries (and Olympic cities with privatised water suppliers!) These include chemical treatments, filtration and distillation. But two big obstacles create problems with most of the available methods: cost and reliability.



A cross section of the Solar Still

A new Australian invention has addressed the water purification problem, and its developers see it as having great potential in developing countries. The Solar Still is by no means a completely new idea, but has tackled some of the problems associated with producing a low cost, low maintenance, durable purifier.

The Solar Still comprises a moulded plastic tray with a glass cover and a steel tubing stand, which tilts the tray at 10 degrees. The tray is insulated underneath with polyurethane and aluminium foil.

There are a series of horizontal channels in the tray. The top channels contain impure water. The sun's radiation passes through the glass cover, and heats both the water in the tray and the tray itself. The water is heated further as heat is conducted to it from the tray.

When the water evaporates it condenses on the glass window. It then slides down the glass, until it reaches a 'drip check', where it drops into a collection channel. An overflow channel between the collection channel and the evaporation channels prevents impure water from entering the purified water supply. The Still also has a collection channel for rainwater collected on the glass cover.

One of the problems encountered by the developers of the Solar Still was distortion of the moulded plastic during use. In the same way that continuous steel railway tracks warp in the sun, the early experimental flat plastic trays bent into shapes that made them less efficient and unattractive. The solution was similar to the one used by railway engineers, who put small gaps between the sections of track to allow for expansion. Gaps in the plastic tray were not an option, of course, but the same effect was achieved by placing small convex domes in the base of the tray. The domes have thinner plastic at their peaks, which allows for sufficient expansion to prevent the tray from permanently distorting.

There are two operating modes for the still. It can be filled to overflowing with impure water and left to distil its contents, or connected to a drip feed. In the drip feed mode, the Still flushes solids out, meaning that it requires very little cleaning. The continuous flow of water also keeps the temperature of the plastic lower, meaning it is even less prone to distortion from overheating.

The Still can be used to remove any contaminants, including the chlorine and fluoride added to some water supplies, bacteria, viruses and salt in sea and bore water. It is even being evaluated for use in the wastelands surrounding Chernobyl to supply radiation-free water.

The current model costs around $350, can distil two litres of water per day, weighs 10kg and is just over 1 metre on its longest side. For the average Australian, the main applications will likely be to make bore water more palatable, and to supply water on camping trips. Then again, given Sydney's recent experience, having one in the cupboard may not be such a bad idea for city residents either.

Michael Linke

The Solar Still was developed by John Ward and Margaret Folkard of Sundials Australia in Adelaide. It is being manufactured by a South Australian company, Barvan Australia.

To find out more about the Solar Still, contact Barvan Australia, 24 Maclean St, Beverly, South Australia. Ph (08) 8346 6699, or Solar Advice, 30 Honister Close, Westminster, Perth 6061 Western Australia, email solar@networx.net.au, Ph (08) 9343 4300 or 0412 45 7569.

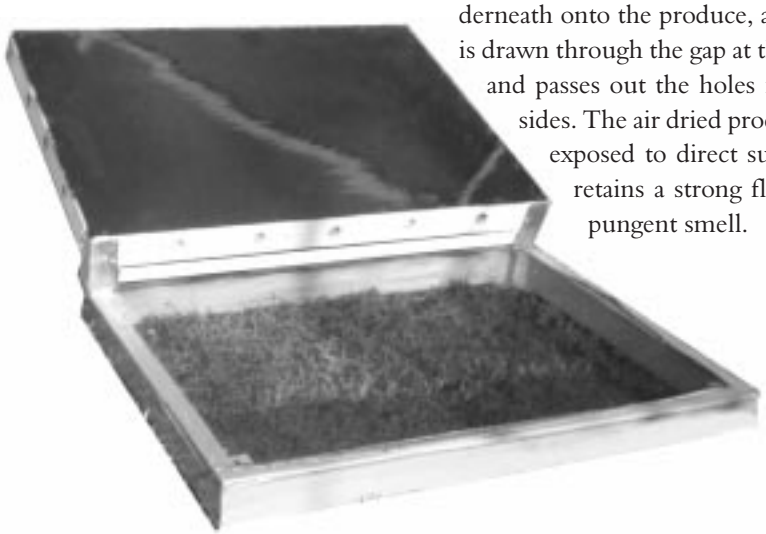
Make a simple solar herb dryer

Why buy expensive dried fruit and herbs when you can do it youself at home? J McLarty shows you how to make a simple but effective drier

A simple home herb dryer is a must for every dried fruit and spice lover. I have discovered a do-it-yourself home solution to an expensive store bought dryer. By following the directions, you can build this in a few easy steps.

The drier is basically two wooden frames, made from 25 x 50mm wood, sitting one on top of the other. Mine measures 610 x 460mm, but the size probably isn't crucial. The bottom one has black aluminium flywire stretched across the top of it, while the top one has a sheet of black painted aluminium on top of it. The bottom frame has 6mm plywood corner reinforcers on top of the flywire, which helps make it sturdy and leaves an important air gap between the frames. The top frame has 16mm holes drilled in the sides. It also has a length of metal cornerstrip on each corner that protrudes downwards about 6mm to locate the bottom tray.

How it works is the metal top absorbs heat from the sun. Heat is radiated underneath onto the produce, and the air is drawn through the gap at the bottom and passes out the holes in the top sides. The air dried product is not exposed to direct sunlight, so retains a strong flavour and pungent smell.



Once the dryer is built you are ready to start experimenting. Spread the herbs or fruit on the flywire and put the lid on. Place the dryer in the sun, directed at the best angle. There is no need to chop up herbs, just separate the leaves from the main stems. I have tried parsley, sage, oregano, thyme, mint and lavender. Drying can take as little as six hours or up to three days. Used jars with tight seals make good storage containers when drying is complete. The banana chips I dried were especially tasty and chewy. Have fun building and drying! ✲

Recipe

Home-made sun dried tomatoes

Halve the tomatoes and remove the stems. Push skin side in and arrange on tray. Salt and pepper lightly. Sun dry for about two days, at which stage the tomatoes should have lost about nine-tenths of their mass. Remove tomatoes and dip in vinegar. Turn skin side up and and arrange on tray. Sun dry until they have the moisture content you desire. This should only take about one day. Pack in jars with one clove of garlic, and cover the beauties with olive oil. Bon appetite!

Make or break time for Victoria's first wind farm

Appeals against Australia's most ambitious wind energy project could stop it from happening, reports Grant Flynn

In November 1997 planning permits were issued to allow what would have been the southern hemisphere's largest wind farm to go ahead. Australian company Energy Equity Corporation (EEC) was issued with the permits by the Glenelg Shire Council for construction of wind farms at two of their three proposed sites on the coast of western Victoria, near Portland.

Construction was to be complete and the wind farm in full-scale production and pouring 'clean and green' electricity into the national electricity grid by September 1998. However, things have not gone according to EEC's plan. Appeals against the Glenelg Shire Council's two planning permits have seen EEC drop their plans at one sight, and threaten to prevent the farm going ahead at the other. At the very least, the appeals have delayed the project, with the hearing not scheduled until November this year.

EEC's main business is in fossil fuels, but apart from the Portland wind farm proposals, they have established a joint venture with AUSTA Energy Limited called The Green Energy Company. This joint venture is planning to develop one gigawatt of 'green' energy in Australia over the next five years and develop other projects in the Asia Pacific region. They have already identified significant potential for increased use of biogas as an energy source.

EEC's original plan for the wind farm was for it to be at least 10 megawatts (MW), selling electricity at 9 cents per kilowatt-hour (kWh). The three proposed sites were at Cape Nelson, Cape Bridgewater and Bridgewater Lakes.

The current plan is for around 20 MW of generating capacity, made up of around 30 turbines rated at either 600 kilowatt (kW) or 750 kW generating capacity. The turbine manufacturer is not known yet, though tenders have been submitted and final negotiations are underway. Some likely contenders include European manufacturers Vestas, Enercon and Lagerwey, all of whom have Australian-based distributors.

Objections to the wind farm

Of the three sites applied for (Cape Nelson, Cape Bridgewater and Bridgewater Lakes) the two Capes were approved by the Shire with the Bridgewater Lakes application rejected because of a potential infringement of air space for one of the approaches to the nearby airport.

The land owners whose properties the Bridgewater Lakes turbines would have been located on lodged an appeal against the Shire's planning permit rejection. At the same time, a number of parties objected to the Shire's approval of town planning permits for the two Cape sites, so a directional hearing was scheduled at the Administrative Appeals Tribunal (AAT) for February 1998.

On trial at the AAT

At the hearing the Bridgewater Lakes landowners' objections were rejected because they were not the applicants (only a town planning permit applicant can appeal against that application's rejection). EEC—who were defending the Cape Bridgewater and Cape Nelson site approvals—then stepped in as the appellant to the rejection at Bridgewater Lakes.

There were protests that EEC had not properly lodged their application to appeal. EEC made it clear that they would simply lodge an appeal at a later date in accordance with the rules, and end up back in the tribunal, so there was no point delaying the hearing. The Tribunal ruled to act 'according to equity and good conscience and substantial merits of the case without regard to technicalities or legal forms'. To those more cynical amongst us this was a refreshingly sensible decision. The Tribunal also ruled that all three applications would be heard as one because of their proximity and similarity.

Opponents to the town planning permits include a number of local residents, the National Trust of Australia, and the Mirimbiah Nations Aboriginal Corporation.

The reasons for appeals against the planning permit that were voiced at the directional hearing included concerns that the wind farm would lead to the destruction of a unique coastal site; concerns about noise; there were no archaeological surveys, and the wind farm could interfere with historic Aboriginal sites; EEC did not have detailed assessment of landscape or the flora and fauna of the area; the wind farm would

adversely affect eco-tourism in the area because it would spoil the untouched natural beauty; and the turbines, access roads and transmission lines would adversely affect the landscape.

A number of submissions were heard at the directional hearing to aid the Tribunal's ruling. Jane Kierce, a Planning and Development Archaeologist at Aboriginal Affairs Victoria, has stated in correspondence that both registered and unregistered archaeological sites are protected under the State Archaeological and Aboriginal Relics preservation Act and the Commonwealth Aboriginal and Torres Strait Islands Heritage Protection Act. Written permission from the Aboriginal community involved is required for the disturbance or destruction of archaeological sites. In this case the Kerrup-Jmarra Elders Aboriginal Corporation represents the community.

She also pointed out there are archaeological sites at Bridgewater Lakes and it is on the Register of the National Estate, so has demonstrated cultural significance. This site (a cave near the Lakes) shows aboriginal occupation up to 11,400 years ago and it is known that the region has other unregistered sites.

The AAT has asked that EEC prepare a report on the archaeological significance of the project and submit it for the final hearing. Ms Kierce has reported positive discussions with EEC and the local aboriginal community.

The region is also subject to a native title application to the Native Title Tribunal by the Gournditch-mare people who have established their standing in the region in a previous case before the Full High Court of Australia against Alcoa during the construction of the Portland Aluminium Smelter at Cape Sir William Grant.

The coastline is also registered as a Scenic Heritage Site and has various other protection measures because of its natural beauty. There is a well developed 250km coastal walk to take in the views of the area.

The AAT's decision

The outcome of the February directional hearing was that the various parties with objections to the planning permits had presented a reasonable case and that the cases should continue to a decision hearing. EEC were ordered to prepare and distribute expert reports on the archeological significance of the sites; bird utilisation of the region; noise impact of the site; the effect of the project on native grasslands; and the impact of the transmission lines involved.

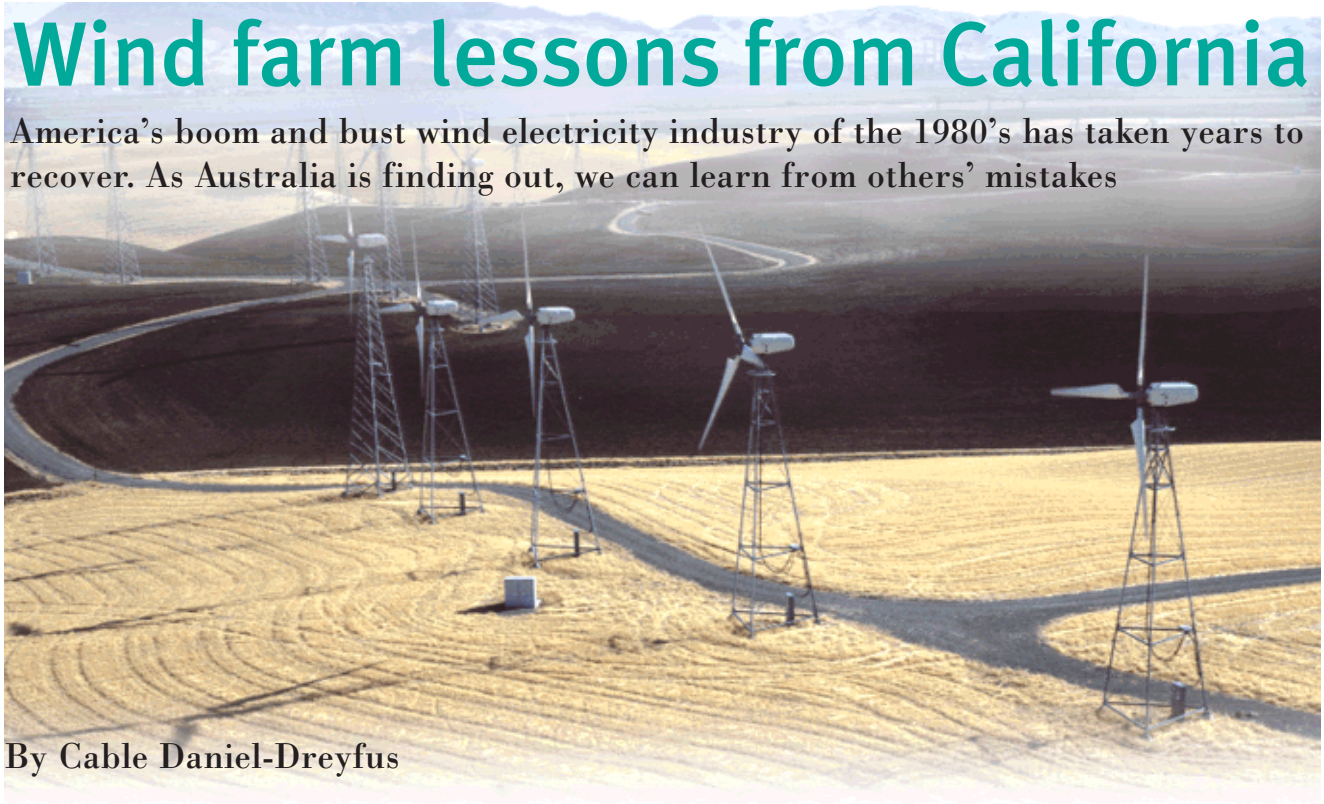
The reports were to be made available one month before the official hearing of the tribunal which is to be held over two weeks—a few days in Portland and a few days in Melbourne. The Tribunal is to have an on-site visit as well as accept submissions from local residents while in Portland.

The waiting game

EEC was unable to gather all its required data and formulate its reports in time for proper circulation of the information to all the parties involved in the appeal. Consequently the appeal hearing had to be postponed. Unfortunately the AAT are a busy tribunal and the next available date is in November 1998. When asked whether EEC was confident about the AAT finding in their favour, the wind farm's project manager, Matthew Rosser, explained that 'optimistic is a better description.' ✲

Wind farm lessons from California

America's boom and bust wind electricity industry of the 1980's has taken years to recover. As Australia is finding out, we can learn from others' mistakes



By Cable Daniel-Dreyfus

The place is Altamont Pass, California; the time is 1980. America is turned on by wind power and to show their support the federal government has announced they will give tax credits to wind turbine manufacturers in the hope of blowing new life into the electricity frontier. Fears that the 1970 oil crisis could repeat itself have forced the government to look at other energy options. The idea of wind power makes sense. It's free, bountiful and not harmful to the environment. The plans for America's largest wind farm are set in motion, and Altamont Valley becomes the gold plated 'X' on America's energy treasure map.

Six thousand turbines and eight years later, Altamont wind farm was no longer the nation's renewable energy darling, and the turbine industry felt a backlash to wind energy so strong it caused many manufacturers to file for bankruptcy. In less than a decade America became so disillusioned with wind energy that many citizens not only asked that no new farms be installed, they also demanded the dismantling of some old farms. The federal tax credits, which seemed like a good idea at the time, led to a boom and bust cycle where many new companies were more knowledgeable in the ways of flashy deal-making rather than wind technology.

Ten years later, Australia is facing its own dilemma concerning wind farms. Proponents of wind power are pushing to develop wind farms which could potentially help to power thousands of homes, yet the public is unsure as to what wind power could do for them as individual home owners. Many people are sceptical as to whether a structure that resembles a giant metal flower with blades for petals could be instrumental in simultaneously running their washing machines and cutting back on greenhouse gas emissions.

In the wake of the inertia facing the proposed Energy Equity Corporation wind farm near Portland, the people of Victoria are asking, 'Do we really want a wind farm?' Gaining a perspective by examining the history of the US wind industry might help Australia to strengthen, protect and foster its own fledgling industry.

But does it really work?

There were a myriad of reasons why many American citizens decided that wind power was not going to be the gold rush of the 1980's. Perhaps one of the greatest concerns the public had with wind farms was aesthetics. In theory, most citizens approved of the idea of a clean, renewable energy source to power their houses, but did not actually want to see the turbines spinning in their own backyards. An understandable sentiment for home owners, but conventional methods, such as oil and brown coal, must be transported through cables, underground pipelines and oil tankers. These methods have been known to fail from time to time and caused such disasters as the contamination of part of the Alaskan coast line, which seems like quite a big cost to pay for a view from a window. Yet, regardless of disasters like the EXXON Valdez, many home owners are not willing to support the development of wind farms.

One reason for this is because the public still views wind power as unreliable. The Altamont Wind Farm is built around Route 580, a mammoth highway thousands of commuters use daily. Out of the

6,000 turbines at Altamont, 1,000 could be idle at any given time due to maintenance and weather conditions. Commuters are known to stare at the still turbines and ignore the spinning turbines. Researchers have found that people perceive spinning turbines more favourably than non spinning turbines, and have advised developers of wind farms to keep the turbines spinning at all times regardless of weather conditions. Having all the turbines consistently spinning helps the public to feel that wind power is reliable.

Looks matter

Another problem people find with the way Altamont Pass looks is that the turbines and the towers all vary in shape and design. The overall appearance is not uniform, and fails to create a cohesive impression. Many commuters on route 580 find the angular designs of the turbines combined with visual clutter on the highway such as bill boards and garbage an overwhelmingly ugly sight. Local people began to think of the wind farm as a source of visual pollution. However, these kinds of complaints are not limited to wind farms. For those who live near a conventional power plant, the range of complaints span from feeling claustrophobic due to the looming smoke stacks, to suffering from wheezing due to the low air quality. What is important to realise is that no solution is perfect. There will undoubtedly be sacrifices from some home owners despite the method of generation chosen, although in general it is usually wiser to pay the cost for our consumption up front. Having a less than perfect view of our hills should be a small price to pay, rather then casting off the problem of a run-away greenhouse effect to future generations to solve.

In the ear of the beholder

The noise a wind turbine emits is a subjective taste. To those who support wind farms the sound of turbines whirring becomes a part of the landscape and is no different than the bucolic mooing of cows and the hum of tractors. Yet, not everyone can learn to live with the noise.

Local opponents of wind farms spoke out against noisy early models of turbines and demanded they be made with lower noise levels. The Dutch environment ministry headed the pack and decided to give a monetary bonus to turbine manufacturers as an incentive to develop quieter models. The plan worked. Manufacturers were influenced by the subsidy and succeeded in pioneering designs which were quiet as well as efficient. Mechanical engineers stress the point that although no turbine is without noise, the new modern models emit levels low enough so as to not interfere with a quiet summer evening on the porch.

The wildlife wedge

As the Altamont wind farm passed its second birthday, another problem presented itself which caused a schism in many environmental groups. Although groups such as the Sierra Club of America acknowledge that wind farms are a superior form of electricity generation compared to conventional fossil fuel and nuclear generation, they had a problem with the issue of deaths of birds due to turbines and wires.

During the period of 1984 to 1988, over 99 rare raptors (birds of prey) were killed at Altamont Pass, including both bald eagles and golden eagles. Some died due to being caught in the blades, while others were electrocuted from exposed wires. The wires have since been covered, and a modern wind farm has its electrical infrastructure underground. A major Californian Avian Task Force identified lattice towers as one of the

The turbine on the left is an example of a tubular tower design, used in many farms in Europe, including Denmark. The turbines on the right have lattice-type towers as found in many farms in California.

main causes of avian casualty. The raptors perch on the top of the lattice towers and dive off toward their prey. Unfortunately, the blades of the turbines can be in their path. This study was partly funded by one of the largest wind turbine manufacturers who supplied their turbines on lattice towers. The company has since designed a tubular tower from which the raptors cannot perch and prey.

It is clearly important for developers to conduct proper wildlife studies so that avian mortality is kept to an absolute minimum. In the US fines can reach up to $250,000 for killing a raptor. This staggering amount is an effective deterrent for developers to make sure they have researched every angle of wildlife impact. Yet, the number of birds that have died flying into turbines is relatively small compared to the number that have died by flying into conventional power lines. In fact, a Dutch study showed that the number of birds killed by conventional transmission lines per kilometre length is ten times higher than those killed in a wind farm per kilometre length.

The facts tell us that if we as a society are going to consume electricity, regardless of our method of generation, birds will continue to die. Anyone who has used electricity has inadvertently contributed to this statistic.

