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ReNew

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A SunProfi SP1200 grid connect inverter

Valued at $3170

See page 6 for details

Conditions apply

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Reusing dead compact fluoro lamps

Electronic renewable energy kits overview

Building with recycled materials

Fail-safe irrigation

What solar rebates are you eligible for?

Issue 83 Apr–Jun 2003
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SETTING THE STANDARD AGAINST WHICH OTHER INVERTERS ARE MEASURED

Contents

Issue 83
April–June 2003

features

Saving and reusing water is becoming an essential practice in many parts of Australia. We feature a simple home-built greywater system on page 16.
Cover: Andrew Taylor

ATA's summer biodiesel seminars provided a great opportunity for people to learn more about alternative fuels and check under the bonnet of some veggie-oil vehicles—article page 34.

FEDERAL SOLAR BATTERIES NEVER COMPROMISE QUALITY FOR PRICE!

All batteries are NOT created equal.
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Complete the *ReNew Reader Survey* on page 5 and WIN! one of five Freeplay radios

The stylish, compact Freeplay radio is fun anytime, anywhere, indoors and outdoors. Incorporating the latest technical advances in self-powered radio design means it winds in seconds and plays for hours.

The Freeplay S.3 will play on spring power, and the solar panel will fully power the radio all day in direct sunlight. With its internal power storage system, it will automatically save all available spring and solar energy, giving up to 15 hours of playtime when fully charged.

How to enter

To go into the draw to win, complete the five minute reader survey on page 5 and send it to: *ReNew Reader Survey,* PO Box 2001 Lygon Street North, East Brunswick VIC 3057, before the competition closing date of 5pm, 30 May 2003.

*** Write your name and daytime phone number on the back of the envelope, because we need to be able to contact you if you win!**

regulars

This cool radio is not only built to last a lifetime, but it's rechargeable and charges from 12 volt DC.
See Products page 88.

Want some help deciding what energy and water efficient appliance to buy? Consult our 240 volt whitegoods buyers' guide, page 49.

From the Editor

Time to take notice

Reading through the pages of this issue of *ReNew* will give many readers the impression that the renewable energy sector is still struggling for recognition and support. Although the industries have a stronger foothold and more participants than even a few years ago due to the Mandatory Renewable Energy Target, this stronger position seems far from secure.

It's sad but true that government support for the industry is looking very doubtful at this point in time, for a number of reasons. Just two years old and the MRET has come under attack in the form of the Council for Australian Government's energy market review; there's only a slim chance that the Australian Greenhouse Office's expiring renewable generation rebates will be topped up; and it seems that the federal government's gaze lays squarely on assisting the fossil fuel industry to clean up its act, rather than assisting zero- and low-emissions technology to assume a larger market share.

As you will read in a number of articles in this *ReNew,* the CoAG review's final report recommended the MRET be scrapped. The MRET was put in place to drive growth in the renewable sector, and it has had good success on this front—although there is certainly room for improvement, starting first with the necessary expansion of the target beyond the current 9500 gigawatt-hours by 2010. That the MRET has been put at risk, even before the beginning of this year's legislated review process, means that not only do supporters of the legislation need to push for the improvement and expansion of the MRET, but also lobby for its continuation—a very compromising position to be in.

When it appears that many of the current government drivers for the renewable energy industry are about to dry up, and seemingly be replaced by clean coal research, one starts to perceive that the past two years has been the 'hey day' of clean energy in this country—which is very gloomy outlook indeed, but then again, we are speaking about Australia's energy policies.

One thing that we've noticed here at *ReNew* is the lack of community participation in the development of energy policy. This appears not only to be due to the complex nature of energy markets, but to the short lead times allowed by government review and the total lack of effective community consultation processes. If you feel any outrage at all about the current backward trends we are witnessing, please make yourself heard by contacting the ATA or any of the other organisations pushing for our clean energy future.

On a positive note, February 2003 was declared sustainability month and there were hundreds of fantastic events to get involved with, including the Sustainable Living Festival held this year at Federation Square in Melbourne. Congratulations to the festival team for another massive effort.

Kulja Coulston

About ReNew

ReNew is published by the ATA (Alternative Technology Association), a non-profit community group concerned with the promotion and use of appropriate technology. *ReNew* features solar, wind, micro-hydro and other renewable energy sources. It provides practical information for people who already use these energy sources and demonstrates real-life applications for those who would like to.