Paul Van Lieshout, Engineering Manager for the Wind Power group of Australian company PB Merz and McLellan, points out that people who oppose wind farms neglect to mention that conventional methods of energy such as oil and coal emit millions of tons of carbon dioxide (CO_2) into the atmosphere each year.

About 95 per cent of Australia's electricity comes from coal. Yet, because the effect the excess CO_2 has on our planet occurs slowly over time, the damage is difficult to visualise and thus harder to quantify. In the age of procrastination and instant gratification, it is easier to focus on the single bird which hits the turbine and falls to the ground, rather than work to remedy the larger problem.

Wind werkt!

Despite the fact that Altamont Pass wind farm has had numerous problems since it was built, it has been an excellent demonstration to other countries and developers of what not to do.

By the late 1980's, European communities were moving away from the California wind farm model. In Denmark, the Tændpibe farm, near Rinkøbing on the west coast of the Jutland peninsula, became the model farm. Unlike California, Denmark's new star offered proportional turbines and towers that were stout and similar looking despite the fact that four different height towers were used. The overall appearance was uniform and soothed the eye. The towers they chose were tubular and helped to minimise bird deaths. The attitude that the turbines should be regarded from an architectural and not just engineering perspective became dominant, a seemingly wise view if wind power is ever to be truly competitive against fossil fuels.

Also, unlike the California design, bigger does not mean better to the Danes. The Tændpibe park has only 100 units. The developers worked hard to keep the turbines constantly spinning and turned a green energy generation system into a tourist industry. Along the highway near Tændpibe, there are numerous signs informing travellers as to where they can go to examine the wind turbines up close. The sight has proved successful and has created new jobs in the tourism industry. A potential tourist has the choice of paying a small fee to go into the park and learn more about the wind turbines from pamphlets and bill boards, or stay outside and watch them spin. The Danish Energy Commission has created and marketed their wind farms wisely, and as a result the farms have become cultural icons that the Danish people regard with pride.

A land use comparison

There is a public misconception that wind farms require more land than conventional plants because the energy gathered from wind is more diffused. A study for the US Department of Energy concluded that the required land for wind farms is no more then the required land for a conventional coal fired plant after accounting for the entire fuel cycle.

Although a wind farm occupies four to five times as much land as a coal plant, the actual condensed occupation of a wind farm is only one to three per cent, whereas a coal mine uses every foot of its land for thirty years, a typical coal plant life expectancy. Moreover, after a coal plant is abandoned, reclaiming the land is difficult due to large open mine scarring and the permanent disturbance of ground water aquifers. This disturbance often causes acidic drainage after reclamation is completed. In most cases the water is polluted and the productivity of the land is never as good as it was before the mining began.

Unlike a coal plant, a wind farm allows other activities to take place on the land, such as agriculture, cattle grazing, and enjoying the clean air and open space. Much of the land that the wind farms in California sit on is owned by farmers. By allowing third parties to rent their land and develop wind farms, they have been able to continue their livelihoods and avoid the boom and bust cycle of the farming economy. Some farmers have gone so far as to say that it was the royalties from the wind farms that has allowed them to avoid selling out their homes and land, while also providing a small income during the winter months when no harvesting is done.

In effect, wind farms have allowed open areas of land to remain open, clean and stay in the hands of families who have owned and worked them for years. The royalties have also afforded home owners the luxury of saying no to real estate developers who would otherwise buy the land from the bankrupt families, subdivide it, and turn it into large, suburban housing developments, dotting the once open landscape with 10,000 identical structures.

Community involvement

While many environmental groups urge society to conserve their resources and curb energy consumption, the likelihood of this happening is low. Although the state of California leads the US in household energy conservation, European households use only a fraction of the energy that Californian home owners use. Unfortunately, states such as Texas and Oregon use twice as much energy per household as California. European energy analysts find this amount shocking.

Because the US emits one quarter of all greenhouse gases in the world, and power plants emit one third of that, many people feel they have a responsibility to develop their alternative energy forms, such as wind and solar. Although Australia's overall energy consumption is considerably smaller than that of the US, our per-capita consumption is among the highest in the world.

One way to involve a community in a wind farm is by enfranchisement. In Denmark, the fact that two-thirds of turbines are owned by co-operatives or individuals helped to accelerate an acceptance of wind electricity. The co-op helps to educate people to the benefits of wind energy, and it guarantees that the community is both financially and emotionally involved. Yet, regardless of what new development is on the drawing board, there will be a faction of the community that disagrees. Opposition is normal. Developers must listen to local home owners and be responsive to their questions and concerns. By compromising, educating and enfranchising, a prospective wind farm will be built quickly and welcomed with open arms.

Finally, there is a satisfying feeling that comes with witnessing a turbine working and knowing that it is helping to power your home. As the journalist John Richter succinctly put it, 'Seeing where your power comes from and relating the warmth of your home to the sunny skies provides a spiritual connection to your surroundings.' ✲

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Gipe, Paul. *Wind Energy Comes of Age*, John Wiley and Sons, ISBN 0-471-10924-X, 1995.

Thank-you

To everyone who responded to the Renewable Energy Development Trust's advertisement in the last issue of *ReNew*. These tax deductible donations will be used to help move the Alternative Technology Association, the publishers of *ReNew*, to a passive solar office powered by renewable energy at the CERES environment park. At the same time, the ATA is also hoping to expand and improve its operations to include maintaining Australia's largest sustainable technology library, and a greater number of education programs. To do all this will require new equipment like computers, an advanced telephone system and photocopier. Your donations to the Renewable Energy Development Trust will help us achieve these aims, and to be in our new office by the end of 1998.
Visit our web site to find out more about us: http://www.ata.org.au/

Yes, I wish to make a tax deductable donation of: ❒$10 ❒$20 ❒$50 ❒$100 ❒$250 ❒$500 other$_____

Please find enclosed my cheque or money order made out to the **Renewable Energy Development Trust**,

or please deduct it from my credit card: ❒Visa ❒Bankcard ❒Mastercard

Card number | | | | | Expiry date /

Name

Address

City State Post code Ph

Singleton PV array

a new Australian standard

Stage two of the Singleton solar array involved sliding close to 3,500 of these specially designed 60 watt Canon solar panels onto steel framing.

Since it was featured on *ReNew*'s cover in the last issue, Australia's largest solar farm at Singleton in New South Wales has doubled in size. Jane Clement explains how the array is put together

The commissioning of the Southern Hemisphere's largest grid connected photovoltaic (PV) installation marked a significant moment for Australia's renewable energy industry.

Located at Singleton in NSW's Upper Hunter Valley, the installation has been built because EnergyAustralia's customers are demanding more green energy.

So far, 6,000 households have signed up for the energy retailer's 'green' Pure Energy product. Singleton is helping to fulfil that commitment and to support expansion of the scheme.

The output of the $4 million solar farm is ten times higher than previously experienced on this side of the equator. Its first stage, completed at the end of 1997, generated 250 megawatt-hours of energy a year and had a rated capacity of 200 kilowatts (kW). When stage two was completed in June, that capacity doubled.

EnergyAustralia's building of the Singleton installation was assisted by a loan from the Sustainable Energy Development Authority (SEDA). Pure Energy is one of the energy products accredited under the Authority's Green Power Accreditation Program as part of its aim to support the renewable energy industry.

Research opportunity

'Pure Energy was a new area for us so it was difficult to make long term predictions for demand,' said Neil Gordon, EnergyAustralia's manager for sustainable energy. 'When customer numbers rose rapidly, we had to quickly find extra renewable capacity.

'We were keen to provide the supply ourselves rather than buying it in,' Neil continued. 'We have substantial experience in grid-connected solar energy so it seemed an ideal opportunity for us and our suppliers to broaden our knowledge and to provide a valuable research resource for Australia's solar energy industry.'

Despite having installed three of Australia's largest roof-top solar arrays, EnergyAustralia decided to build the new installation directly on terra firma. One reason for this was the tight schedule for the project. Planning started in mid June 1997 with the aim of commissioning the solar farm just six months later.

'We were also aware of potential disadvantages to using an existing roof-top for such an ambitious project, such as weight loading, roof integrity, wiring access and planning,' Neil said. 'And we couldn't wait for a new building to be constructed.'

The search was on for a low cost, easily accessible piece of level land close to a grid-connected power supply.

Singleton Council were keen to be involved and suggested several affordable pieces of Council-owned land in the Hunter Valley.

The final choice was a 1.25 hectare paddock 3km from Singleton. The site's proximity to a sewage plant limited its commercial development but was perfect for EnergyAustralia as it meant there was a grid connection.

The firm, rock-free ground could easily support the installation and building traffic without levelling or adding gravel. This suited the project's aim of minimising ecological disruption to avoid the 'dust bowl' effect of some overseas sites.

However, the site's location near an airport nearly provided an unexpected obstacle to obtaining planning permission, with concerns about the solar panels reflecting onto passing aircraft. Research proved the fears to be unfounded.

'This was not something we previously considered and was one of many lessons we learned during this project,' commented Paul Myors, project manager for EnergyAustralia's sustainable energy unit.

Design challenges

Singleton's main designer, Phil Gates, had a range of options to consider. 'There was no standard engineering solution so everything had to be assessed,' he recalled.

'Our major challenge was to balance design needs while minimising capital costs, finding a speedy solution and designing for a 25 year life-span.'

Wind loading was one variable factor so the framework was designed by a structural engineering company, which tested different wind loading scenarios using simulation software.

Different mountings were another consideration. The design team eventually chose a fixed array in preference to a tracking array that followed the sun.

'Fixed arrays are our area of expertise and are generally lower on maintenance requirements,' commented Phil. 'They also require shadow prevention from just one direction rather than from many.'

The resulting north-facing steel structure is angled at 30 degrees to the horizontal and is securely housed in concrete footings. Electricity is exported to the grid at 11kV via overhead wiring connected to a 200kVA pole-top transformer substation.

For stage one, the framing supported 3,456 Solarex photovoltaic modules, each rated at 60 watts. There were 38 sinewave inverters to convert the DC electrical output from the panels to AC for exporting to the main electricity grid.

Installing a cover for a Power Solutions inverter at Singleton.

At peak output, the installation generated up to 200kW, enough to provide the solar component for 3,000 Pure Energy customers.

The question of how many inverters should make up the 200kW requirement was a particular challenge for stage one. The final decision was to install one 50kW inverter plus 37 4kW inverters from two different manufacturers.

'We wanted to compare the cost and performance of large and small inverters and that of inverters from different

The Singleton solar farm

Vital statistics

Stage 1

•200kW peak solar output, comprising of 3,456 Solarex photovoltaic modules, each rated at 60 watts and consisting of 36 individual polycrystalline silicon solar cells.

•Modules bolted on to steel framing fixed at 30°.

•1x50kW Power Solutions sinewave inverter, 3x4kW Power Solutions sinewave inverters and 34x4kW CSA sinewave inverters convert DC electrical output from the panels to AC for exporting to the main electricity grid.

Stage 2

•200kW peak solar output, comprising of 3,456 Canon photovoltaic modules, each rated at 60 watts and consisting of single sheets of 9-layer amorphous silicon.

•4x50kW Power Solutions sinewave inverters.

•Modules slide into grooved steel framing fixed at 30°.

Stage one of the Singleton solar farm: 200 kW of Solarex panels.

manufacturers at the same site,' said Neil Gordon.

Power Solutions Australia supplied the 50kW inverter. The company was also able to supply three 4kW inverters with the same ratings as the 4kW CSA inverters so the two could be easily compared.

The resulting data has proved useful for the suppliers. The inverter manufacturers are unwilling to divulge performance details for reasons of commercial confidence but, according to the managing director of Power Solutions, Dr James Brown, the inverters have performed about equally.

'This is a rare opportunity for us to gather truly comparative data and will enable us to make effective adjustments and performance improvements,' said Dr Brown.

Power Solutions Australia's inverters contain sophisticated electronics that enables two-way connection to AC supply sources such as the grid or a generator and, with a telephone connection, allows remote management. This ability will be utilised at Singleton for purposes such as collecting data when a remote monitoring system is installed later in the project.

The inverters are designed to operate in remote country areas and are rated to work at 40°C or more, the kind of temperatures endured by the crew during the final months of building stage one.

Lessons learned

Stage two, which was constructed during the cooler autumn months, has increased Singleton's output to 400kW.

One major lesson was to simplify. Stage two was easier to construct than stage one as it is based on thin film, amorphous silicon technology from Canon. Instead of being separately screwed on and wired up, the panels simply slid onto the framing.

The Canon panels perform acceptably and offer substantial savings on on-

site assembly labour costs. Similar amorphous solar cell technology is being laminated into sheet steel and used as energy-generating roofing which is being trialed in several Australian projects. They use four PowerSolutions 50kW inverters to supply electricity to the grid, and a second 200kVA substation was installed.

Stage 2 also includes new elements such as bird guards to scare away the magpies which covered the panels with droppings, potentially affecting performance.

The addition of an automated security system will provide links to base for automatic alarm calls in the event of a security breach or a freak incident, such as the lightning which struck the installation's power line in its second month of operation and rendered several inverters inoperable.

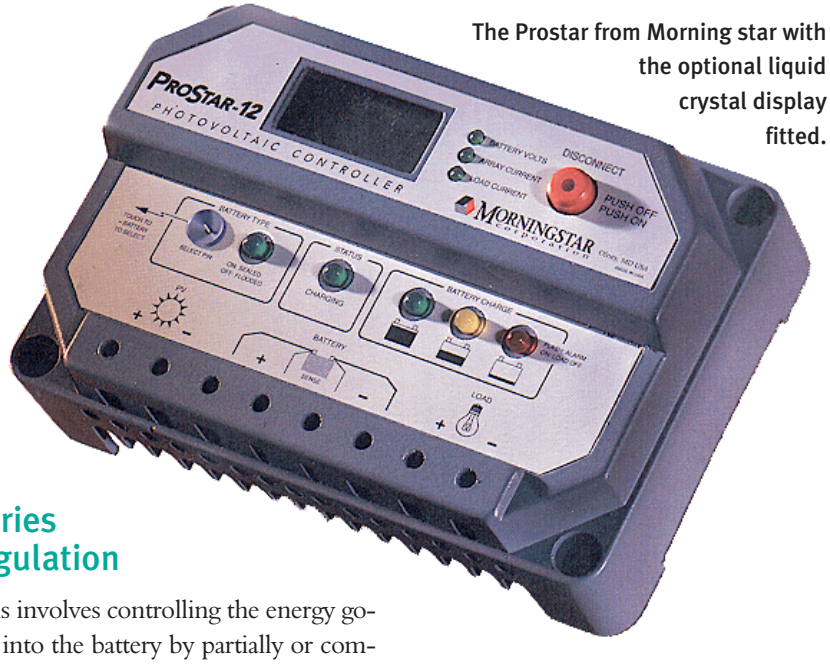
'Those kind of unforseen events have provided us and our suppliers with a better insight into the technical and logistical problems of building an open air solar installation on a scale not seen before in Australia,' said Paul Myors.

So far, Singleton's energy production levels have been slightly higher than anticipated and, apart from the lightning strike, it has had no more maintenance requirements than a standard roof top installation. ✲

Regulator buyer's guide

Fitting the right regulator in an independant power system is very important—if you want your batteries to live a long and healthy life

Adrian Oakey



The Prostar from Morning star with the optional liquid crystal display fitted.

The battery regulator is usually the least thought about component in an independent power supply system. After all, it is only a fraction of the cost of the other components—PV panels, batteries and inverter. However, the regulator is worth thinking about because it can have a significant effect on the correct operation of your system. In order to select the right battery regulator, you need to understand a bit about them and the choices that are available.

We will look at regulators designed for flooded cell, lead acid batteries, but they are just as important for sealed lead acid and nicad batteries.

What does a regulator do?

A battery regulator controls the amount of energy going into the batteries that are used to store energy from your PV panels, wind turbine or micro hydro unit. In particular, it is intended to prevent the battery from being overcharged.

There are several ways in which energy flow to the batteries is controlled. The methods that you are most likely to find are open circuit series switching, shunt, or diversion switching, or shunt power dissipation. There are also other methods, such as switchmode voltage regulation, but these are less common.

The method used varies between manufacturers, and as can be seen in the tables, often depends on the energy source the regulator is designed for.

Series regulation

This involves controlling the energy going into the battery by partially or completely blocking the flow of current. This is done in one of several ways, including series switching and taper charging.

Open-circuit switching is usually referred to as 'series switching regulation'. The regulator monitors the state of charge of the batteries, and when sufficient energy has gone into the batteries, the regulator opens the switch and disconnects the charging source from the batteries. When further charging is needed, the switch is closed again.

Two methods are employed to switch the power—relays, which are electrically operated mechanical switches, and solid state switching, which uses transistors. Solid state switching technology is more commonly used, due to its relative low cost and high reliability (there are no relay contacts to burn or wear out mechanically.)

Open-circuit series switching is usually used with photovoltaic (PV) panels because they can be left open circuit (that is, not providing power to anything) without damage. This type of regulation is also quite cheap to implement, as no load dumps are required for the excess power.

However, potential generating capacity is wasted, which means that your investment in PV panels is not being fully realised.

Change-over series switching. In this form of regulation, the charging source is not just disconnected from the batteries, its energy is diverted to another load, such as a water pump, water heater element or a second set of batteries. Some series switching regulators may provide an additional feature for load diversion, which is actually change-over switching.

Change-over switching would normally be used with PV panels. However, if the change-over switching is done using fast electronic switches, the regulator could be used for other loads,

such as wind turbines. This is achieved by rapidly switching back and forth between the two loads with an appropriate percentage of connection time for each load, providing an apparent smooth load without voltage ripple (small, rapid fluctuations in the output voltage which can effect the operation of appliances).

If your regulator has a change over facility, establish what it is capable of.

Taper series regulation involves gradually reducing the amount of energy flowing into the battery as it approaches a full charge. The excess energy is usually dissipated by the regulator itself as heat.

Shunt regulation

With shunt regulation, the excess energy is diverted, or shunted, into an alternative load which is connected to the batteries in parallel by the regulator. The voltage across the alternative load is the same as the voltage across the batteries. Depending on the degree of control sophistication, either all the energy is diverted—that is 'on/off'—or an appropriate proportion of the energy is diverted through the dummy load.

The method of controlling and dissipating excess energy varies but is generally one of the following:

Low-power shunting is done using Zener diodes which allow current flow through the Zener when a certain voltage is achieved. The excess power is dissipated as heat in the diode.

The maximiser from AERL will actually boost the current going into the batteries.

Medium-power shunting is done using a transistor or similar electronic device. The excess energy is dissipated in the transistor.

High-power shunting is also done by a transistor or similar device, but the energy is dissipated in another load, usually a bank of resistive heating elements, water heating elements or, sometimes, incandescant light bulbs.

If you want to use the excess energy from your power source when using a shunt regulator, then regardless of power level, the last method is used.

Because the voltage is consistent across the system, shunt regulation is usually used with wind generators. As a result, the wind generator does not have any sudden loading or unloading which can cause undesirable structural stresses.

There is no reason why PV panels could not be operated using this type of regulation, but it is usually more expensive than series switching due to the cost of providing an alternative load.

Maximisers

These are a different type of device that use high frequency switching to convert the varying input voltage and current from the solar panel array to the correct voltage for the battery bank. Because they are capable of maximum power point tracking, they can convert any excess power in the form of high panel voltages into usable current, thus increasing available power from the panels.

The only maximising regulator that we know of, the Australian Energy Research Laboratories range, are claimed to increase average current to the batteries by 20 to 30 per cent.

Regulation control

Regardless of the means by which regulation is achieved, control of the regulation process is required. By control, we mean the conditions under which the energy is allowed to flow into the battery, and in some cases, the rate at which it flows. There are various levels of sophistication but the main controlling parameter used is the battery voltage.

The Plasmatronics PL series intelligent regulator.

Single stage control

The simplest method of control is single stage regulation. With single stage regulation there are preset upper and a lower voltage limits. The regulator switches power to the batteries when their voltage falls below the lower limit and switches it off at the upper limit. The upper limit is usually set at a value that will approximate full charge, and the lower limit is set at a value that can approximate anywhere between 50 and 80 per cent of full charge. The reason for having an upper and lower limit instead of just an upper limit is to prevent the switch turning on and off rapidly once the upper limit is reached.

However, there are problems with using this simplistic approach. One is that the voltage is not a true representation of the charge condition of the battery, as other factors such as temperature and battery condition can influence the battery voltage. The other problem is that flooded-cell batteries require a regular boost charge to equalise the individual cells. This means charging the

battery to a higher voltage occasionally, something a single stage regulator cannot do.

You can have some control over the boost problem by installing a bypass switch that allows you to manually boost charge the batteries or by having a manually adjustable voltage set point. But you must remember not to leave your system on boost, or the batteries could be destroyed. For this reason most set points are determined in the factory, but some regulators are adjustable.

Sealed batteries, however, do not require a boost charge, and indeed may be damaged if charged to too high a voltage. If you have these batteries in your system, a simple single-stage regulator may be all that you require.

Taper control

Taper control involves gradually reducing the flow of energy into the battery as full charge is reached. This can result in a more complete charge being achieved. The rate of charge is determined by the voltage of the battery.

Taper control is typically used with shunt regulators, but it can also be achieved using fast solid state switching technology in a series regulator (this is known as pulse width modulated, or PWM control). The rate of switching is very fast, resulting in no apparent voltage ripple on the load, but this method may produce high frequency interference that may affect sensitive appliances.

This Sollatek regulator is housed in a weatherproof enclosure for outdoor use.

Dual stage control

Dual stage regulators serve to address the problem of providing some boost charge. With this method of control there are two charging conditions. One is 'boost' and the other is 'float'. When the battery is being charged from a starting voltage that is below that of the float voltage, for instance after a discharge, the battery is charged until the boost voltage is reached. Then the regulator drops the voltage to the float level and maintains it until a load is applied.

Once again, the correct voltage for regulation can be affected by other factors and though the boost is available, it occurs on every charging cycle. This can result in excessive gassing and more than normal loss of water from the battery.

'Intelligent' control

This is a rather loose term which includes any regulator that is using more than just the instantaneous voltage of the battery to determine regulation. These regulators may be referred to as 'intelligent', 'programmable' or 'smart', but the basis of all of these regulators is that they provide a complex sequence of control. With modern electronics, these regulators are most likely to use microprocessors, but complex sequences are possible using more basic electronic circuitry.

Some of the things that these regulators are capable of include boost regulating at a particular time of day; determine correct voltage to charge up to, based on rate of charge; know what battery configuration is being used and keep track of the amount of energy that has been discharged from the battery.

Like the Pecan Engineering PSR21, most regulators designed for solar use series switching.

If you are seriously considering a more sophisticated regulator you will need to look at the various strategies being used and decide whether they are appropriate (and worth the extra cost). If you are not sure, ask around to see what the people using these regulators think.

Temperature compensation

The battery voltage can be affected by temperature, particularly when cold. Because of this, the voltage set points for control can be inappropriate. Many regulators, including the simple types, offer temperature compensation. This is achieved by using a temperature probe to sense battery temperature and adjusting the voltage set points based on that temperature.

Whether this feature is of any real value is debatable, particularly for single stage control. However the choice to install a probe is usually optional, so you can have the feature but not use it if you wish. As battery voltage is more affected by cold than heat, it is more commonly used in cold locations.

Additional features

Though the chief purpose of the regulator is to regulate the energy flow, many regulators provide additional features that allow the user to observe what is happening and to control other aspects of the independent power system.

Status displays

Displays on regulators vary from nothing to the very complex. The range of displays that you are likely to find are:

Status lights. Status lights are usually LEDs (light emitting diodes). The number of status conditions can vary but typical status indicators are for boost, float and low voltage. These are useful as they provide a visual indication of the battery condition.

Meters. Meters can be provided that show voltage and amperage. Voltmeters are more common, but ammeters are quite helpful in determining whether the system is producing the energy expected. Meters are often of the analogue type, but liquid crystal displays (LCDs) are now becoming more widely used. There may be a separate display for each function, but a more common approach is to use a single display with a selection switch to allow you to look at different parameters.

Historical displays. By using microprocessor-based control and data storage memory, some of the more advanced regulators are capable of recording the number of amp-hours or watt-hours being collected and used by the system. This information will not make the system run better, but those who take a keen interest in the system's performance may consider these features money well spent.

Low-voltage cut-outs

If the battery is overused and the voltage drops to a low level, some systems offer an option where all or part of the output load can be switched off via a relay or transistor. This reduces or removes the load and prevents the battery from being run completely flat. This is particularly useful in an unattended system where something may have been left on unintentionally. Some form of time delay is advisory to prevent operation of the low-load cut out due to a sudden large power draw, such as a motor starting up.

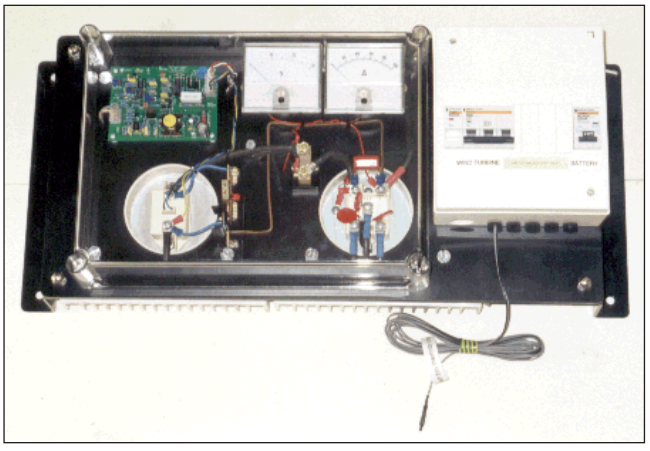
Generator start switch

On some regulators a generator start relay or control output is provided to operate a backup generator if the voltage drops below a certain point. Once again delays need to be built in to prevent a premature start and to allow the generator to operate for a reasonable time.

Independent power control systems

Quite a few companies provide many of the above features as part of a full control system where the regulator is only a sub component. Other manufacturers are building the system control and regulator control into one unit. If you want all the bells and whistles look at both arrangements.

Be aware that an advanced display system may not mean advanced charge control and visa versa—advanced regulation control can exist without advanced dis-



This regulator from GP and GF Hill (Westwind) is designed specially for use with wind generators and uses shunt regulation.

Manufacturer/ supplier	Model (made in)	Voltages available	Current capacities	Type	Application	Adjustable setpoints	Temperature compensation	Battery types	Displays	Case t
Ananda Power Technology (APT)	Smartline (USA)	12	12, 20	Series PWM	PV	Battery type only	Yes (sensor optional)	Flooded or sealed	Battery, load disconnect	Wall m
Australian Energy Research Laboratories (Australia)	300 B	13-132	16	Switchmode maximum power point tracker with current boosting and auto equalisation	PV	Yes	Yes (sensor optional)	Flooded	LCD, LV, output alive, input alive	Wall m
	600 B		20							
	900 B		24							
	1200 B		28							
	800 BLV	13-85	28							
	1800 BHV	26-250	20							
BP Solar	GCR/M (Germany)	12, 24, 48	8, 12, 20, 30	Multi-stage series/shunt	PV, wind	No	Yes (sensor optional)	Flooded or sealed	LEDs, LCD display optional	Wall m
	FBR (Australia)	12, 24, 36, 48	40 (12-36 volt) 30 (36-48Volt)	Multi-stage series	PV	Factory adjust only			Numeric LED (A, AH, V)	
	BPMR (Australia)	12, 24	15	Single-stage series	PV	Factory adjust only			LEDs	
	BPNG (Australia)	12, 24, 36, 48	40, 80 (12-36V) 30, 60 (36-48V)	Multi-stage series	PV	Factory adjust only			Numeric LED (A, AH, V)	
JA Brebner (Australia)	Hydro controller	240VAC	Up to 50kW	See comments	Hydro	—	—	—	—	See com
Jaycar Electronics	ICP (Canada)	12	2	Switching	PV	No	—	Flooded	C	Wall m
GP & GF Hill (Australia)	Westwind	24, 48, 120	2.5kW	Taper shunt	PV, wind, hydro	Yes	Yes	Flooded	Voltmeter, ammeter, LEDs	Wall m
			5kW							
			10kW							
Morningstar (USA)	SunSaver	12	6.5, 10	Constant-voltage series PWM	PV	No	Yes	Flooded or sealed	C, LVD	Wall m
	ProStar	12, 24	12, 24, 30		PV	No	Yes	Flooded or sealed	C, V, LVD	Wall m
Oatley Electronics	K09	12, 24	16	Series switching	PV	Yes	No	Flooded or sealed	C	See com
Pecan Engineering (Australia)	LRT8	12, 24	8, 4	Series taper	PV street, sign and billboard lighting	Factory selectable	Yes	Flooded or sealed	C, F, LVD	See com
	LSR6	12, 24	6, 3	Series taper	PV		Yes		C, F, LVD	Flange r
	LSR10	12, 24	10, 5	Series taper	PV		Yes		C, F, LVD	
	PSR21	12, 24	21	Series switching	PV		Yes		LVD	
	PSR30	12, 24	30	Series switching	PV		Yes		C, LVD	
	PSR120	12, 24, 48	50	PWM or switching	PV	Float only	Yes		C, F, LVD	
Plasmatronics (Australia)	PC series	12, 24	12, 30	Series switching	PV	Only some	Optional	Flooded or sealed	C, F, B, LVD	Wall m
	SPSD series	12, 24, 48	50, 100, 200	Series diversion	PV	Yes	Yes (sensor extra)	All types	LCD	Wall m
	PL20	12, 24, 32, 36, 48	20	Series and/or shunt PWM (selectable)	PV, wind, hydro	Yes	Yes (sensor extra)	All types	LCD	Wall m
Platypus Power (Australia)	B-SR50	12, 24, 48	0-400 watts	Constant voltage taper shunt	PV, wind, hydro	Yes	No	Flooded or sealed	V, A	See com
			400-750 watts							
Sollatek (USA)	SPCC05	12, 24	5	Single-stage series	PV	Factory adjustable	No	Flooded or sealed	C, V, LVD	Wall m
	SPCC10	12, 24	10	Single-stage series	PV	Yes	Yes	Flooded or sealed	C, V, LVD	See com
	SPCC16E	12, 24	16	Two-stage series	PV	Yes	Yes	Flooded or sealed	C, V, LVD	See com
Solarex (Australia/USA)	SR4	6, 12, 24	4	Series switching	PV	No	No	Flooded	None	Wall m
	SRX-6	12	5.5	Shunt	PV	No				See com
	SR8	12, 24, 36, 48	8	Series switching	PV	No				Wall m
	SC18	12, 24, 36, 48	18	Series switching	PV	No			B, F	Wall m
	SC30	12, 24, 36, 48	30	Two-stage series	PV	Yes	Yes		V, A, C, B, F	See com
	SM30	12, 24, 36, 48	up to 200	Series switching	PV	Yes	Yes	Flooded or sealed	Alpha-num LCD	Shelf m
	VRX	12, 24	4, 8, 16, 25	Shunt	PV	Yes	Yes	Flooded or sealed	C, LVD	Wall m
Solar Charge (Australia)	SC100	12, 24	6	Taper shunt	PV or wind	No	No	Flooded or sealed	None	Heats mount,
	SC200	12, 24	13							
Trace (USA)	C-12	12	12	Series or shunt	PV or wind	—	Yes (sensor optional)	Flooded or sealed lead acid, nicad	V, A, AH, W See comments	Wall m
	C-30	12, 24	30			—				
	C-40	12, 24, 48	40			Yes				
Sustainable Technologies	Idea	12	3	Shunt	PV or wind	—	—	Flooded	2 LEDs	Wall m
		12, 24	10	PWM	PV				3 LEDs	
		12	10	PWM	PV				2 LEDs	
	Jade	12	12, 16	PWM	PV	—	—	Flooded	2 LEDs	
		12, 24	25, 30	PWM	PV	—	—	Flooded	2 LEDs	
	Solstice MX 120	12	20	Shunt	PV or wind	—	Yes	Flooded	4 LEDs	
Trace (USA)	C-40	12, 24, 48	40	Series or shunt	PV or wind	Yes	Yes (sensor optional)	Flooded or sealed lead acid, nicad	V, A, AH, W See comments	Wall m
Windpower Australia (Australia)	ESR-5	12	5.5	Series switching	PV	Yes	No	Flooded	LEDs	Weather
	ESR-10	12, 24	10.5					Flooded or sealed	LEDs	
	ESR-20	12, 24	21					Flooded	LEDs	
	Seminar 2000	12, 24, 36, 48	50	Series switching	PV	Preset in software	Yes	Flooded or sealed	LCD and LEDs	Wall m
	XL70	12, 24, 36, 48	70, 65, 45, 30	Series switching	PV	Yes	No	Flooded or sealed, nicad	LEDs	Wall m
	3491/250	12-96	250 watts	Shunt switching	PV or wind	Yes	No	Flooded	LEDs	Wall m
	3491/500	12-110	500 watts							
	3491/750	12-110	750 watts							
	3491/1000	12-120	1000 watts							

ype	RRP $	Comments
ount	$225	Has low-voltage load disconnect, reverse polarity protected on all inputs and outputs. Automatic equalisation.
	$799	Panel voltage does not have to match battery voltage, allowing panels to be wired in series to reduce cabling costs. 2 year warranty.
	$899	
ount	$1199	
	$1399	
	$899	As above, plus is designed for 12, 24 and 36 volt battery systems.
	$1799	As above, plus is designed for 110 volt battery systems.
	$99, $123, $183, $196	LCD display metering extra.
ount	$461	100 amp shunt for metering $42 extra. Has generator start ability.
	$120	
	$730 BPR2NG $1000 BPR4NG	Has generator start ability.
ments	$1000	Supplied as circuit board. Options available. Is designed to control voltage and frequency of 240 volt AC generators. Requires load dumps.
ount	$79.95	Has low voltage disconnect
	$2816	Includes air-cooled load dump.
ount	$3587	Includes air-cooled load dump and current limiting inductor.
	$3987	
ount	$85	
ount	$156, $185, $225	Optional LCD to display battery volts, array current and load current.
ments	$29	Supplied as a kit containing circuit board and components only.
ments	POA	Supplied as bare circuit board for OEM applications. Has 10 amp low-voltage disconnect.
nount		Has 10 amp low-voltage disconnect.
		Has 20 amp low-voltage disconnect.
	$450	Has low voltage alarm output.
ount	Contact dealers	Microprocessor controlled.
ount		Microprocessor controlled. Made to order. Available with any options.
ount		Microprocessor controlled. Can be set to use PWM or slow switching modes. Has 20 amp load control. Vinyl coated circuit board.
ments	$957	Comes with one resistive element, circuit breaker, water resistant case.
	$1040	Comes with two resistive elements, circuit breaker, water resistant case.
ount	$64	
ments	$90	LVD manual reset button. Sealed enclosure for outdoor use.
ments	$169	LVD manual reset button. Sealed enclosure for outdoor use.
ount	$49	Epoxy sealed.
ments	$56	Designed to be mounted inside Solarex Mega Module junction boxes.
ount	$70	Epoxy sealed
ount	$138	
ments	$480	Has high and low battery alarms/control outputs. Available with various cases.
ount	POA	Fully programmable, energy use monitoring, genset starting, RS232 interface.
ount	POA	Auto equalisation, Low-voltage disconnect (all except VRX-M).
ink	$90	Has positive ground on heatsink.
open	$120	
	$177	Automatic monthly equalisation
ount	$169	
	$395	Digital display option available for $195 extra.
	$72	Has low-voltage disconnect
	$101	
ount	$101	Has low-voltage disconnect
	$104, $139	
	$164, $202	
	$165	Has low-voltage disconnect
ount	$395	Digital display option available for $195 extra.
	$49	
rproof	$65	
	$99	
ount	$699	Has low voltage generator start, amp-hour metering, array malfunction alarm.
ount	$299	Has manual boost charging, concealed cable entry.
	$359	Includes shunt load resistor bank. Battery may be disconnected without harming wind generator.
ount	$399	
	$629	
	$699	

Suppliers' Details

Adtech distribute the BP Solar GCRM2000 regulator with their AC/DC control panel. For details of this control panel, see our subscriber give-away on page 7. Adtech, 37 Isabella St, Moorabbin VIC 3189, ph:(03)5341 8232.

Ananda Power Technologies regulators are available from Yager Electronics, PO Box Q43, Sydney NSW 1230, ph/fax:(02)9979 9672, email:yager@mpx.com.au

Australian Energy Research Laboratories, MS 660 Lawsons Broad Rd, Proston QLD 4613, ph:(07)4168 9308.

BP Solar, PO Box 519, Brookvale NSW 2100, ph:(02) 9938 5111, fax:(02) 9939 1548.

GP and GF Hill, 29 Owen Rd, Kelmscott WA 6111, ph(08)9399 5265, fax(08)9497 1335, email: venwest@iinet.net.au

JA Brebner Pty Ltd, 74 Second St, Ashbury, NSW 2193, ph(02)9797 9247.

Jaycar Electronics, ph:(02)9743 6144, fax:(02)9743 2066, order line: 1800 022 888, email: mailorders@jaycar.com.au.

Morning Star and Sollatek regulators are available from RF Industries, 16 Kyabara St, Newstead QLD 4006, ph:(07)3252 7600, fax:(07)3252 5505, Solar Sales P/L, PO Box 190, Welshpool WA 6986, ph:(08)9362 2111, fax:(08)9362 3231, email: solar@ois.com.au, and Sustainable Technologies Australia (see address below).

Oatley Electronics, PO BOX 89, Oatley NSW 2223, ph:(02)9584 3563, fax:(02)9584 3561, email: oatley@world.net, www.ozemail.com.au/~oatley

Pecan Engineering, 13 Acorn Rd, Dry Creek SA 5094, ph:(08)8349 8332, fax:(08)8260 6643, www.southaustralia.com/pecan

Plasmatronics regulators are widely available through renewable energy equipment suppliers. Alternatively, check out their web site at: http://plasmatronics.taz.net.au/

Platypus Power regulators are available from Integral Environmental Energies, Locked Bag 8849, South Coast Mail Centre, NSW 2521, ph: 1800 644 550, fax(02)4228 2890, email: integral@integral.com.au

Solarex, ph:(02)9727 4455, fax:(02)9727 7447, Tollfree: 1800 802 762.

Solar Charge, 115 Martin St, Brighton VIC 3186, ph:(03)9596 1974, fax:(03)9596 1389

Sustainable Technologies Australia, ph:(02)6299 1250, fax:(02)6299 1698, email: catalog@sta.com.au, www: www.sta.com.au

Trace regulators are available from Solar Sales P/L, PO Box 190, Welshpool WA 6986, ph:(08)9362 2111, fax:(08)9362 3231, email: solar@ois.com.au and Sustainable Technologies.

Windpower Australia P/L, 200 Ninth Avenue, Austral NSW 2171, ph:(02)9606 0033, fax:(02)9606 0720.

C:	Charging	A:	Input current
F:	Float	AH:	Amp-hours used
B:	Boosting (equalising)	W:	Input watts
LVD:	Low-voltage disconnect	LCD:	Digital display
V:	Battery voltage	LED:	Light Emitting Diode

play systems. You should also distinguish between the cost of advanced charge control and advanced system control when deciding the value of these systems.

Weather proofing

Your regulator may be subject to a high humidity atmosphere or occasional exposure to rain. The unit should be sealed to prevent internal corrosion of the components. If you are in the tropics, be particular about establishing the suitability of the regulator under high moisture conditions.

Temperature

There are temperature ratings associated with most electronic components. If you are likely to be operating in a hot environment, then check to see that the unit you are purchasing is capable of operating at high temperatures (60°C plus).

Choosing your regulator

The tables included in this buying guide list many regulators with different features. When you take voltage and current rating into account there are lots of regulators to choose from. So which regulator do you choose?

Generally your system will be configured as a 12, 24 or 48 volt system though other less common voltages such as 36, 96 and 110 volts are possible. Regulators are generally supplied at one of these voltages, so you would normally select a regulator that suits the voltage of your system. For some of the less common voltages you may have to make a special order.

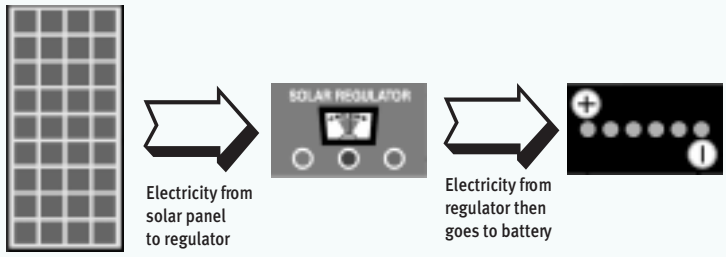
There are some regulators that can operate over arrange of voltages and you are required to select the operating voltage. If it is really smart, it will work out the voltage for itself. Buying a system where the operating voltage is selectable is of value if you anticipate that your system will grow, resulting in the voltage being increased. This is particularly true if substantial investment is made in an advanced system because you don't want to have to replace it later.

Current ratings are more varied than voltage ratings and can range from 5 amps to over 100 amps. The selection of the correct size depends on the size of the power system that you are installing. With PV systems, calculate current rating based on the maximum peak power of the array and allow for the addition of a few more PV modules later. Wind generators are usually sold with

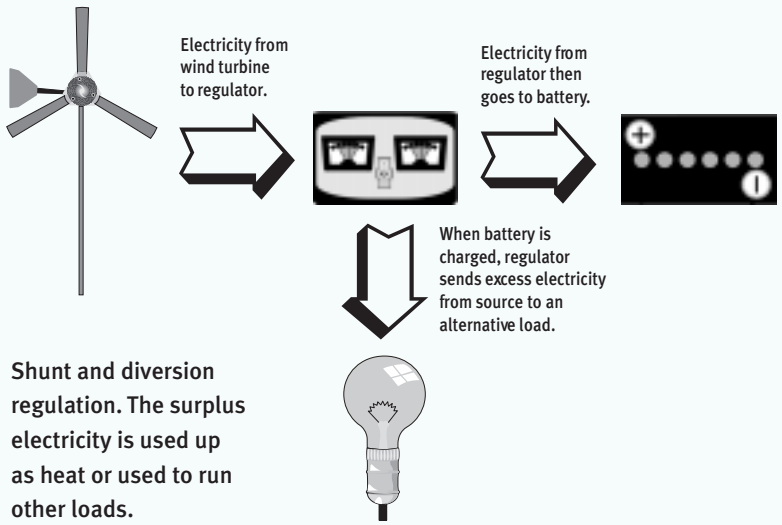
The basics of regulators

A regulator is a device that controls the flow of power into the storage batteries of an independent power system. They are necessary to prevent overcharging and damage to the batteries. They are fitted into the system between the power source, such as a solar panel, wind generator or micro-hydro turbine and the batteries. There are three main types of regulator: series, shunt, and diversion. The basic layout of a system using a regulator can be seen below.