ReNew also covers sustainable transportation and housing issues, the conservation of resources, recycling and broader environmental issues. *ReNew* is available from newsagencies, by subscription and as part of ATA membership. ATA membership costs $49 per year, and offers a range of other benefits.

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Managing editor: Kulja Coulston
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Web site: www.ata.org.au
Street: Solar Workshop, CERES Environment Park, 8 Lee Street, East Brunswick VIC.

Contributions are welcome, guidelines available on the web: www.ata.org.au or on request.

Advertising in ReNew

Advertising is available for products and services relevant to our audience. We reserve the right to refuse advertising at our discretion. Advertising enquiries: ph: (03) 9380 3406 fax: (03) 9388 9322

Next advertising booking and editorial deadlines:
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Complete this *ReNew* reader survey and go in the draw to *WIN!* One of five Freeplay Radios, value $99

(see page 3 for full details).

Please take this opportunity to tell *ReNew's* publishers more about you! By completing this reader survey you will be contributing to the ongoing development of *ReNew* and help us to select appropriate content and advertising. By completing the whole survey and returning it to us before 30 May 2003, you will go in the draw to win one of five Freeplay Radios.

Send completed surveys to: *ReNew Reader Survey*, PO Box 2001 Lygon Street North, East Brunswick VIC 3057.
*Write your name and daytime phone number **on the back of the envelope**—this is an anonoymous survey, however we need a way of contacting you if you win.

How you read ReNew magazine

How many people read your copy of ReNew?

❑Only yourself ❑1 other ❑2-3 others
❑4-5 others ❑More than 5 others

How frequently do you buy ReNew on average?

❑Every issue ❑2-3 times a year ❑Once a year
❑Occasionally, when an article interests me ❑First time

How do you read ReNew, on average?

❑Read thoroughly, cover to cover
❑Look at every page, then stop and read
❑Go straight to items of special interest
❑Browse for items of interest
❑Skim

What attracts you to ReNew (you may tick more than one)?

❑House articles ❑Product info ❑Advertisements
❑Technical articles ❑Buyers' guides ❑Policy updates
❑Industry info ❑Water conservation ❑Energy-saving
❑Environmental awareness ❑Renewable energy systems
❑Other _____

How do you rate the content in ReNew articles?

❑Too technical/specialised ❑Just right ❑Could be more detailed
❑Other _____

How did you discover ReNew?

❑Friend/family member ❑Internet ❑News agent
❑Event/expo ❑Media ❑Advertisement
❑Professional advice ❑ATA ❑Other _____

What do you usually do with your copy of ReNew?

❑Keep it for reference ❑Keep some copies for reference
❑Give copies to friends/family ❑Recycle them

What other magazines do you buy?

❑None ❑Earth Garden ❑Grassroots
❑Owner Builder ❑New Scientist ❑Nexus
❑Ethical Investor ❑Caravan World ❑Your Garden
❑Other _____

In the past two years after reading a copy of ReNew have you ever:

- Bought something directly in response to an advertisement in ReNew? ❑Yes ❑No
- Completed a do-it-yourself project? ❑Yes ❑No
- Visited the ATA website? ❑Yes ❑No
- Bought something from the ATA? ❑Yes ❑No

Do you read the advertisements in ReNew?

❑Always ❑Often ❑Rarely ❑Never

Do you read the *Suppliers Directory* in the back of ReNew?

❑Always ❑Often ❑Rarely ❑Never

Tell us about your projects

What type(s) of sustainable technology or building project are you planning?

❑Remote Area Power Supply system ❑Water conservation
❑Grid-connect renewable system ❑Energy efficiency
❑Sustainable home/renovation ❑None
❑Other _____

What is the time-frame for your sustainable technology or building projects?

❑Current/ongoing ❑Next 1–2 years ❑Next 2–3 years
❑Next 3-4 years ❑More than 4 years from now

How do you prefer to research for projects?

❑Magazines/books ❑Internet ❑In person
❑Seminar or course ❑Other _____

Tell us about yourself

Gender? ❑Male ❑Female

Age? ❑under 18 ❑18-29 ❑30-39 ❑40-49 ❑50-59 ❑60 and over

Occupation? _____

❑Trades ❑Student ❑Sustainable technology industry

Where do you live? (postcode or suburb *and* state)

_____

❑I have a RAPS system ❑I have a grid-connect system

What is your highest educational standard?

❑Degree/diploma ❑Year 12 or equivalent
❑Trade qualification ❑Other _____

What is your average yearly earnings (before tax)?