The series regulator turns off the power to the batteries, and is usually only used with solar panels. The shunt regulator can be used with all three types of power sources, and works by shunting excess power away from the battery. This power can either be lost as heat inside the regulator itself, or used to run other appliances, such as pumps or water heating elements. The diversion regulator is similar to the shunt regulator, but is wired into the system differently.



Series regulation. The flow of power is reduced or disconnected from the battery.



Shunt and diversion regulation. The surplus electricity is used up as heat or used to run other loads.

regulators as part of the package, so the regulator will be appropriately sized to meet the maximum generating capacity.

The choice of regulator type is to some degree dictated by the market. Wind regulators are usually shunt type and are prepackaged with the wind generator, thus limiting your choice. Most PV regulators are series switching, which again doesn't leave much choice.

However, if you consider it worthwhile to look after your batteries, then you might find it valuable to mix and match different manufacturers' systems.

One of the main issues to consider is which type of regulator will offer the best battery operation. Taper charging is generally considered to be the best form of charge control, but because of the costs associated with shunt or high-speed electronic switching, is relatively expensive in most cases.

Intelligent control using series switching regulation may prove to be more cost effective while still providing good performance. However, the technology is still relatively new and is yet to prove itself worth the extra cost.

Simple regulation systems are generally cheap, but may not provide as good performance from the batteries. If substantial investment is made in batteries, then using a cheap regulator may not be a good idea.

And as a final point, all methods of regulation and control can be used for all types of batteries, but sealed batteries can be more easily damaged by overcharging, thus requiring different control voltages. Some regulators allow for this through different factory settings or user adjustment of the control voltage. As for the various advanced features—particularly display features—the question is, how much are they worth to you?

This guide was adapted from the regulator buyer's guide in issue 48 of *Soft Technology*.

The Platypus Power shunt regulator comes with its own load dump element.

Sinewave inverter buyer's guide update

In issue #64 of ReNew we failed to include the details of the German made Sunny Boy range of grid interactive inverters. These inverters are available from Powercorp Pty Ltd, 3406 Export Drive, Trade Development Zone, NT 0822, ph:(08)8947 0933, fax:(08)8947 0925, email: mail@pcorp.com.au

Model	Operating voltage range	Power output cont.	Peak efficiency	THD	Idle power (watts)	Standby power (watts)	Output isolation	Indicators	Output current limit	Protection	Size (mm) W x H x D	Weight (kg)	Comments	RRP $ (ex tax)	Warranty
SWR 700	75-250V	700	>93%	<3%	<4	0	yes	Connection to PC	yes	reverse polarity, short circuit, earth fault, temperature	322 x 290 x 180	18.5	IP65 sealed, can be mounted outside.		
SWR 850	125-250V	850													
SWR 1500	125-500V	1500	>96%	<3%	<7	0	no					12	Transformerless design.		

My toilet is alive!

Unwanted guests in your composting toilet? Dave Keenan shares his concerns about flies in his loo, and two manufacturers offer some practical solutions

I want to live in as ecologically sustainable a manner as I can afford, and I'm prepared to lose a little convenience if necessary. So six years ago I researched the theory of composting toilets and the different models that were available. They seemed the obvious way to go. I was convinced that the flush toilet was a fiendish invention.

So I bought and installed a four-chamber Rota-loo. A Clivus wouldn't fit and these were the only two brands I knew about at the time. The Rota-loo was supposed to have a 200 watt heater in the bottom of it which would be turned on if the liquid level got too high, but I elected not to buy it. I wanted as passive a system as possible. I even decided to run the vent fan off a solar panel. The instructions also said not to put fruit and vege scraps into it, but what is the point of having a composting toilet, if you can't put into it what you would put in a compost heap?

I live in a sewered area on a 600m^2 suburban lot in Brisbane, and it was illegal for me to use a composting toilet, but I didn't ask permission and was never challenged about it. So it should be obvious that I didn't let any social barriers stop me either. My wife was totally behind it, and my baby boy had known nothing else.

With three adults using the toilet and adding fruit and vege scraps and crumpled newspaper, we found that we would need to rotate to the next chamber after about six months. So after 2 years we needed to empty the first chamber. As promised, we found that the product had little smell and happily put it on our gardens. We also emptied our child's nappies down the chute and so two years later we learnt that nappy liners do not decompose at all! We had to pick them out of the compost to save them blowing around the yard and looking unsightly. It's amazing how little material is actually left after 2 years, it seemed as if it was mostly nappy liners!

Together with a greywater recycling system we had installed, the Rota-loo cut our total water usage by about 40 per cent. We basked in the warm glow of having done the right thing for the environment, but one little problem continued to nag. In fact it nagged so much that after about four years of use I decommissioned the composting toilet and installed a low flush conventional toilet instead. Through bitter experience I had come to understand that the flush toilet was not at all fiendish, but in fact a brilliant solution to a serious problem. What problem? In two words: 'insect escape'.

Tiny invaders

No matter what I tried over the years there were always times when one could not lift the lid without several flies lifting off and heading for the kitchen. The flies were of two main kinds, the tiny drosophila or fungal fruit fly and some larger wasp-like black flies. Incidentally, drosophila can fit through the holes in ordinary insect mesh, and even ordinary mesh gets clogged with dust too fast to use it on the vent outlet or inlet.

I tried more newspaper and I tried less newspaper. I tried urine separation with a half funnel siliconed to the front of the chute and polypipe going to a drum which I periodically diluted and poured around the fruit trees. I insulated my vent pipe where it went above the roof, by putting mineral wool and a larger PVC pipe around it. This was essential to stop evaporated water just condensing and running back into the tank in winter. I moved the vent connection from the top of the tank to the bottom, to be near the surface of the liquid that drains into the bottom of the outer tank. I changed to a vent fan with more oomph. I arranged for air to be continuously drawn through the pedestal by blocking the intake on top of the tank and propping the seat up about 20mm with a piece of foam rubber taped under the front. I hoped that the continuous downdraft would prevent the insects from flying up, but they just walked up the sides instead where the airflow was least.

I toyed briefly with the idea of painting the inside of the pedestal black and getting a black seat and lid, to eliminate any attraction to light, but paint would not wear well. In mad discussions with inventive friends we tried to come up with some automatic shutter system, but the complexity and the consequences of failure were always too messy to contemplate.

You may be thinking that it's only the Rota-loo that has this problem, and then only when not used strictly in accordance with the manufacturer's recommendations. A four chamber Rota-loo without the heater may be a worst case, but even the best, which I believe are the DOWMUS range, have this problem. I mentioned the problem to a friend who has a DOWMUS and he said 'No, I don't have that problem'. The DOWMUS has

a light trap which is intended to attract the flies away from the pedestal. When the opportunity came to visit his place I went straight to his toilet, lifted the lid and said, 'What's this then?' as a large yellow fly sat there looking at us for a few seconds before taking off inside his house. Now this may have been the only fly that ever escaped from his system, but it does seem unlikely. I would guess that most people are not very observant when it comes to looking down a toilet.

While it's fine to have all kinds of worms, flies, spiders, cockroaches—a whole mini-ecosystem—in your composter, you don't want them coming out of the pedestal and into your house. Even if I was to be convinced that there was little health danger from flies coming out of the toilet and landing on food (for instance, drosophila go straight for the fruit bowl) how would I convince my guests that it was okay? Guests rarely had a problem with the composting toilet, although I did move the light so it didn't shine straight down the chute, and some wanted a tape-recorded flushing sound to really feel that the act was complete. But at one stage I was spraying low-toxic personal insect repellant down the chute just before the guests arrived, and hoping for the best.

Manufacturers will say that if the toilet is working properly, the flies won't breed. I don't doubt this, but the fact is that a composting toilet is a very delicate biological system (mainly because it's such a small one), and it will get out of balance at times no matter how hard you try. There's temperature, oxygen, water content, carbon to nitrogen ratio, and ammonia build up, to mention a few considerations.

The system we have for greywater treatment involves a septic tank followed by a 10m^2 aerobic sand filter, followed by planted ponds. If this system had been made twice as big, it would not have cost much more and it could have handled the toilet waste as well. This is what it was originally designed for. The sand filter is practically invisible since it is built by lining and filling a 1 metre deep hole in the ground, and it can be finished back to original ground level and turf (or strawberries, or anything shallow rooted) can be grown on top of it. The ponds are optional and can be replaced by a simple pump chamber.

"drosophila", a yellow-coloured fruit fly, is introduced to composting toilets by putting in fruit and vegetable scraps

Modern flush toilets use very little water, and if treated wastewater is used in applications where it replaces fresh water (it can even be returned to the cistern) then it is not a net user of water at all. The S-bend solves the insect escape problem beautifully, acting as a liquid shutter.

Another problem with composters is that much of the useful plant nutrient goes up the chimney. My plants just love my treated greywater. And of course this is water I don't have to buy from the city council.

Another problem with composting toilets is that, despite the advertising, there *can be* a smell from the vent pipe, and despite having it well above my roof peak there were some wind conditions that brought it down to ground level. Not very nice for us or our neighbours. Again, this would probably not be noticeable if the system was 'working properly'.

It should be noted that there may be some health-diagnostic value in briefly smelling, and looking at, your own shit. Humans probably did this for hundreds of thousands of years before the invention of any kind of toilet.

One aesthetic advantage that is sometimes cited for composting toilets is that there is no smell in the toilet room at all. This is true. With a flush toilet the stuff sits there stinking the place out until you're finished, but with a composter even your farts are immediately whisked away by the action of the vent fan.

Considering the sum of my experiences though, I cannot recommend composting toilets to anyone, unless they have a serious water shortage, they live in a non-urban area, and they locate it outside their insect-screened house envelope (on a verandah would be fine). Since greywater treatment is

required anyway, why not save money and use the same system (only larger) for treating toilet waste as well? Although DOWMUS, and possibly others, offer a flush 'composting toilet' that you can put your greywater through, I remain to be convinced that they can achieve anywhere near the efficiency and resilience of a properly sized aerobic sand filter. ✲

Dave Keenan can be reached by email at d.keenan@uq.net.au. A longer version of this article can be found on his website at http://uq.net.au/~zzdkeena/ To learn about a water treatment system similar to Dave's, designed by a civil engineer with a postgrad diploma in environmental engineering, visit the website at http://www.cyberone.com.au/~enviro/sand.html.

A response from Buzz Burrows, General Manager of Environment Equipment, manufacturers of Rota-Loo compost toilets

Unfortunately, from time to time we receive feedback about an installation that doesn't appear to be working properly. I can not dispute what Dave has said about his particular circumstances, and I will not be drawn into discussion about a competitive system, though I am aware of how and why they do or do not operate. I have a great deal of experience in troubleshooting on non Rota-Loo systems for people and helping them overcome the problems or advising them to pull them out. I even helped install one of the very first DOWMUS systems in the Torres Strait Islands. From my experience I would say that 90 per cent of problems in well designed systems are people problems, not system problems.

In the majority of cases the customer has been 'sold' a system by a sales person and not advised on the correct system for their needs, by a consultant or a designer. Whilst, historically, the typical purchaser of a composting toilet system was doing it for environmental or ethical reasons, today, more and more people are doing it for purely economic ones and are demanding sales service as opposed to meaningful advice and recommendations.

Dave's comment about there being a fine balance in providing the right conditions for composting is both true and false. In regard to providing the 'optimum' conditions for any given site, climatic or geographic conditions, the statement is true. However, the composting process is extremely robust and occurs naturally at various forms of efficiencies all over the planet. The best example is a Rota-loo that was in use, very successfully, at the Greenpeace base in Antarctica for two years before it was disbanded. The Rota-Loo was then moved to their new headquarters in the Pacific. So in this context the statement is false.

The real issue is what type of composting process is at work in any given system, and what the user requires and expects the end-product to be like. If the user is expecting the most fantastic friable humus from their composting toilet, in the shortest possible time, then they are more likely to learn about the process and find out what they need to do to help it happen. Is their installation going to make the system aerobic or anaerobic? and what temperature range is it likely to work at?

The problem of flies

With regard to Dave's comments about flies, yes they can be a problem in certain areas and under certain conditions. A great deal of time, money and effort has gone into this type of research. For example, the Australian Wool Industry has spent many millions of dollars trying to work out how to control the occurrence and effect of fly blow on sheep, but they still can't work out why they are there or how to control them. In composting toilets the problem is a little bit different. There are basically three types of flies associated with this process.

Drosophila is a fruit fly, and can cause infestations in a compost pile if putrescibles are thrown into the system.

Putrescible substances such as fruit or vegetable scraps can contain the spore or larvae of fruit fly and they will breed given the right environment.

Ceratopogonidae is a biting midge or sand fly, which is attracted by CO_2 and animal smells. This insect is prevalent in coastal areas and is known to fly down the vent pipe in search of a blood meal. In order to deter this chap there are a number of strategies that one can adopt to either minimise the odour from the vent or protect the vent from the insect coming in.

Sphaerocerdae is a dung fly, that is also attracted by animal smells, will fly down vent pipes and will also breed in faecal matter. This insect is very small in size and needs stocking-like material to stop it.

Herbal remedies

Other strategies can also be adopted to increase the rate of decomposition by using herbs. The following is an extract from an article published in Gardening Australia, August 1997.

Yarrow (Achillea millefolium) has the most dramatic effect. It accumulates copper, nitrates, phosphates and potash and will enrich compost in the process. For those having trouble getting new composting established, there is simply no better activator.

Valerian (Valerianna officinalis) increases phosphorus activity and its leaves are rich in minerals. It also appears to attract earthworms to the compost heap.

Dandelion (Taraxacum sect. Ruderalia sp) speeds up the decomposition of the compost heaps and is also rich in copper, iron and potash—all valuable additions.

Tansy *(Tanacetum vulgare)* is known to concentrate potassium in the soil where it grows, and will also add to the compost. It also speeds up decomposition.

Chamomile *(Chamaemelum nobile)* is rich in calcium and will prevent excessive acidification and 'sweeten' the pile.

Comfrey *(Symphytum officinale)* is top of the heap so to speak. Rich in calcium, phosphates, potassium and nitrogen, it has a chemical composition not dissimilar to that of farmyard manure. Its large floppy leaves break down quickly and soon get to work.

Nettles *(Urtica Doica)* are also an excellent compost starter.

Composting is a natural biological process that is extremely effective in the decomposition of human waste. Potential purchasers of any composting system should always ask for advice on where and how best to install their system, or failing that they should thoroughly research the concept and process of composting human waste from an objective source. Two of the best sources are:

The Humanure Handbook written and published by Joe Jenkins in the USA. Available from Environment Equipment and various bookshops for $33.

Cornell University in the USA have a website which has some of the best research material available anywhere, located at http://www.cals.cornell.edu/dept/compost/

If anyone is still having a problem that they just can't seem to overcome, please give me a call on (03) 9587 2447. If I can't solve the problem I will find someone who can. ✲

A response from Jake Bugden, Environmental Engineer, DOWMUS Resource Recovery, manufacturers of DOWMUS systems.

Dave has made some very good points about compost toilet systems including:

- Council regulations on sewerage and greywater treatment are often unreasonable.
- Flies can become a problem with dry systems if they are not well managed.
- Compost toilets are a biological system and can get our of balance for a variety of reasons, although they are fairly robust.

In recognition of the problems inherent in dry composting toilets, DOWMUS manufactures a system to take influent from a standard 6/3 litre dual flush toilet. This system is more than a composting toilet, converting household scraps, toilet waste and wastewater into treated effluent suitable for sub-surface irrigation. This is achieved by the use of a biolytic filter—an advanced, chemical free, organic waste treatment process. DOWMUS provides different degrees of treatment level depending on reuse options. Treatment is far superior to that of a septic tank. Some councils now inspect septic tanks, in recognition of problems associated with these crude systems which are acknowledged as major polluters of the environment.

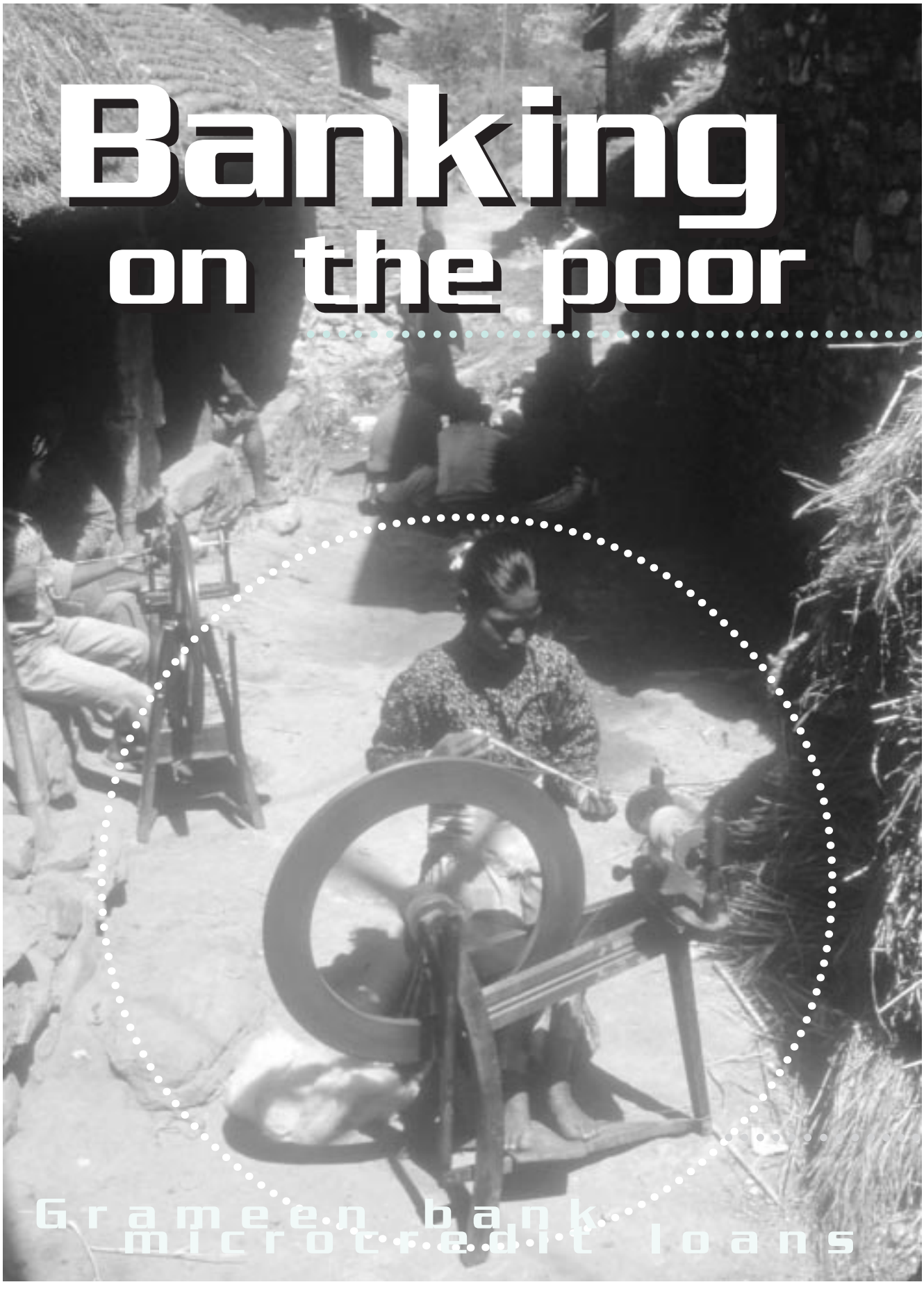
In regards to sand filters, DOWMUS manufactures the Activated Sand Filter that can be coupled with the Biolytic Filter for further treatment of the effluent to Australian Standards. Where council approval allows, this water can be reused (after UV disinfection) for toilet flushing and clothes washing.

The dry systems are not all bad. Committed users worldwide have been using dry systems for many years with a minimum of inconvenience. The main advantage over wet systems is that they conserve water—our most precious resource.

Insects and fly larvae are usually introduced into dry systems from kitchen scraps that are not stored in a container with a tight-fitting lid. If a fly infestation occurs, we recommend the use of a pyrethrum based cockroach bomb over a four week period to ensure the fly breeding cycle is broken.

Composting toilets can offer considerable advantages over septic tanks, and some owners report no problems with insects whatsoever. ✲

Banking on the poor



Grameen bank
microcredit loans

Photo: Carolyn Watson courtesy PLAN International

For centuries the world's poor have been branded worthless, lazy and beyond redemption. But in 1976 an economist in Bangladesh challenged the myths and began lending money to those with nothing. The Grameen Bank has been a startling success and there is now a fledgling replica in Australia

By Penelope Sell

How many of us feel a sense of hopelessness towards the world's 1.3 billion poor? With an international aid industry collecting $80 billion a year why is the poverty problem still so prevalent? As with most income disparities in the modern world, the problem lies within economic structures designed by the rich and powerful, and the final process of distribution.

Western aid is often inappropriate, condescending, and self perpetuating. Charity does nothing for the morale and self esteem of the receiver, and is often for short term emergency purposes. Besides the worldwide charitable institutions which can spend considerably more money on fundraising than helping, there's also government aid which is usually 'tied' in the form of monetary controls and trade agreements designed to suit western financiers and exporters rather than those they purport to help.

Modern Poverty

Poverty is a result of man made economic systems. Many unemployed or working poor are not given the opportunity to help themselves out of their situation. On the contrary, with their traditional resources being constantly eroded by development, the rural poor have been forced to move to the cities to find waged employment in factories, often to be disappointed. In richer countries there may be social welfare handouts to keep them alive. In poorer countries drugs and crime are a very valid alternative. This is the result of 'trickle down' economics, trickle being the operative word. It is clear that cities are no solution.

The Grameen Bank

As common sense would dictate, the best people to help the poor are the poor themselves. Assuming they have enough to eat, and therefore enough energy to work, poor people are quite capable of working themselves out of poverty through enthusiasm, initiative, and entrepreneurial skills. They need to be taken seriously.

Enter the Grameen Bank, a bank that lends money only to the landless, rural, poor. Rather than assessing your eligibility on how much money you do have, the Grameen Bank assesses how much you don't have. If it's low enough you'll get a loan.

It all started in Bangladesh in 1976 when a local economist, Professor Muhammed Yunus was astounded to find that a local woman, Sophia Khatoon, was in effect paying 300 per cent per annum interest to her loan shark in order to buy raw materials for her self made bamboo furniture. Professor Yunus realised that with a small loan of 50 taka, (a few dollars), Sophia could break the poverty trap, increase her earnings dramatically, and repay the loan. It was the first 'microcredit' loan and the foundation for many more to come. Today in Bangladesh the bank extends US$30 to US$40 million per month in new 'micro' loans to 37,000 villages across Bangladesh. It employs 12,600 staff, (all local), and it has a 98 per cent repayment rate. One of Professor Yunus's priorities was to keep the ownership and control of the bank in the hands of its borrowers. To this effect the savings of the borrowers has grown from nothing to US$165 million in just twenty years. This, from the poorest people on the Earth, the supposed 'basket case' of Bangladesh. It is a massive amount of growth

and indicative of just how credit worthy the poor are.

Australia's replica

But it doesn't stop in Bangladesh. The 'experiment' has been so successful there are now over 200 Grameen bank replications in 57 countries, and a new replica is created somewhere in the world each week. Poverty exists in every country, including the developed world. Hilary Clinton bought the Grameen Bank to America, and Brian Ridgeway has done the same for Australia. A semi retired businessman, Ridgeway came to Australia from New Zealand in the 1970's and lives in the coastal town of Merimbula. He heard Professor Yunus speaking on ABC radio and was inspired to help the poor in the rural community here.

Ridgeway believes in the honour of the poor. He believes people do not want social welfare handouts, but rather wish to work their way out of poverty with dignity. He believes poverty is created by unemployment and maintained in this country through our banking system, created by the rich and powerful. Commercial banks here follow the same scenario as in Bangladesh which lock out the poor, rendering them powerless to help themselves. And the poor are growing in numbers in Australia, with the Salvation Army estimating that there are now 900,000 families living in poverty.

Brian Ridgeway's 'Ridgeway Microcredit' is a non profit, non political, community service organisation. It is still in its infancy, having been founded in March 1997, and the small trial operations begun so far have received a 100 per cent return on loans. The maximum loan is $1000 and must be used for the purposes of self-employment and income generation. No collateral or security is needed. Each borrower must find three other people, (five in the Grameen model), to form a borrowing 'group' with, and in this way responsibility is encouraged, as default by one member of the group implies default for all. It is this interdependency, and rounding up of reliable people, which has made the Grameen model so successful.

As with the Grameen bank, Ridgeway Microcredit is solely owned by its borrowers who each buy one share in the bank and must contribute $1 per day in the form of savings which can be put towards repaying their loan at the end of each year. Their money, and all monies from outside investors, will earn a return of 4 per cent per annum, a fixed rate quite competitive with traditional banking.

Brian Ridgeway has met invaluable support for his project but he has had plenty of detractors as well. People who have never experienced poverty often prefer to think it doesn't exist in a country like ours. It is through his conviction in the dignity of all people that he has persevered and devoted so much time and money to the project. His anagram for the DOLE is 'Dignity Of Local Employment' and he is convinced that those on welfare would rather be working. Self employment will always be a more attractive and self-sustaining option than working for others. It is through self-employment that Microcredit operates, providing satisfaction appropriate to the work undergone, and, of course, boosting dignity and self esteem.

Banking on women

The world's richest people tend to be men and the world's poorest people tend to be women. There is no explanation for this other than man made sexist structures attached to property ownership and the ability to generate wealth. It is ironic then that the experience of microcredit shows that women are a far better investment than men. In Bangladesh, where women are often treated as second class citizens, the Grameen Bank gives them priority. Ninety four per cent of their clients are women. Ridgeway Microcredit will also give priority to women borrowers. Why?

Firstly, it follows the general principle of lending to the poorest of the poor, but there is more to it than that. Women have been found to be more reliable in repaying their loans, and once they have money they use it more responsibly. Where men are more likely to buy consumption items for themselves, feeding the family takes precedence for women. This is followed by education for their children, health priorities, and improving the family's housing situation. It has also been found that as women become financially independent, birth rates drop off. This is another area where microcredit has succeeded where other expensive family planning projects have failed, and it wasn't even an intention!

An optimistic future

The Grameen bank support group is very optimistic about the future for the world's poor. The near exponential growth of Grameen replicas around the world is one reason for this optimism. It is clear that the poor are hard working and can be trusted to repay their loans.

The other reason for optimism is the small amount of money it takes to make a difference. In Bangladesh, the size of a loan which is most favourable for growth is around half the average annual income—US$140. A similar pattern emerges in other countries. Worldwide, with 1.3 billion people living in poverty, it is estimated their total credit needs would be between 25 and 60 billion dollars. This is considerably less than what is already being spent on the poor in charity form—around 85 billion US dollars a year. The gains of

self employment are also much more long term than one-off handouts. After paying off an initial loan, people can take out successive loans and consequently provide employment for the whole family, working themselves up into a more prosperous future.

Ill health is one of the most serious consequences of poverty. In this respect the governments of countries must work harder to provide such basic necessities as clean drinking water and appropriate sewerage systems. The Grameen Bank is working towards alleviating ill health with a medicare scheme where members pay US$1.25 a year and US 2 cents per clinic visit. These small amounts cover 40 per cent of the clinic's cost with the remaining being sought from the Bangladesh government and foreign donors.

Poor housing is another obstacle in alleviating poverty. The Grameen bank is also making inroads in this area. They offer a $300 housing loan for a specific house, to be repaid over 10 years. The interest is cross-subsidised from the interest earnings of the working capital loans. The house is specially designed to suit the conditions of Bangladesh and uses only local raw materials. The architects won a prestigious award from the Aga Khan foundation for their low cost design. ✲

How you can help

Anyone interested or wanting to invest in the Grameen Bank or any of its replicas through the Grameen Trust can contact Shan Ali at the Grameen Bank Support Group:
7 Bourke Place, Mt. Colah, NSW 2079
Ph: (02) 9552 2380 Fax: (02) 9457 8805 email: grameen.oz@mypostbox.com
Web: http://www.rdc.com.au/grameen
For those wishing to make a difference in Australia, (and a four per cent return on investment), contact Brian Ridgeway at:
Ridgeway Microcredit
2 Kowara Crescent, Merimbula, NSW 2548
Ph: (02) 6495 1276 Fax: (02) 6495 1931

PLAN International also offer microfinance loans along the same lines as the Grameen Bank as part of their development programs.
PLAN can be contacted by writing to GPO Box 2818 AA, Melbourne 3000, or freecall 1800 033 614

Harsh realities confront the electricity market and its administrators

People involved in the sustainable energy industries have known all along that the new 'competitive' electricity market was stacked against us. We can all feel a warm glow in our hearts as we find that the bureaucrats and lawyers are beginning to shift ground. It's a pity we need to repair the damage done to our industries over the years it has taken them to learn from their own experience what we have long tried to explain to them.

In a recent submission to the National Electricity Code Administrator's (NECA) review of transmission and distribution pricing, Commonwealth government departments sounded some notes of concern:

'*Without attention to these issues* [such as cost-reflective transmission charges, non-discriminatory access arrangements and treatment of cross-subsidies] *it is unlikely that the environmental benefits which can flow from market reform—including greater penetration of gas, cessation of creation of new excess generating capacity, growth in cogeneration and renewables, greater attention to demand management—will be realised. Indeed, an incomplete market reform process can easily lead to worsened environmental outcomes.*'

The submission goes on to lay out what the government expects to emerge from NECA's review, including more cost reflective network pricing and fair access to the grid for independent generators. It also admits that existing arrangements include 'significant distortions', and urges that these market distortions should be removed as quickly as possible. This is an admission that almost a decade of economically rationalist effort has failed to deliver a fair, competitive market. The question is whether such a goal is attainable by these means. The bureaucrats' response is that we just haven't gone far enough—we have to charge further and faster down the road that they have mislaid so far.

The Government itself is being forced to confront the fact that energy markets are not delivering the expected outcomes. Its two per cent renewables target and generation efficiency standards, announced by the Prime Minister before Kyoto, show that it is no longer relying entirely on markets. It can't afford to: it knows Australia must deliver on its modest Kyoto commitments or face serious international consequences.

Apparently the lawyers (who have profited enormously from the energy industry restructuring) are also learning a few things. According to the latest Cogeneration Association newsletter, a leading lawyer noted at a recent conference that the legal profession was realising electricity and gas had some similar characteristics, and that gas and electricity were interchangeable for many purposes. Soon they may even realise that electricity, gas, renewables and energy efficiency all share common features: they are all means of delivering energy services (cold beers, warm homes, etc). When they come to terms with the principles of energy services, they will have reached the point that readers of US energy efficiency advocate Amory Lovins' books reached over twenty years ago. But can Australia and the Earth afford to wait for them to learn?

Pauline Hanson's popularity in country areas will add to the difficulty of energy market reform. What politician would now have the courage to approve market frameworks that double the price of energy in country areas? Yet that would be a direct outcome of the removal of cross-subsidies and pork-barrelling electricity supply schemes, which is necessary for an efficient market. And it is critical if sustainable energy is to gain fair access to its most cost-effective market opportunities under a market framework.

Maybe a pragmatic and principled path forward will involve both ongoing evolution of market frameworks and commitment of short term financial and political support of energy options being adversely affected by the ongoing identified market distortions. For example, cross-subsidies to rural energy consumers cost hundreds of millions of dollars each year. A fund of comparable size could be established, and sustainable energy providers could bid for funds to implement projects that would reduce the scale of ongoing rural subsidies. This could lead to a resurgence in rural economies, as many jobs would be created both by sustainable energy projects themselves and the industries they would underpin. As the scale of cross-subsidies declines, the compensating support can be reduced. Isn't that just the kind of win-win outcome the politicians need?

Carbon trading —the new cargo cult

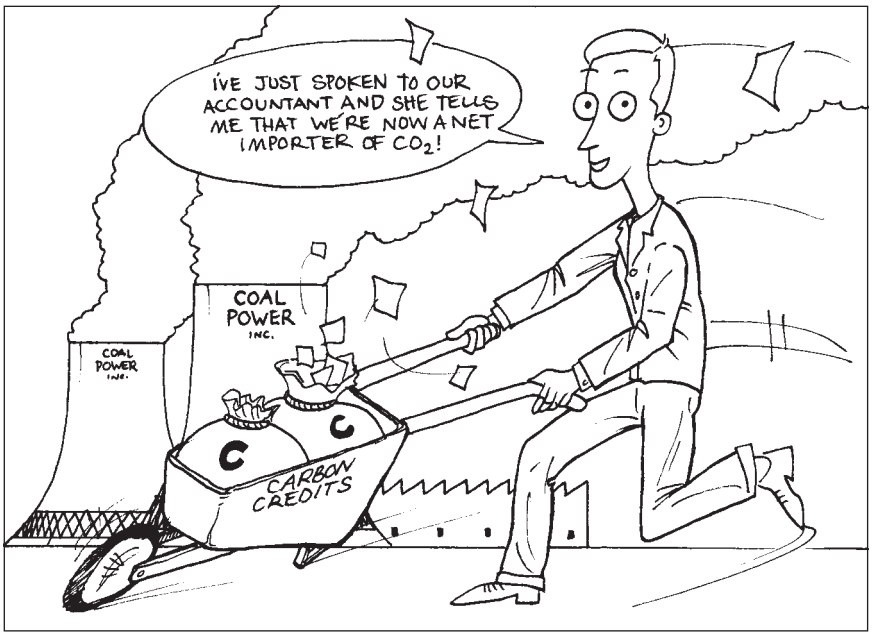
Since the Kyoto Climate Change negotiations, there has been a dramatic increase in interest in greenhouse emission trading schemes, including trading of carbon stored in sinks, such as forests. In principle, carbon trading

makes good sense, as it allows the cheapest, easiest options for emission reduction to be pursued.

But emission trading threatens to be more like a cargo cult than a rational market. There is a rush to establish rights to emissions stored in forests and plantations, in the hope of large profits from sale of carbon credits. Energy consumers are being mesmerised by the potential of buying cheap carbon credits from forests or countries such as Russia, whose emissions have declined since 1990 due to economic restructuring. This focus on the possible opportunities offered by emissions trading has led many energy users to ignore much more attractive investments in energy efficiency and renewables. Carbon credits will cost money, while sustainable energy options can save money. Yet ignorance and prejudice mean many will miss out on financially attractive opportunities.

What potential benefits do we risk losing? Various sources suggest that emission credits will be traded at prices ranging from US$5 to $200 per tonne of carbon, with the range more likely to be US$5 to $25. To make comparisons with energy, we need to convert this to carbon dioxide (3.67 tonnes of CO_2 contain a tonne of carbon) and to Australian dollars (at US$0.60). At US$5/tonne of carbon, the equivalent is A$2.27 per tonne of CO_2, and at US$25 it's A$11.35 per tonne of CO_2. But what does this mean?

Let's look at an example of an Australian manufacturer of a super-efficient refrigerator that uses, say 300 kilowatt-hours per year instead of the average for similarly-sized new models of 900 kWh—saving 600 kWh each year. Over a 15 year life, one fridge would save 9,000 kWh. Assuming an average greenhouse intensity of Australian electricity of 0.9 kg CO_2/kWh over that period (10 per cent lower than the present



Drawing by Shanon Sproule

1.0 kg CO_2/kWh), the efficient fridge will save 8.1 tonnes of CO_2.

If carbon credits are worth US$25/tonne of C (A$11.35/tonne of CO_2), this energy and emission saving is worth $92. But who should receive this money, and who can claim 'ownership' of the credits so they can be traded—the manufacturer, the appliance buyer, the electricity industry or a broker? If the appliance manufacturer receives the money, it can offset extra production cost involved in making the more efficient product, and improve its profitability.

Also, the householder who saves 9,000 kWh will save around $1,000 on energy bills over the life of the appliance, and the electricity industry benefits by limiting summer peak demand and will therefore avoid some infrastructure costs (although it will also lose some revenue). This investment in energy savings offers large financial benefits, while paying for carbon credits simply costs money.

Many businesses reject energy savings that repay their cost within two years (that's a 50 per cent tax-free annual rate of return on investment for the life of the saving measure), yet may consider paying for carbon credits to avoid what they believe is the high cost of investing in energy efficiency. It's a strange world...

For suppliers of renewable energy, gaining access to carbon credits could contribute around 1.1 cents per kWh (assuming US$25/tonne of carbon) of coal-fired electricity replaced. This could tip the balance in favour of development of many renewable energy facilities that are now close to commercial viability. And solar water heaters could be allocated life-cycle emission credits based on the amount of fossil fuel they will displace over their lives, just like the energy-efficient fridge in the above example.

We need to make sure sustainable energy options will be fairly treated in emissions trading schemes, and that business, bureaucrats and politicians understand what a great opportunity sustainable energy options provide to save or make money, develop the economy and reduce greenhouse gas emissions. Given the level of prejudice and ignorance that exists, this won't be easy.

[Kids' stuff]

Noel's Treasures from Trash

To build these magnifying lenses you will need:

- a milk carton or a piece of cardboard
- some clear sticky tape
- some clear plastic gladwrap
- an elastic band
- a large jam or fruit tin, the larger the better
- a clear plastic soft drink bottle with straight sides
- some sugar, salt and clear vinegar
- a sharp knife

This will be the last project on bending light, and this time we will make light bend by passing it through different substances. Because light travels slightly faster or slower when passing through different materials, it bends. We see this effect if we look at fish in a pond—they are not quite where we actually see them to be.

The magnifying glass

Start by cutting a piece out of the milk carton, 25mm wide by 60mm long, then cut a hole in it 12 x 30mm. Be careful when using the knife to avoid cutting yourself. Place a piece of sticky tape over the hole. Place a drop of water on the sticky tape and look at your finger through the drop.

At about 20cm away, you will see your finger upside-down. Bring your finger closer and it seems blurry. This is because you have moved it outside of the focal point. As you bring your finger closer you will see the finger enlarged and the right way up. You can change the size of the drop to see which thickness works best.

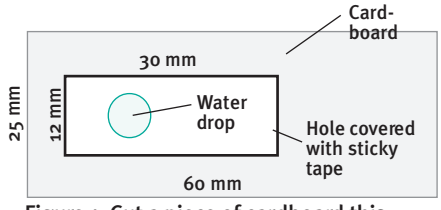
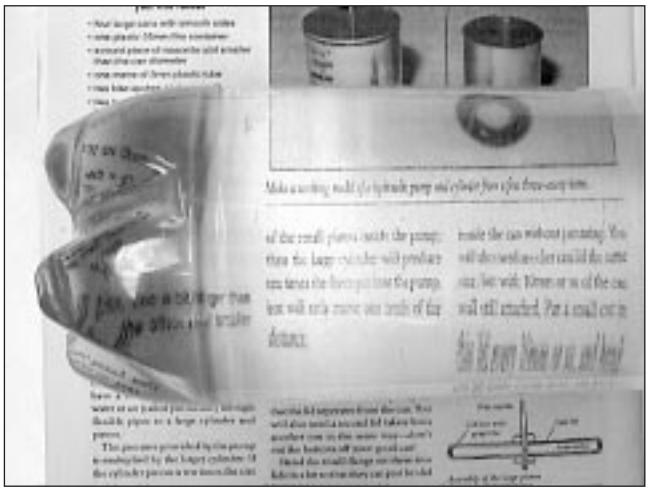


Figure 1. Cut a piece of cardboard this shape and place a piece of sticky tape over the hole to make a magnifying glass.



A linear lens

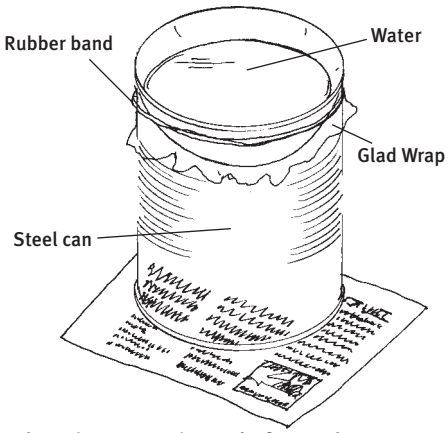
To make this lens, take the label off the bottle and put some water into it and replace the cap. Turn the bottle on its side and look through it at some text in a book or newspaper. You will see that the lines of text underneath the bottle are enlarged to some degree. Try different amounts of water to see the changes in magnification. Fill the bottle completely and see how well it works. Bottles with water in them can actually start bushfires, because they concentrate the sun's rays.

Making a microscope

Take the fruit tin and cut both the top and bottom from it. Place the piece of plastic wrap across one end of the tin. Put a marble or similar small round weight in the centre of the plastic so that the middle hangs down about 30mm into the can. Put the rubber band around the can to hold the plastic wrap in place.

Position the tin on some newspaper and pour some water into the plastic wrap. With your head about 300mm above the tin you should see parts of the print magnified. The effect is best at the edges of the water because the flat surface of the water and the curved edges of the plastic give the best magnification (bend the light the most). You can try different depths of water, different head heights and gently lifting your water lens to vary the effect.

Because different substances bend light differently, you can try using some sugar or salt dissolved in water to see the effect it has. Dissolve three teaspoons of sugar or salt in 50ml of water and put this in your microscope. Also try using vinegar instead. When you have finished, have a look at some lenses made of glass or plastic, such as a magnifying glass, binoculars or reading glasses, and note the different curves and shapes of each lens and how they affect the magnification level.



The microscope is made from a large can, some food wrap and a rubber band.

Food Drying Technology in the Asia Pacific Region

Food and Agriculture Organisation of the United Nations
Available from PA Hicks, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, 39 Phra Atit Road, Bangkok, Thailand. 77pp

Anyone interested in food drying, as I am, may be interested to look at a recent UN Food and Agriculture publication. It is a special issue of the Rural Energy Bulletin and its purpose is to report on the status of food drying technology in the Asia Pacific Region.

The book is designed to convey up-to-date information to engineers, scientists, planners and funding agencies who make decisions on the promotion and implementation of food drying technology. It contains 11 articles on different aspects of food drying technology, mostly based on papers from conferences and research journals.

The abridged papers give a fair representation of drying activities in countries of the region. However, Thailand dominates with four articles, probably because the FAO Regional Office is located in Bangkok. Other countries represented include Malaysia, the Philippines and Indonesia and, inexplicably, Italy! Similarly, the crops dried are varied, ranging from rice to more specialist products such as shrimp paste.

Two of the dryers reported are worth mentioning in more detail because of their relative success and, in one instance, relevance to Australia. In most southeast Asian countries, drying of rice is a problem, especially in the rainy season. A mobile fluidised bed dryer with capacities up to 10 tonnes per hour has been developed and commercialised in Thailand. Approximately 100 dryers have been sold so far. One of the papers describes this dryer in detail, and reports performance data.

A version of a solar dryer, originally developed in Germany, is also described in the book. Essentially this dryer consists of two low tunnels linked together, one contains the crop and the other acts as a heat collector. Air is drawn through the unit by a fan, picking up heat and then moisture before being exhausted at the exit end of the unit. This dryer has been trialled in over 30 countries around the world, and used to dry many types of fruit and vegetables in commercial quantities. In Turkey, the dryer is being commercially manufactured.