❑Under $15,000 ❑$15,000-$30,000 ❑$30,000-$40,000
❑$40,000-$50,000 ❑$50,000-$65,000 ❑Over $65,000

Are you a *ReNew* subscriber or ATA Member? ❑Yes ❑No,

If No, do you plan to subscribe or join ATA? ❑Yes ❑No,

If No, why not? _____

WIN!

A SunProfi SP1200 grid-connect inverter

in the ReNew/Advanced Energy Systems subscriber competition

Features of the Sunprofi SP1200 grid-connect Inverter.

- Suitable for 1500 watts of solar
- Wide (125-375) DC input range
- Designed for reliable long-life
- IGBT power stage with high safety margin
- Sturdy outdoor cabinet (IP33)
- MPP-Tracking with high accuracy
- Low cost optional data-logger
- Fully compliant for Australia

Total prize value: $3170*

***Take out an ATA membership, become a supporter, subscribe to ReNew, or renew your current membership or subscription, before 25 April 2003 and you could win an Advanced Energy Systems SunProfi SP1200 grid-connect inverter valued at $3,170 including GST. See the conditions below, and get your membership or subscription in today!**

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, and to *ATA Supporters.*

(2) The prize is not redeemable for cash.

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

(4) The competition runs from 26 October 2002 to 25 April 2003. Subscriptions/memberships must be paid by 5pm on Friday 25 April 2003 to be eligible.

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

(6) To subscribe or join the ATA, use the subscription form in this issue (or a copy of it), or call the ATA on (03) 9388 9311 to pay by credit card.

(7) The competition is only open to *ReNew* readers in Australia and New Zealand. New Zealand winners must pay the cost of freight from Melbourne, Australia to their destination in New Zealand. The prize does not include installation of the unit.

The *ReNew*/Advanced Energy Systems subscriber competition is proudly sponsored by Advanced Energy Systems Limited. Brisbane: 11 Hi-Tech Court, Eight Mile Plains, QLD 4113. Perth: (Head Office), Suite 1/5 Turner Avenue, Technology Park, Bentley WA 6102, ph:(08)9470 4633, fax:(08)9470 4504, email: sales@aesltd.com.au, www.aesltd.com.au
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Renewable energy centre loses funding

The Howard Government has announced it will no longer fund the Australian Cooperative Research Centre for Renewable Energy (ACRE). The decision not to renew ACRE's $10.5 million over seven years grant funding beyond June 2003 draws to a close specific government support for renewable energy research in Australia.

The latest round of Cooperative Research Centre (CRC) funding saw the mining industry benefit substantially, with Rio Tinto receiving $35 million for a Sustainable Minerals Industry Foundation to investigate carbon sequestration. Mining related CRCs received a total of $65 million in funding.

Labor and the Greens attacked the move as a further erosion of the renewables sector in Australia. Greens Senator Bob Brown accused government chief scientist, Robin Batterham, of a conflict of interest over his long-term involvement in the mining industry, a claim branded as 'an incredible, almost unbelievable allegation' by Science Minister Peter McGauran.

ACRE, based at Murdoch University in Perth, has coordinated research into renewables for the past almost seven years. ACRE recently worked with Brisbane TAFE to restructure renewable technology courses for TAFEs Australia wide.

ACRE is the latest renewable energy program to be axed by the federal government. It follows the shut down of the Energy R&D Corporation, the International Greenhouse Partnerships Program and funding cuts to the Australian Greenhouse Office which have seen a number of renewable research programs close.

The cut to ACRE's funding was announced only weeks after Prime Minister John Howard nominated an 'Environmentally Sustainable Australia' as one of four scientific research funding priorities for 2003.

Late last year the Council of Australian Government's (CoAG) review into the national energy market was released. The review final report called for the scrapping of the federal government's two-year-old Mandatory Renewal Energy Target (MRET), which requires that large buyers and users of electricity proportionally source 9500 gigawatt-hours of new renewable generation by 2010, and to source it annually thereafter. Originally introduced as the two per cent target, the Business Council for Sustainable Energy now says the target will need to be increased to 14,000 GWh to truly reflect a two per cent increase in market share for renewables by 2010.

The CoAG review was led by Warwick Parer, former federal resources

minister with strong links to the mining industry, including a stint at the helm of Utah Development Company, one of the country's biggest coal miners. The final Parer report favoured replacing the target with an undefined greenhouse gas emissions trading system.

The review was criticised for failing to address some of the key issues of greenhouse gas abatement and climate change by a range of conservation groups, the Federal Opposition and the Greens.