However, this is really a book for the specialist, and in my opinion will only

interest a relatively small number of readers. The information presented is more for academics than practitioners. For someone who has been involved in drying, particularly solar drying, for more than a decade, I will find the book useful as a reference. But having said that, I do have some criticisms of the publication.

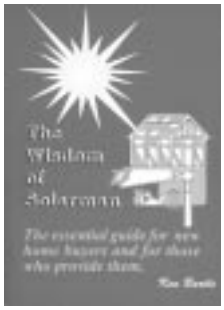
Abridged versions of papers can be frustrating, and perhaps not reflect the author's original intent. As an author of one of the papers in the book, I would like to have been given the opportunity to suggest some changes to the 'cut-down' version. It makes me wonder whether other authors felt the same!

Another criticism is that one of the articles has not been referenced, so we do not even know the author to contact for more information. This really is a bad oversight for a publication from a UN organisation.

Reviewed by Bob Fuller.

The Wisdom of Solarman

By Ken Bartle
Self-published, available from
7 Mosspaul Close, Duncraig WA 6023
Ph: (08) 9447 1777
ISBN 095866402, 200pp, RRP $24.95



The Wisdom of Solar Man is not the essential book of passive solar design.

Far from it, despite the title. It is quite another perspective. When asked to review it, I had expected a treatise on solar homes. This instead, is a book which asks questions about the bulk of the Australian home construction market. It is an analysis of the way the project home market works and why that market does not adopt what readers of *ReNew* magazine would probably regard as the obvious. The *Wisdom Of Solarman* is a basic tour of an industry that still supports the sale of a 'product' rather than a lifetime investment that can have such a fundamental (and positive) effect on our lives.

We can dock two spacecraft travelling at 25,000 kmh, yet we seldom take advantage of the sun when we build houses brick by brick on terra firma.

The idea of designing a house to exploit the climate is usually ignored by both the project home industry and the buyers of their product. Ken Bartle has taken the project home industry to task.

Using the sun to heat, (and paradoxically, to cool), both without the aid of any technological device is still hard to believe for the average 'mum and dad' buyers. It is not yet in our consciences that for many of us, heaters may be unnecessary and air-conditioners an expensive (often after-market) bolt-on that can be dispensed with.

We have built houses in Australia in the firm belief that we need heaters in the winter, and more latterly that we need air conditioners in summer. The first need arises from the housing legacy the English left us, the second is the result of the power of good marketing. But Bartle argues that with the proper attention to the site—knowing the site and its potential, and the application of some fairly straightforward 'solar' design principles—we can not only arrive at a home we can enjoy but also one which maintains comfort levels naturally.

Turning the industry around so that it builds homes that operate more naturally is not so easy. The author says the blame can be laid directly at the sub-divisional planners and the fact that only a small percentage of new homes in the temperate southern cities can be built with an acceptable orientation to the sun's path.

The reader is provided with a very readable history of the project home and also the way 'solar' homes came into a brief acceptance, then to die (in marketing terms) because they were even-

tually perceived to be 'ugly and expensive'. Some two decades after the first solar houses were built, we are now stuck on an equally inaccurate description—'energy efficient'.

Yet in Bartle's opinion the first essential of a passive solar house is to maintain comfortable temperatures, not to save energy—a refreshing view indeed. He suggests that even the push to get 'energy efficient' designs may not equate to good design.

I can attest to this position. I really do not think about energy on a cold morning as I get up and take a shower. The uppermost thought is one of comfort, and because of yesterday's thermal gain it is gone in an instant. I just enjoy the warmth and the sunrise.

If you are embarking on a new house, read this book first.

Reviewed by Bill Parker

report reporter

new sustainable technology reports

New ERDC report distributor

The Energy Research and Development Corporation (ERDC) was wound up last year by the federal government, but copies of the organisation's reports are now available through Canberra company Energy Strategies. Send orders or requests for catalogues to:
Publication Sales, Energy Strategies,
PO Box 4170, Manuka, ACT 2603.
Ph: (02) 6260 6444, Fax:(02) 6260 6555
Email: publications@enerstrat.com.au

Advances in Solar Energy

Volume 12 of the American Solar Energy Society's (ASES) review of research and development is now available in Australia. The 516 page review contains 10 reports on renewable energy technology and policy, including *Photovoltaic systems in the built environment* and *The World Bank's solar initiative*. For more information about the review, vist the ASES web site at http://www.ases.org/solar. To order in Australia, contact the Australia and New Zealand Solar Energy Society (ANZSES). Price $A150 + $A10 p&p, send orders to George Hardy at PO Box 1140, Maroubra NSW, 2035.
ph (02) 9311 0003, fax (02) 9311 0004, anzses@unsw.edu.au.

NECA review

Anyone interested in the Commonwealth's submission to the NECA review of the electricity industry (see this issue's Pears Report) can view it on the internet at http://www.neca.com.au/files/commonwealth_submission.doc

Hot 100 update

In October 1997, the Alternative Technology Association (ATA) initiated a program to encourage 100 of its members to install solar water heating systems within the following year. Well, almost a year has passed, and although the number of systems installed has fallen well short of the target of 100 (about a dozen systems were installed), the ATA has learnt a lot about the promotional effort required for such a scheme, and hopes to extend it for another year. If you, like the people who have shared their ideas below, would like to participate in the Hot 100, contact the ATA, 247 Flinders Lane, Melbourne VIC 3000, ph:(03)9650 7883, fax:(03)9650 8574, email: ata@ata.org.au

Some Hot 100 participants share their experiences...

My system is an Edwards with a collector size of 4m^2 and a 300 litre stainless steel tank. Our house has three bedrooms, and there are two adults (1 baby in October!).

The purchase/installation cost was around $2,400 and it was installed in February '98. The orientation is northwest (not the best, but works great so far), but the tilt angle is only 15 degrees, though there is no shading on the system.

We were lucky, as our old gas hot water system sprung a leak in the middle of summer. It gave me two weeks to look around and make an unpressured decision. That's not quite true, I was under some pressure from my wife Lisa as she still likes a bit more warm water than I and the issue of dollars was a bit too spooky for her. I managed to talk her around and put my money where my mouth is.

Although the tilt and orientation is not great, I decided to lay the water heater directly on the roof. This was partly an installation cost factor and partly an aesthetics factor. Either way, it is working wonderfully. The unit was installed and filled with water by about 2pm. We had enough warm water for a shower that night. By the next, it was boiling!

I am proud to announce that we have only used the electric booster twice and both of these occasions were in April and May after a few overcast days when it is still reasonably warm in Brisbane. The first boost was for an hour, the second for half an hour.

Perhaps we have been lucky as the weather has been absolutely fabulous in Brisbane for about two months now—clear skies and warm days. At work I sit beside a window and spend so much time dreaming about spending the day on the golf course and coming home to a nice free hot shower.

Martin de Jong, Everton Hills, QLD

Bernard Yeack's wife, Elizabeth, with their solar water heating panels.

We had solar hot water fitted mainly because of summer. The traditional Stanley wood stove keeps the house warm and cosy during the coolest part of the year, but during summer we only used to light the Stanley for hot water. We save a lot in firewood now—approximately five cubic metres a year.

The components of the systems are: Sunbather hot water heating panels and associated parts, a Stanley cooker for main cooking and hot water boosting, and the water storage is a standard copper tank. Rain water is run through the whole system, so we have no real corrosion or dirt problems.

Does it work? Yes it does, and it is saving us firewood, provides boiling hot water and allows the house to be 10°C cooler than outside in summer.

Bernard Yeack, Kyneton VIC

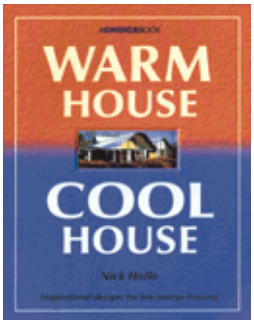
As new users of a Solahart hot water system we are impressed with the continual flow of hot water. We have noted that even on winter days the sun has been strong enough to help heat the water. There are six adults living in our house and everyone is able to have a hot shower before going to work. We are looking forward to spring and summer when solar power will become our major source of energy for producing hot water.

We are very pleased with our decision to purchase a solar hot water service and to be one of the Alternative Technology Association's Hot 100. The Solahart gas-boosted hot water service is an efficient supplier of hot water and an effective way of reducing greenhouse gas emissions.

Rob and Chris Jolly, Berwick VIC

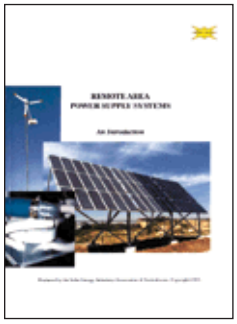
ATA recommends

Superb sustainable technology books available from the Alternative Technology Association



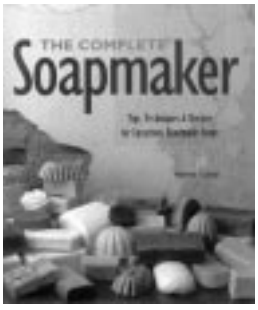
WARM HOUSE, COOL HOUSE

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



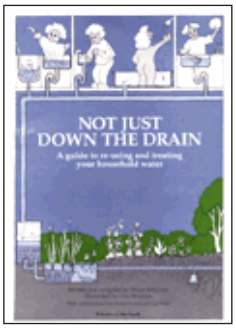
REMOTE AREA POWER SUPPLY SYSTEMS: An Introduction

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



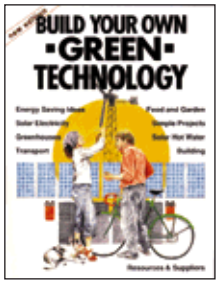
THE COMPLETE SOAPMAKER

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



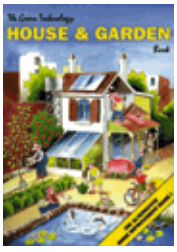
NOT JUST DOWN THE DRAIN: A Guide To Re-using And Treating Your Household Water

Author: Stuart McQuire
Price: $11.60 Softcover, 59ppg
Reviewed in *ReNew* #57
Whether you live in a house, a flat, in the suburbs or the country, this book will help you cut your water costs while conserving Australia's most scarce natural resource.
Item code: NJDTD



Build Your Own Green Technology

Price $18
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



The Green Technology House and Garden Book

Price $15
A comprehensive guide to improving your home's energy efficiency. Includes do-it-yourself projects, real life experiences and a comprehensive listing of suppliers.
Item code: GTH&G

Windpower Workshop

Author: Hugh Piggott
Price $28 Softcover, 160ppg
Reviewed in ReNew #61
The ultimate resource for anyone who has ever wanted to build their own wind turbine. Provides practical advice on how to design and build a machine up to five metres in diameter.
Item code: WPW

ATA Booklets

Price $5 each (inc postage)
Available titles include solar workshop, building a Savounius rotor wind turbine, solar fruit drying, low-voltage appliances and green cleaning. (New titles out soon: solar hot water, solar electricity.)

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Soft Tech Issue 42 $5

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[Sustainable technology events]

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

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

Australian Electric Vehicle Association AGM
Friday 11 September, 1998
Melbourne, VIC
To be followed by a dinner to celebrate the 25th anniversary of the association.
Contact: Jacky or Kevin Woodhouse, ph:(03)9701 6078 (bh) or (03)5977 4982 (ah).

Going Solar Info
- **12 September—Bio Paints/Aromatherapy**
- **10 October—Composting toilets and grey-water systems**
- **12 December—Solar hot water**

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

Model Solar Car Challenge
19-20 September, 1998
St Hilda's School, Gold Coast, QLD
A Queensland-wide competition for primary and secondary school students.
Contact: Michelle Berardone, ENERGEX, ph:(07)3407 4049 or 0417 622 625.

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

Cogeneration Summit
23-24 September, 1998,
The Grace Hotel, Sydney
A practical workshop on establishing the feasibility of cogeneration for your site.
Contact: AIC Worldwide, ph:(02)9210 5732, www: www.aic-ausnz.com

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

EcoDesign Foundation courses
1-3 October—Architectural Sustainments
30-31 October—Brief Development
Contact: EcoDesign Foundation, ph:(02)9555 9412, fax:(02)9555 9564, email edf@edf.edu.au, www: http://www.edf.edu.au

SRD Talks
6 October—Responsible manufacturing
3 November—Responsible design marketing
Milsons Point, NSW
Contact: SRD office, ph:(02)9564 0721, fax:(02)9564 1611

Hand Made House Tour
8-11 October, 1998
Nambucca Valley, NSW
A self-drive tour of 15 non-conventional buildings, landcare and permaculture displays.
Contact: Marion, ph:(02)6564 7908, email: jordan@midcoast.com.au

International Renewable Energy Conference
14-16 October, 1998
Tokyo International Exhibition Centre, Japan
Contact: Nikkan Kogyu Shimbun LTD, International Division of the IRECE Secretariat, 1-8-10 Kudan-Kita, Chiyoda-ku, Tokyo 102-8181 Japan, ph:+81 3 3370 2710, fax:+81 3 3370 9797, email: renewcon@mb.infoweb.ne.jp

Ecobiz '98
22-23 October, 1998, Adelaide, SA
Focusing on the relationships between business and the environment.
Contact: Ecobusiness Consultants, ph:(08) 8212 8050.

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

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

Renewable Energy Fair
14-15 November, 1998, Daylesford, VIC
Aimed at creating a yearly event to promote renewable energy and sustainable living. Going Solar is also offering free sites to sponsors, magazines, community and environmental groups in exchange for promotion of the event.
Contact: Going Solar, 322 Victoria St, Nth Melbourne VIC 3051, ph:(03)9328 4123, fax:(03)9328 1249.

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

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

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

Environmental Education Conference
14-18 January, 1999
University of New South Wales, Sydney
Improving community understanding of environmental issues, strengthening environmental learning capacities, integration of education, communication and training into sustainability strategies at local, national and global levels.
Contact: AAEE International Conference, fax: 02 9949 4933, email: orggroup@orggroup.aust.com, www: http://www.education.uts.edu.au/eeconf

Eco Design '99
1-3 February, 1999, Tokyo, Japan
The first international symposium on environmentally conscious design and manufacturing.
Contact: Business Centre for Acadenic Societies, 5-16-9 Hokomagome, Bunkyo-ku, Tokyo, Japan, fax: +81 3 5814 1459, email: van@bcasj.or.jp

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

Sustain '99
25-27 May, 1999
Amsterdam, The Netherlands
Covering renewable energy, waste to energy, sustainable transport and energy efficiency.
Contact: European Marketing Media ph+44 181 289 8989, fax:+44 181 289 8484, email: sustain@emml.co.uk

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

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

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

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

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

Davy Industries solar tracker

The energy output per day of solar panels can be greatly increased if they are mounted on a solar tracker

When I first started to set up my own independent power system I was a little apprehensive about solar panel trackers. I wanted my system to support my three kilowatt-hour electrical load throughout Melbourne's four seasons without back up from a generator.

As I am in the trade I was able to get trade prices on all components. Despite this, the exercise had to make economic sense. When my wife and I moved out of the city, we actually went looking for land with no power. We found our little piece of paradise and luckily it was $25,000 away from mains power, so the independent power system had to be competitive with mains power and had to be costed at retail prices for a fair comparison.

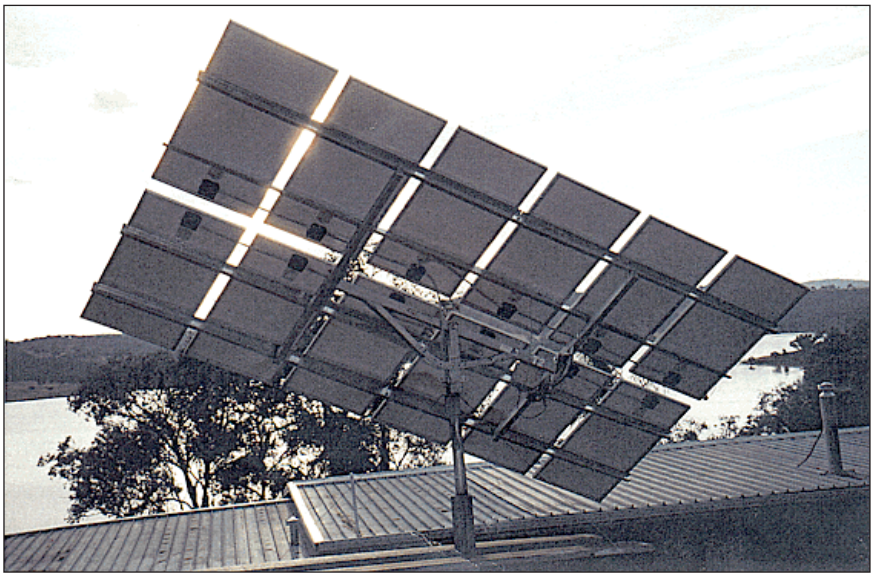
I looked around at trackers as part of this exercise and felt they did not make enough economic sense. Add to this the fact that I would be introducing another mechanical device—and my particular site is very windy (mainly gusty)—I was tentative. Also, all the trackers I had seen to this stage were eight panel trackers, and we wanted more panels.

I then found the Davy Industries MKII tracker and immediately recognised two important factors: that 16 panels on a tracker changes the economic equation, and that this tracker had some thought put into the mechanical design, clearly demonstrated by the gaps between the panels to reduce the wind loading. I then looked at the financial comparisons this way:

The costs of a tracking system are:

- a 16 x 64 watt module tracker: $1700
- 1 cubic metre of concrete for the tracker mount: $90.

This gives a total cost of $1790.



To get the equivalent power from a fixed array you need:

- mounting frames for 16 panels (4 x MSX4): $1000
- 15 per cent more solar panels to allow for the lower output compared to the tracking array, which equates to an extra 2.4 panels: $1524
- 2.5 per cent more solar panels to allow for the reduced output due to higher panel temperatures compared to a tracking array, equal to 0.4 panels: $254

This gives a total cost of $2778.

So, based on my calculations, I felt the Davy tracker was worth a try. The tracker has now been installed for just over four years, and at this point I am delighted with its performance. Mechanically I cannot praise the tracker enough, I must admit after a few extremely windy nights I expected to find it in pieces but have never had a problem, just a little routine maintenance with a spanner and some grease.

Electrically, the tracker did have some teething problems, mainly due to a bad batch of light dependant resistors. The important thing here is that Davy Industries never stopped giving service of the highest quality.

Since the teething problems have been solved the tracker has performed faultlessly, providing sufficient power for our system right through the Victorian winter. Generator run time has been reduced from 50 hours per year to around two hours per year. Another advantage here is that the average battery depth of discharge has been greatly reduced.

I have carefully monitored the performance of my system over the past four years now, and would have to say that my expected increase of 15 per cent from the tracker was extremely conservative. All in all, I am very happy with this great Australian made product.

Review by Lyndsay Hart. Lyndsay works for Solar Energy Australia.

Distributor contact:
Davy Industries, RMB 1036,
Barnawartha North Vic 3688,
ph:(02)6026 7711.

A spiral waterwheel pump

You don't need expensive pumps and high technology to pump water from a river or creek. John Hermans explains his solution to low-cost water pumping

This pump follows on from an idea taken out of earlier ReNew magazines, (issue 59, page 60 and issues 60, page 8) and refers to a form of positive displacement pump made from a single length of coiled polypipe. I have designed this pump to be driven by a water wheel and suggest that they are a perfect match as a water pumping unit.

For readers unfamiliar with the earlier descriptions of how this pump works, I will describe it briefly. The pipe is coiled in a vertical plane and is mounted on a horizontal axle. When the bottom quarter of the coil is immersed in water and the whole coil is rotated, an alternating sequence of air and water will be driven along the pipe towards the centre point of the coil. Additional successive coils of pipe lead to a cumulative increase in the pump's output pressure. When a reticulation pipe is connected to the end of the last inner coil, the water can be shifted to a higher point, such as a dam or tank on a hill. Add to this a set of paddle wheels and place it above a flowing river and you have one of the oldest and simplest forms of motor, driving one of the oldest and simplest forms of pump. The whole unit consists of one rotating part.

The working example in the photo is one which I fabricated for Jill Redwood, a dedicated environment campaigner living along the upper reaches of the Brodribb River in far east Gippsland. The 'spiral pump' was recently adapted to the water wheel to replace an old small piston pump, which was driven by a series of chains and cogs to give a 1:4 stepup ratio. Although this setup worked quite well, the pump was prone to mechanical failure and there was a possibility of pump oil leaking into the pristine Brodribb River. This new setup has several advantages; it is very environmentally friendly, it is made of basic materials(¾" polypipe and a small amount of 25 x 25 x 3mm angle iron), it is relatively easy to make and it is not expensive.

This pump is a low-tech approach to low-cost water pumping. It pumps around 2000 litres per day at this site!

One of the primary problems that I faced when assembling the coil of pipe on its spoked frame was to be sure of just how many coils, and at what diameter, would be sufficient to force water to the 16 metre head at this site. I suspect that there is a real lack of data on the performance of this type of pump. No doubt an opening for some research!

As Jill's property is a three hour drive from my workshop, I had to make a guess at what would work and hope for the best. The water wheel is around two metres in diameter, and as both the open end of the coil and the paddles need to dip into the stream, the spiral diameter needed to be this size also.

Three quarter inch polypipe can be coiled down to around 500mm in diameter before it starts to kink, and if close coils are laid over the angle spoked frame, then a total of around 40 coils can be made. I decided that that 40 coils would be excessive and instead made two sets of 20 coils which tee into a single outlet at the centre. Theoretically, this arrangement would pump twice as much water as a single coil which rotated at the same speed.

Well, as it turned out, 50 metres of ¾" polypipe, coiled into 20 loops from 0.5m to 2.0m in diameter, is sufficient to pump

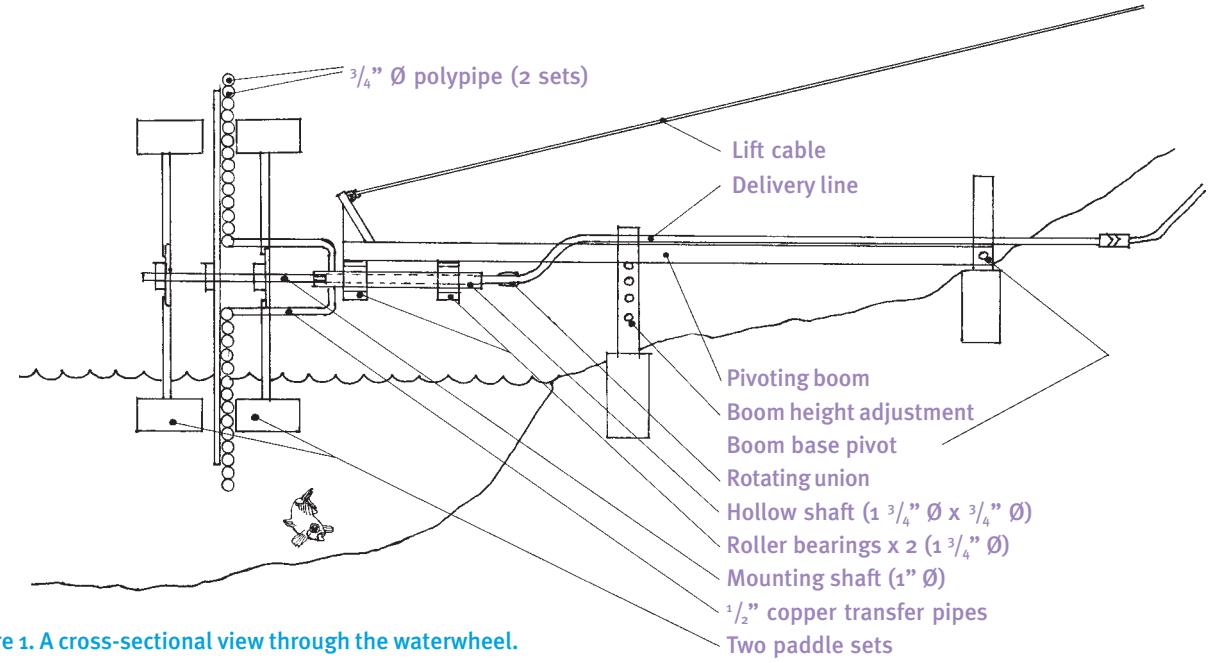


Figure 1. A cross-sectional view through the waterwheel.

water to a 16 metre head. But the paddle power (torque) of the water wheel was insufficient to drive both of the coils of pipe. We had to block one inlet end before the unit would spin at all.

My theory is that to pump water up to a head of 'X' metres, the length of coiled pipe needs to be around '3X' metres. I assume here that the size of the loops is not so important, but rather the total lenght of the pipe. Large loops are more effective at forcing water up than small loops, but consume more length of pipe. Many small loops may be just as effective as fewer large loops.

There is one aspect of this water wheel pump setup which throws a degree of complexity into it's design, and I will describe it only briefly. As with most creeks and river systems, there are times when flood waters may rise metres above the optimum level for a water wheel or pump. To avoid flood damage to this pump, I mounted the axle and bearings of the water wheel onto a three metre long boom made of 100mm square RHS (rectangular hollow section—square pipe), which can pivot at the opposite end to the water wheel. There is a height-adjustable support at the half-way point and a steel cable attached to the water wheel end. This allows for the whole unit to be winched up vertically at flood time, or for paddle height adjustments.

Herein lies the complication. In order for the water to get from the end of the smallest polypipe coil to the delivery pipe along the boom, the water needs to go through the centre of the shaft which supports the water wheel. The water, upon leaving the end of this axle, must pass through a rotating union.

A few additional pointers relating to construction are:

- To attach the polypipe to the angle iron spokes, use 1.0mm stainless steel wire (available from apiarist's suppliers, or use cable ties instead).
- The end of the ¾ inch polypipe which scoops up the water should be increased in diameter for the last loop. I used a one inch polypipe half loop, then a 1¼ inch for the last half loop. This allows for a greater volume to be scooped up each rotation.
- As both water and air are pumped up the delivery line, it is best to send the pumped water directly to a storage tank or dam, otherwise a special air-bleed line is required.

There are some other variables which allow this design to pump effectively. These are: river water flow rate (speed), size of paddles, number of paddles, diameter of water wheel, diameter of coils, diameter of polypipe, number of coils, submergence of coil set, pipe mouth diameter and rise in delivery line.

As this spiral pump was a direct replacement for a small standard piston pump, it was found that the volume of water pumped per day was much the same, so its efficiency of operation is very acceptable. The pumping rate at this site averages 2000 litres per day but varies according to the stream flow. Overall, a beautiful piece of alternative technology.

Jill with her pump in the flood position.

The C-Tick fiasco

There has been quite a bit of debate on the new EMC framework of late. Lance Turner takes a quick look at what it will mean to the consumer and small business.

From the beginning of 1997, any new electrical or electronic products sold in Australia have had to comply with the requirements for electromagnetic emissions and, for some equipment, immunity from interference. These requirements are covered under standards made under the Radiocommunications Act 1992 and various other standards, which are enforced by the Spectrum Management Authority (now under the umbrella of the Australian Communications Authority, along with Austel) and similar regulatory bodies.

The equipment that these standards apply to includes 'all products offered for sale in the residential, commercial and light industry environments'. What this basically means is that every electrical appliance and device will need to comply, and this includes renewable energy equipment such as inverters, regulators, pumps, generators and just about anything else you can think of, as well as all the standard 240 volt AC appliances currently available. There are very few exceptions.

However, while not stated specifically in the EMC framework documents we received from the Spectrum Management Authority (SMA), devices with the CE logo are deemed to already comply. Kits of parts and product designs, such as those that appear in *ReNew,* are not covered by the standards. However, because of the new requirements, we can no longer sell our mini-maximiser in pre-built form, only as a kit.

Gaining compliance

How does a device become compliant? Well, there are basically four stages: Establish sound technical grounds for product compliance; make and hold a Declaration of Conformity; prepare and keep a Compliance Folder; label the product as directed. To 'establish sound technical grounds' requires one of two methods.

The first, and the one that most companies will be forced to use, is product testing. This means having a sample of every device that they sell fully tested by an approved lab. This is expensive, ranging from $500 into the thousands of dollars. The second method is called a Technical Construction File. This is used for devices that are too difficult to test due to physical or other constraints.

Once the device has been tested, the forms have to be filled out and signed and the application lodged. The manufacturer then waits for approval to sell the device, applies the C-tick stickers and the product can then be sold, providing none of the specifications of the device change. If a device is updated with new features or components, the product must go through the testing and approval procedure all over again.

So, what does it all mean? Basically, Australian manufacturers will have to cough up lots of money to have their products tested, fill out lots of forms, and generally waste lots of time just so that they may sell their products. And all of this must be completed by January 1999.

Having talked to a few people in the industry, I get the feeling that very few of them have actually begun compliance procedures. It seems that many of them are ignoring the requirements and are just hoping it will all go away—not a chance!

There are harsh penalties for trying to sell non-compliant devices. I have heard figures up to $200,000 for serious breaches of the regulations, so companies that do not have their products approved by next January will basically be out of business. How's that for stifling small business!

Why not just get your products approved and stop the complaining? Well, for many companies, that will be easier said than done.

Take the example of a company that sells small quantities of many different products. If they had 50 different devices, but only sold a few dozen of each per year, then they could spend up to $150,000 getting them all approved. This is an impossible situation for them, so they are faced with the choice of paying up large sums of money of shutting up shop.

Unlikely? This is just such the case for one company who recently wrote a letter to a popular Australian electronics journal. And you can bet there are many others, some of which are in the renewable energy industry.

There is also the problem of just who can do the testing. Appendix F of the EMC Framework lists those companies who have been accredited by the National Association of Testing Authorities to test for EM compliance. To date, this list consists of a total of five laboratories—three in NSW and two in Victoria, with a fourth company from NSW awaiting

accreditation. This means that if you operate your business from any other state, you must send equipment interstate to be tested or have it tested locally by a non-accredited laboratory who may then have to prove their ability to test the equipment correctly!

In conclusion

What will happen to the small-scale manufacturing industry in this country on 1 January 1999 is anyone's guess, but I suspect that many small companies will say it is all too hard and close up shop, while others may continue to sell unapproved products at the risk of being prosecuted.

While controlling unwanted EM emissions is a good thing, there could have been better ways of doing it than just regulating the hell out of everything. In the USA, devices are labelled as to the level of emissions they may produce, then it is up to the consumer to use them correctly. But it seems this is not the way we do things in Australia, so expect to see some changes in the industry in the next 12 months.

Copies of the EMC Framework can be obtained by contacting the Australian Communications Authority on ph:(03)9963 6988 or (02)9245 4000, or their web site at: http://www.aca.gov.au

Send us your questions

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

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

Why install solar?

I have land near Creswick with high voltage lines going past on the other side of the road. Powercor quoted me $8100 plus extras for civil work (I can't pay it off in installments, they need the money to purchase the box to put up the pole). So I decided to shop around for solar and wind energy. I also looked at generators. That's when my problems started.

I read the article about Michelle and Wayne McNamara (ReNew April-June '97). They had a quote from Powercor for $10,000 and ended up spending $26,000 on wind energy. Where are the savings? How long does it take to get your money back? How long do the batteries last? Can somebody please explain to me in a simple way how solar and wind energies work?

I read about all these technical words which is mumble-jumble to me. Inverters—invert what? There is 6, 12, 24, 32, 48, 110, 240 volts. Why all these different voltages? Can't you produce 240 volts straight away?

What about my appliances? TV, video and all my power tools which run on 240 volts? Do I have a garage sale and buy new 12 volt ones? Except for a caravan fridge and TV I have never seen 12 volt power tools or appliances. (I have worked with 110 volt power tools, which are a lot weaker than the 240 volt ones. Imagine a 12 volt welder!)

In the meantime I read the letter from P Dix (issue 59, page 9), *High voltage can be cheap too!* Confusing? It is for me!

At the moment I am paying about $350 electricity and about $100 for LPG a year (Solar hot water with electric booster, LPG stove and heater in a two person household).

I had verbal quotes for a power system from $10,000 to over $20,000 but no-one ever explained the whole system to me. Can you advise me what to do?

Horst Wolfe, Belmont VIC

There are a number of key issues here. The first is the cost of a renewable energy system compared to connecting to the grid. In your case, it seems that it will be cheaper to connect to the mains grid, as you are unlikely to save the extra cost for an independant power system during the system's lifetime when you compare the cost with electricity bills. However, the cost of the system is not the only factor to be weighed up.

For many people, the independence that generating their own power gives them far outweighs the extra cost. When you are connected to the grid and it fails, you have no power. There have been cases in Australia of power being cut to some areas for two weeks or more due to line failures. Also, many rural areas have notoriously unstable and fluctuating mains voltage, and brownouts (where the voltage can dip as low as 150 volts or less) are not uncommon. Ask some locals what the power is like in your area.

There is a lot of technical language used in the magazine, though we do try to explain the different terms wherever we can. An inverter does exactly that, it inverts extra-low-voltage DC, like that found in batteries, up to 240 volt AC for your standard appliances. The DC voltage that the inverter requires could be any one of the voltages you mention, and there are models to suit all of these voltages on the market. Many of these terms were covered in our Back to Basics articles in issues 52 to 56 of Soft Technology. We also published a glossary in issue 60 of ReNew.

Now to the subject of system voltages. It is indeed possible to produce the power directly at 240 volts DC, as Peter Dix does in his system. However, there is very little commercially available equipment, such as inverters, to suit this voltage, and battery bank voltages this high are not for the novice system operator, so a lower (safer) voltage such as 24 volts would be more suitable. You can also produce 240 volts AC directly, if you have a stable energy source such as a permanent creek or river. However, there are very few sites that are suitable for this type of system, so a lower voltage is usually produced and fed into the battery bank for conversion to 240 volt AC later.

There are so many voltages in use today simply because different systems require them. Small systems are fine with a 12 volt battery bank, but larger house systems are better with a 24 volt or higher battery bank. The higher voltage means proportionally lower current flows for the same power usage, which equates to less power loss in cables and allows thinner (cheaper) cables to be used.

Some people chose to use the power from their battery bank directly, without converting it to 240 volts AC. This requires the use of special extra-low-voltage appliances, which can be difficult to find. While some of these appliances are indeed lower power than their higher voltage cousins, this is usually only because of the difficulty of supplying the large currents required. A 12 volt, 480 watt power drill, for example, would require 40 amps—heavy cables and plugs/sockets would be required.

An extra-low-voltage welder is actually quite viable—a 240 volt welder uses a transformer to convert the voltage down to around 25 to 30 volts anyway. Indeed, many people have successfully welded using two car batteries connected in series with a current-limiting device, though three work better.

Lance Turner

Integrating a big system

I am a long time reader of ReNew with an alternative home power system. The system is a bit on the big side but it

works very well and keeps Ron Tito (local ATA contact) in pocket money with tweaking and repairs. We didn't plan for it to be a big as it is—it just grew, as these things do.

A short summary: wind turbine—currently 4kW (broke the 5kW one), both second hand about ten years ago; thirty-six 64 watt Solarex modules; 110 volt, 225ah battery bank (almost worn out); 4 or 5kVA Siemens Sunsine inverter with custom made 110 volt DC input; backup inverter WEA 4kVA and 40 amp WEA battery charger; Plasmatronics 'smart regulator', also custom made; backup Lister 5kVA diesel genset—not often used when the wind turbine works.

Basically we run a normal household with mostly fluoro lights, normal appliances, wood heated cooking, hot water and space heating. We are very happy with the concept of living with renewable power and don't really mind that the payback period for our system is probably several lifetimes.

We have a system which works but it frustrates me that at the moment we can't log our power production and usage, while load dumping (we often have to dump power) is almost but not quite a manual affair. That is a bit of a simplification but the real problem is one of integration of all the bits and pieces.

I would very much like to set up a computerised control system of logging and load switching. Have you any suggestions as to where I should look for these sort of control systems?

I mentioned above that we broke the 5kVA wind generator. We think that a dead short in the cable from the turbine to the house basically took the load off the alternator and it simply sped up to the point where it threw one blade, overbalanced and jumped up out of its mount at the top of the tower. Damage sustained includes the blades now matchsticks, the hub a total write-off and a bent attachment at base of alternator. Do you have any idea where I could look for someone to carve a new set of blades? The old ones were each about 2 metres long and made of spruce.

Jim Atkinson,
jatkins@tyndale.apana.org.au

I would suggest that you start by getting a new regulator for your wind turbine, some form of shunt unit would be the go. This would eliminate the need to manually dump power when the batteries are full. However, you do have to be careful that the two regulators (the new and the current Plasmatronics) don't interfere with each other. This problem can be solved by using a regulator with multiple inputs, replacing the existing unit entirely. Many of the newer regulators use microprocessor control, and can perform many more functions than just charge regulation. See our regulator buyer's guide in this issue for a suitable unit.

If you really want everything to be automatic, this could take quite a bit of work and rewiring, not to mention money. Some renewable energy system installers may be willing to redo your wiring and add the necessary components to make it perform as you require. Alternatively, you could use standard industrial monitoring and process control equipment available from various suppliers you would find in the Yellow Pages under the heading 'Electrical Switches & Control Equipment'. However, this could be expensive.

Another alternative is to use a laptop computer to monitor such things as battery voltage, input voltages and currents and the like and then have the computer make the decisions. This would allow you to make adjustments as you gained experience with the system and collected data.

You can buy various interfaces, both prebuilt and in kit form, that can connect directly to the parallel or serial port of any PC compatible computer. These have anywhere from one to 64 inputs and outputs, meaning that you can monitor many aspects of the system and add these to the software (which you will have to write, or get someone to write for you).

You would have to make sure that you used a laptop with low power consumption, though it may not be too much of an issue with a system as large as yours. Most old computers are power hungry, so a 'bare bones' newer unit with power management would be ideal.

Lance Turner

A parabolic solar collector

I am a maths teacher at Hamilton College in Western Victoria. I am developing a unit of energy with a solar/wind/conservation emphasis. I'd really like to build a parabolic solar collector to cook sausages (and vegie burgers too).

I'd like to know how to calculate the energy that a 1 metre diameter parabolic dish can collect from the sun and the heat that would be generated at the focal point. Also, any advice on the best way to make one?

Ray Peck, hamcol@ansonic.com.au

The amount of energy available from the sun on a clear sunny day is around 1 kilowatt per square metre. By using the formula for the area of a circle, $A=\pi r^2$, you get an area of around 0.8m^2, which means your collector will have a collecting ability of nearly 800 watts. However, no collector is perfect, and not all of that 800 watts is heat, so you will not get this much heating effect at the focal point.

However, many solar ovens and cookers use collectors this size or smaller to achieve great results, so I would suggest that your cooker should be able to sizzle those vegie burgers to perfection. As with most projects of this type, the best way to find out how well it works is to make one. Your prototype could be a simple unit made from cardboard with unpatterned aluminium foil as the reflector. The ATA also has a leaflet that contains plans for such a cooker. It costs $2 including postage.

Lance Turner

Modifying a shunt regulator

Have you ever done an article on making a solar heating system for a home swimming pool that I could get a back issue on?

Also a question regarding the shunt regulator in issue 59. My local amateur radio club is constructing a VHF repeater to be installed in a remote location. We will be reliant on solar power.

The batteries are a bank of six 2 volt deep cycle units (250AH total). We have available 2 x 2 amp panels with an option of another panel, taking the total to a peak output of six amps.

As the unit will be remotely situated the equalise mode will not be used. Can I omit either VR1 or VR2 and just have one voltage setting? Would this also remove the necessity for led 2, R7 and SW1?

If I wanted to be able to have a small relay (to operate a cooling fan) connected into the circuit so that the fan would only run when the unit is charging the battery bank, where would I put it?

Alan Gilchrist,
gilly@camtech.net.au

Alan, the only article we have that may be suitable describes how to build a solar water heating system using flat coils of polypipe. This system can generally be expanded as large as you like, so may well work in your application, though we have not tried it. The article appears in our book 'Build Your Own Green Technology', available from the ATA. Alternatively, I would suggest that you take a look at some commercial ones to get an idea of how they work.

Regarding the shunt regulator, you can indeed leave out VR2, SW1, R7 and LED2 if you don't require equalisation. However, I would not suggest using flooded cell batteries in a situation where they will not be equalised or where no-one will be checking on them periodically. Equalising helps reduce stratification of the electrolyte, and thus eventual damage to the cells. I would suggest using sealed-lead-acid batteries such as the Sonnenschein gel or Panasonic absorbed glass matt units, which I have found to be virtually bulletproof.

The regulator would need to be set to around 14.2 volts, despite what the battery supplier may tell you, as setting it lower than this may result in one cell in the battery not being fully charged. I have learned this from experience!

To run a fan while the battery is being charged, you need to add a couple of components to the circuit. When the battery is charging, the output of the op-amp is low, so you can switch the fan on via a transistor activated relay.

The add-on circuit can be seen in figure 1, which works as follows: When the output of the LM358 is low (ie, the MOSFET is off and the batteries are being charged), the BC548 is off and so the BC337 transistor is on, activating the relay. However, when pin 1 of the LM358 is high (and the MOSFET is diverting current from the batteries), the BC548 is turned on, pulling the base of the BC337 to almost 0 volts, thus turning it, the relay and the fan off. The 1N4001 diode prevents damage to the circuit from the high voltage spike caused by the relay's coil. The 4.7K and 47K resistors limit current through the transistors and must be included. The BC337 can switch about half an amp, but this should be more than enough for a good quality relay.

Lance Turner

A dodgy generator

Last year I purchased an ST Long Chinese diesel generator which was recommended to me by my solar supplier. Unfortunately it has had one problem after another. First, the generator would run for about 30 minutes and then cut out. The oil pressure switch was faulty and replaced but it still didn't work properly so in the end I disconnected it and checked the oil each time I started it.

About two months later the alternator packed up and again was replaced under warranty. Now after just 16 months they tell me the crankcase is cracked. Unbelievable, and of course

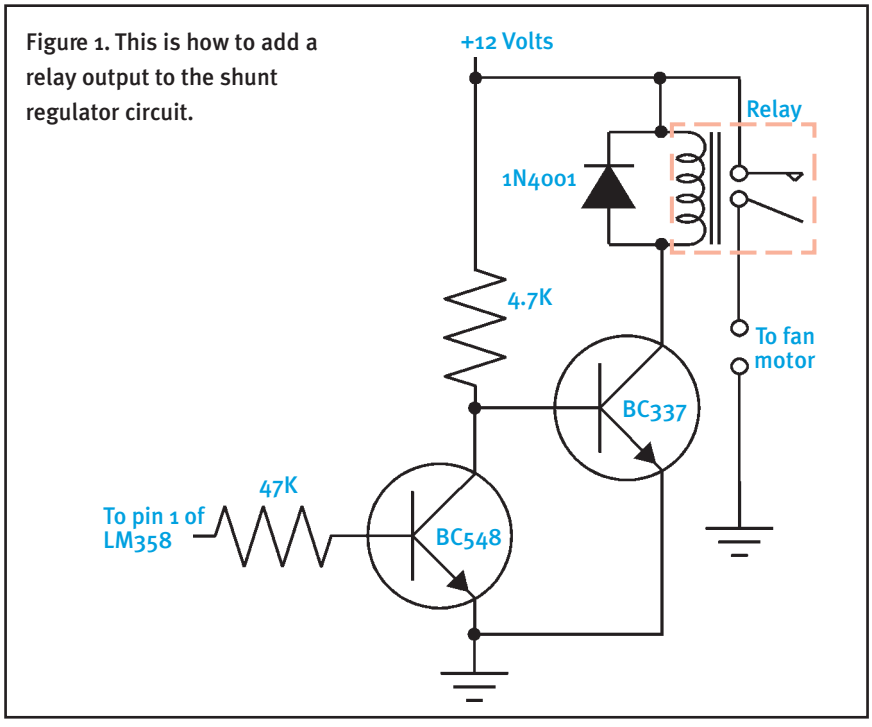


Figure 1. This is how to add a relay output to the shunt regulator circuit.

out of warranty. The new distributors informed the local mechanic that it was not an isolated problem.

I am now looking for a new generator and would appreciate your advice on what size and power output are required for the following system:

- Batteries: 1050 amp hour (C120) Century Yuasa at 24 volts
- Fourteen 60 watt Solarex modules
- Selectronic SA30 sinewave inverter
- One 30 amp Woods Dialomatic and
- One 12 amp iron-core battery charger.

The highest power appliance is a 1200 watt vacuum cleaner but there is high demand over the weekend with chores like washing and vacuuming. I need backup particularly in the winter months, as there is lots of shading from trees on my panels. I want something that is quiet and dependable. I used to have a 2.2kVA Yamaha petrol which I purchased second-hand and it did most of the job but seemed to struggle when the iron was drawing power.

What would you recommend for my system?

Ian Annetts,
annetts@hermes.net.au

It sounds like you run your iron and other large appliances directly from your generator. I would be inclined to run them from the inverter, as it is more than adequately rated, as are your batteries. You then just use the generator to charge the battery bank if it gets low. The charger will keep a nice even load on the generator, not the stop-start load of an appliance like an iron—the inverter is much better suited to this sort of usage.

Really, your battery chargers are a bit on the small side for your system. You should have a charger capable of putting out around 10 per cent of your battery's capacity. This equates to about 100 amps for your battery bank. With a battery charger capable of 100 amps output, you would need a 5kVA generator.

Personally, I hate fossil fuel powered generators, but petrol is (slightly) less toxic than diesel. If you can find one, go for an LP gas unit, though these are difficult to get.

Another option is to build yourself one from a suitable motor (around 3 to 4 horsepower) and a truck alternator. This does away with the charger altogether, the regulation will be much better than the chargers you have, and the overall system should be more efficient. What's more, you don't have to use fossil fuel to power it, you could use a wood-fired steam engine. An article on a home-made generator appeared in issue number 62 of ReNew.

Lance Turner

A 12 volt printer

I was very interested in your article on printing with 12 volts (*Soft Technology* number 55). I notice that the printer you used ran on 9.5 volts. My printer is a Hewlett Packard Desk Writer 320, and it runs on either a 6 volt battery or a 10.8 volt, 1.3 amp AC adapter.

I am presuming that the best option for 12 volt printing would be to provide the 10.8 volts. What changes would be required in your circuit to get 10.8 volts out of it?

Christopher Cordeaux,
Strathfield NSW

Your printer would most likely be able to run on the 9.5 volts or so that the power supply provides. As your printer has a 6 volt battery, I would suspect it has internal voltage regulators, and the input voltage should be able to fluctuate a reasonable amount without problems.

My suggestion is to try it and see. If the voltage is not adequate, just increase the voltage of the zener diode to the next value up, and maybe reduce the value of the resistor, R1, to 92 or 89 ohms.

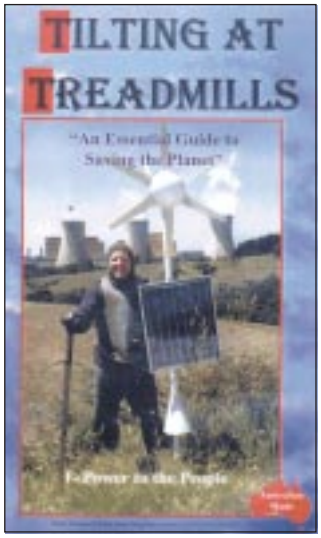
Lance Turner

Renewable energy video

Tilting at Treadmills is a documentary on renewable energy. It discusses the different methods of power generation available, including solar, wind and hydro power, gives many examples of each, and shows how they can be integrated into our everyday lives.

The presenter takes the viewer on a tour of institutions such as the Centre for Alternative Technology in Wales, and the Rocky Mountain Institute in the USA, and we get to meet some local renewable energy installers.

The video itself is of reasonably good quality, and is supplied in a white plastic case with a colour-photocopied cover.



For anyone wishing to learn more about renewable energy technologies in an easy and enjoyable way, this video is definitely worth buying.

rrp: $30 plus postage.

Distributed by Benton Productions, 8 Rawhiti Rd, Emerald VIC 3782, ph:(03)5968 4736, fax:(03)5968 5747.

A big ram pump

Using water power to pump water is not a new idea, but most pumps on the market that use this method are more suited to smaller, house-sized installations. If you need to pump a lot of water, then the Hyawatta Power Pump may be the answer.

While still in prototype stage (expected to be in production early next year), the pump is capable of pumping up to 110,000 litres of water per day to a height of 21 metres from a supply head of just 1.3 metres and a flow rate of 27 litres per second. This pump differs from other ram pumps in that it is a double-acting pump, which means it pumps water when the piston is moving in either direction. Dimensions are 1200mm long x 400mm high x 500mm wide and weight is around 40kg.

For more information, contact Hyawatta Power Pump, 58 Irelands Rd, Blacktown NSW 2148, ph:(02)9920 5043, fax:(02)9920 5243.

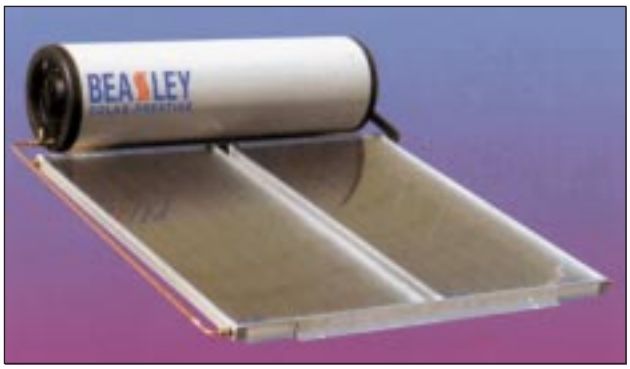
Don't smoke it, wear it!

Hemp has many advantages over other fabrics, not the least of which is its durability, being around three time stronger than cotton, and as durable as many synthetics. It requires little or no pesticides to produce, and produces very high yields per hectare while rejuvenating the soil as it grows.

Green Planet Fabrics have a range of fabrics made from hemp as well as mixtures of hemp and other fabrics such as cotton and silk. Included in the range are the satin-finish hemp silk, a 60/40 blend of hemp with silk, light and open weave hemp cotton blends, hemp canvas, an assorted range of upholstery fabrics and hemp/cotton and hemp/viscose knitted fabrics suitable for T-shirts and similar clothing items.

The woven fabrics are sourced from China and Hungary, while the knitted fabrics are Australian. Also available are hemp/cotton blend yarns, a range of bed linen, homewares and other clothing products.

Distributed by: Green Planet Hemp Fabrics P/L, PO Box 962, Byron Bay NSW 2481, ph/fax: 02 6685 8841.



Frost-free Beasley

There are numerous systems used to prevent frost damage in solar water heating systems, and Beasley have just released a new system designed specifically for frost prone areas.

Called the *Heat Transfer Module*, or *HTM,* the unit does away with the idea of circulating water through the collector panel, and instead uses a special fluid that passes the collected heat to the water via a built-in heat exchanger.

The Beasley system has a completely sealed heat collector circuit, with no valves or vents, and so will not lose any of the special fluid during its lifetime, according to Beasley.

The HTM units are available in 180 litre and 300 litre mains pressure versions.

rrp: Contact your local Beasley dealer.

Manufactured by: Beasley Industries P/L, Bolton Ave, Devon Park SA 5008, ph:(08)8340 2299, fax:(08)8340 0829.

Repairing old pumps

There is now an alternative to throwing that pump out when the casing or impeller has worn out. Palmer Enecon have a range of synthetic coatings that can be applied to the inside of pump and turbine casings, as well as to the impellor, to bring the device back to working order.

The coatings contain metal or ceramic particles to provide a very high wear-resistant surface that the maker claims will provide old pumps and turbines with a new lease on life. These materials can also be applied to the inside of new pumps to greatly increase their expected lifespan. Palmer Enecon say that any pump worth more than $1000 can be economically repaired with their products.

While they generally do the first repair themselves, the company also offer their coatings for sale.

Manufactured by: Palmer Enecon Services P/L, PO Box 91D, Noble Park DC, Noble Park VIC 3174, Ph:(03)9769 1010, fax:(03)9769 1717.

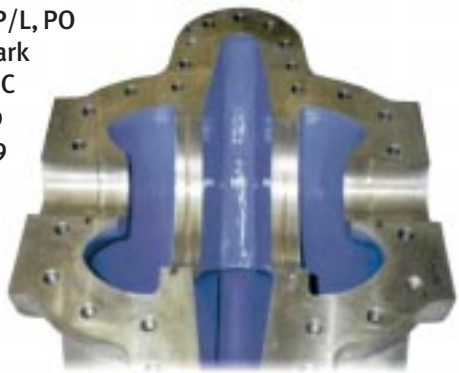


Photo courtesy Tree Project

Smoke in the water

With many areas of native bushland being devestated by logging and farming, speeding up revegetation of damaged areas is of vital importance. However, this is a slow process, with germination rates for most species being quite low. However, recent research has shown that many species react very favourably to the presence of smoke, rather than the heat or ash of a fire.

Regen 2000 is basically a mixture of smoke and water designed to break dormancy and greatly increase germination rates for revegetation projects and nurseries. So far, 400 species have been found to respond to smoke treatment.

The product is available in two forms, Regen 2000 Direct, which is applied directly to the soil prior to when germination is most likely, and Regen 2000 Smokemaster, which is better suited to nursery use or pre-soaking of seed prior to sowing.

rrp: $2.99 per litre from the factory.

Distributed by Grayson Trading, PO Box 134, Bayswater VIC 3153, ph:(03) 9720 7705, fax:(03) 9720 7706.

Multi-purpose solar torch

This torch, from Dick Smith Electronics, is not only solar powered but has a built-in three LED warning flasher, much like a flashing bike light.

The torch is unusual in its design in that it is completely encased in a waterproof clear plastic case. Unscrewing the lens cover allows the torch to be removed from the case. The globe can then be replaced, or, if the internal nicad batteries are flat, two standard AA batteries can be inserted into the battery holder so that the torch can still be used.

The torch has an encapsulated ten-cell solar panel that looks fairly well made. It comes with a swivel bracket that allows it to be mounted onto a bike for use as a bike light. It also comes with two spare globes, and is light enough that it will float in water.

rrp $22.95

Distributed by: Dick Smith Electronics, who have a mail order service on ph: 1800 366 644.

Halogen downlights

If you are using incandescent lights on your extra-low-voltage power system, then you are just wasting power. And while fluorescents are the most efficient of the commonly available lighting types, they are not always the best option. Halogens can be a good compromise, but they are generally available in just 12 or 24 volts.

The Fosnova range of downlights differ from other halogen lights in several ways. They don't use a sealed lamp/reflector assembly, instead only requiring a small bulb to be replaced when they fail. The two pin G4 or GY6.35 bulbs are available in a range of voltages including 6, 10.5, 12, 14, 24, 28 and 240, and wattages from 6 to 50 watts.

The fittings come in three types, a 130mm eyeball style, and 62mm and 90mm fixed style, which are totally sealed against drafts to prevent heat loss from a room in winter.

rrp: $35 for the 62mm fixed unit, $45 for the 90mm fixed unit and $65 for the 130mm eyeball model.

Distributed by Kookaburra Security, ph:(03) 9469 4025.

Repairing broken aluminium parts

Aluminium is one of those metals that is notoriously hard to repair. Unless you have good welding skills or are willing to pay someone else to do it for you, there is little option when an aluminium component breaks other than to replace it.

Ultra Bond aluminium repair rod can be used to weld broken components back together, as well as for general fabrication. According to the manufacturer, the rods bond with the metal to form a weld that is stronger than the original material, providing the parts to be joined are prepared correctly before welding. Ultra Bond has a melting point of 380°C, allowing it to be used even with propane torches. It will also weld copper, zinc, brass, bronze and pewter, but cannot be used to weld ferrous metals, such as steel or stainless steel.

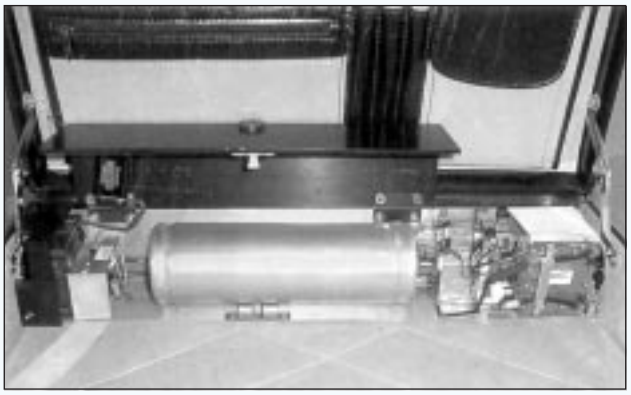
rrp: $10 for 5 rods, $20 for 12 rods, $50 for 35 rods and $65 for a 1kg pack. Postage is $3 for the two smaller packs, $5 for the larger ones.

Manufactured by Lavere Products, PO Box 50, Taralga NSW 2580, ph/fax:(02)4840 2017.

Fuel cell power packs

We have covered fuel cell developments a number of times in *ReNew*, but until now there have been no commercially available devices on the market in Australia.

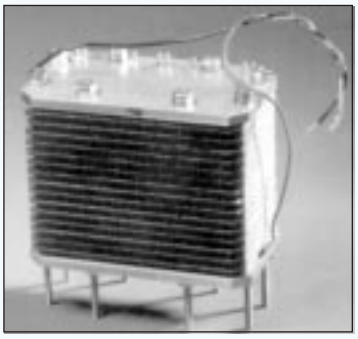
A US company, H Power Corporation, have developed a small proton-exchange membrane fuel cell to production stage and they are now available in Australia incorporated into a portable power pack. The pack consists of a tiny fuel cell stack and associated equipment, connected to a fuel module with two fuel canisters containing hydrogen stored in the form of a metal hydride, which is a safe way to store this highly explosive fuel. This allows the gas to be stored at an easily contained pressure of around 200 psi.



The fuel cell system is so small it can be mounted inside a briefcase for powering a laptop computer.

The fuel cell uses the hydrogen in combination with oxygen taken from the air to produce up to 50 watts of regulated 12.8 volt DC power. Fuel consumption rate is around 0.7 litres per hour per watt produced. To recharge the system, you simply swap the spent fuel canisters (each of which holds 70 litres of gas) for new ones. Each pair of canisters gives four hours of electricity at the 50 watt output rate, or longer for lower consumption rates.

Uses for these systems include powering highway message signs, lighting and traffic lights, emergency call boxes, professional video equipment, remote refrigeration, remote lighting, auxiliary and emergency power for vehicles, electrically assisted bikes, remote data loggers and many other applications that would normally require the use of solar panels and batteries.



The fuel cell stack, where the hydrogen and oxygen combine to form electricity and water. Note the two electrical output wires.

The standard unit, the PowerPEM-SSG50, has dimensions of 231 x 114 x 152mm, and weighs 3.4kg. The fuel module, which mounts on top of the fuel cell when running, weighs an extra 3.2kg. The unit can be run from other sources of hydrogen, such as standard gas cylinders, which will give greatly increased running times. Service life of the system is 10,000 hours before the 24 membranes inside the fuel cell need to be replaced, which is a little over a year of continuous use.

rrp $9975 including tax and delivery. Fuel refills will be available for about $0.01 per litre ($1.40 per module plus filling charge).

Distributed by H Power Pacific, PO Box 1052, Hunters Hill West NSW 2110, ph:(02)9887 3116, fax:(02)9870 7681, email: bigwheel@ozemail.com.au

High voltage inverter

Most inverters have a large and heavy power transformer inside them to step up the voltage from the extra-low voltage battery bank to 240 volts AC. This requires two stages inside the inverter—change the DC to AC, then step it up.

The 10kVA semi-squarewave inverter from Sharpe and Jephcott does away with one of those steps, and the requirement for a large transformer, by using a 250 volt battery bank. The use of only one stage in the power conversion process also allows for greater efficiency, which ranges from 90 per cent at 10 per cent load up to 96 per cent at 100 per cent load.

The inverter has a maximum continuous power output of 10kVA continuous, and a surge rating of 32.5kVA. Idle power is 15 to 25 watts, depending on battery voltage, which can range from 234 to 325 volts DC. The inverter has high and low voltage and overload shutdown, and LED indicators for overload conditions as well as AC standby and AC on. A remote LED indicator board is also supplied.

rrp: $3500

Manufactured by Sharpe and Jephcott, 5 McLaughlin Ave, Sandringham VIC 3191, ph(03)9598 5775.

Local Suppliers' Directory

National

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Ph:(03) 9459 2888

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Clifton Hill VIC 3068,
ph:(03)9481 5731

All types of deep cycle batteries ranging from 12 volt 60 amp-hour to 2 volt 720 amp-hour.

50 years experience

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Suite 66, Canberra Business Centre
Bradfield St Downer ACT 2602
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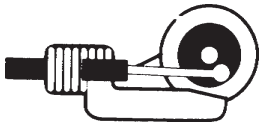

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Continued from page 11

inclined to throw the baby out with the bathwater, or should that be greywater?

In contrast, I found all the other articles to be excellent. Particularly the inverter buyer's guide and the vegetarianism article.

Dave Keenan,
Web site: http://uq.net.au/~zzdkeena

Once again, while my methods aren't as scientific as Choice's (I use my nose to inspect the clothes after washing), I have found that plain water doesn't deodorise clothes as well as the disks. With regards to Bio-paint, I painted my loungeroom with it about 18 months ago, and there has not been a hint of mould (though I live in Victoria). It isn't possible to scrub clean water-based Bio-paint (or milk paint) the same way you can with their synthetic counterparts, but I keep a small amount of left-over handy for minor touch-ups, and there's no way I would go back to nausea-inducing synthetic paints.

—Michael Linke

A word on green computing

Just a little note on buying new energy efficient computers. I recently upgraded my ailing (10 years old) XT computer and wanted to ensure that I could buy a more energy efficient desktop computer since they are more comfortable to work with than a notebook computer.

I wanted to get the most energy efficient model, drawing less than 70 watts when operating and printing (that's what the XT consumed). So I took a power/energy meter from work and set out to check various models in operation.

Well it turned out that it is a difficult task in Australia to ask computer sales people about energy efficiency. They haven't got a clue and in most cases give all sorts of misleading info.

Firstly, they distrust anyone with a power/energy meter thinking that if they plug in their computer, the meter may damage their computer. Hence just to take a measurement can be a battle.

Secondly, they make all sorts of claims that you don't save any energy by using the in-built software to switch the computer (monitor then hard drive) to lower power consumption states.

Thirdly, they say that switching the computer on and off shortens the life considerable so don't do it, even thought hard drives are rated for more than 40,000 on/off cycles.

All of these responses represent just another barrier to implementing efficiency measures. I would hate to be a non energy expert trying to buy an energy efficient computer.

By the way, my new computer draws 90 to 100 watts (maximum while printing). So much for energy efficiency in the Australian market!

Trevor Berrill,
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Computers crashed, video recorders forgot what day it was, and the bedside clock just sat there blinking at you. You couldn't even listen to your favourite radio program, because the electrical noise from some battery chargers would drive you bananas. And boy, did they gobble fuel. You see, doing it this way, for every dollar you spend on fuel, you only get 12 cents worth of battery charging.

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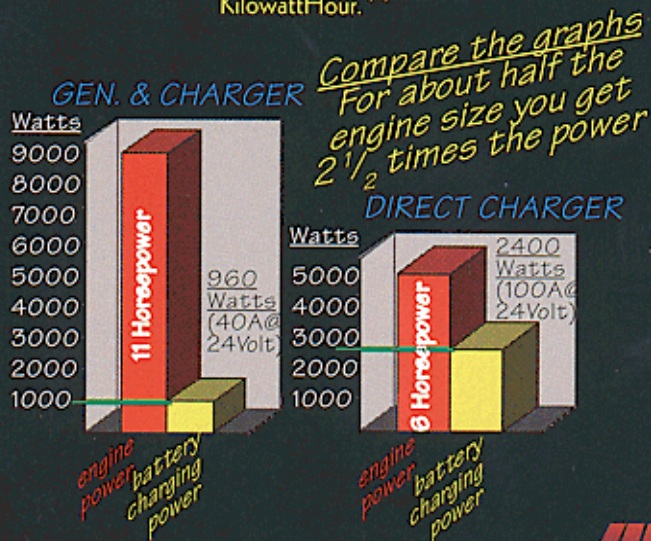

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