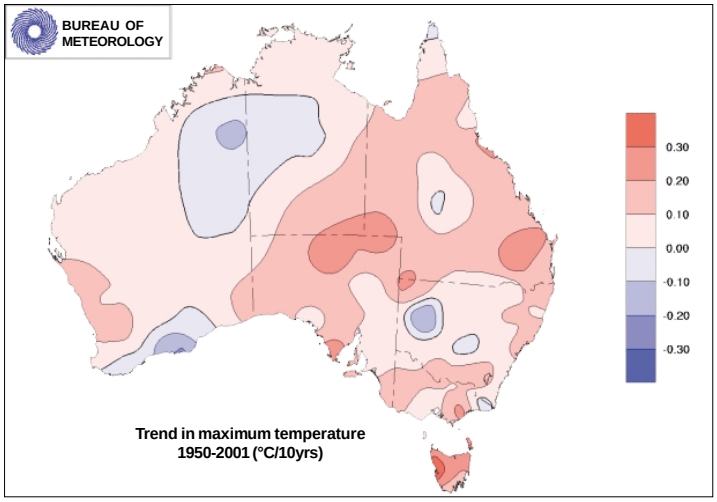
Critics said the report lacked foresight and was too focused on short term economic costs as opposed to the long-term benefits associated with the renewable energy sector and also runs counter to trends in almost all other developed countries.

The Australian newspaper reported the review had also come in for criticism from Babcock and Brown, a leading international investment bank with $1.65 billion invested in renewable energy projects in Australia.

New Scientist described the review as 'a depressing triumph of ideology over rational analysis'.

Drought link to global warming

A new report by the WWF Australia and Monash University meteorologists has shown that human-induced global warming contributed significantly to the severity of the 2002 drought.



Maximum temperature trends across the Australian continent have increased over the past 50 years. Globally, 2002 was the second-hottest year recorded.

The report *Global Warming Contributes to Australia's Worst Drought*, also warned the drier conditions and higher temperatures have created greater bushfire danger. The report compared 2002 with four other drought periods from 1950, finding higher temperatures and significant increases in evaporation rates from soil, water courses and vegetation.

Rainfall for 2002 was the lowest for 50 years, less than 50 per cent of normal falling from March to November.

The report also found the average daytime maximum temperature across Australia was 1.6°C higher than the long-term average and 0.8°C higher than the previous record. The report acknowledges El Niño as causing the drought but says the maximum temperatures recorded are unusual.

'While higher temperatures are expected during El Niño triggered droughts, the 2002 drought temperatures are extraordinary when compared to the five major droughts since 1950, with average maximum temperatures more than 1.0°C higher than these other droughts,' the report said.

Co-author of the report, Professor David Karoly, formerly Professor of Meteorology at Monash University, said the 2002 drought was the first where the impact of human-induced global warming could be clearly observed.

'Most of this warming is likely due to the increase in greenhouse gases in the atmosphere from human activity such as burning fossil fuels for electricity and transport, and from landclearing.'

Findings in the report links the drought to increased bushfire risk. Increased temperatures and greater evaporation rates have worsened bushfire prospects, with vegetation nationwide under markedly higher stress than in recent years. The World Meteorological Organisation says 2002 was the second hottest year on record.

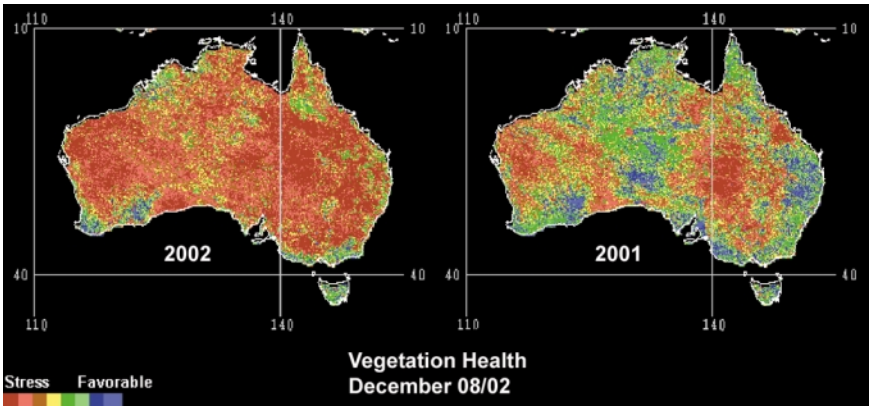
In other news, climatologists have predicted the drought-causing El Niño could end by April 2003, providing relief to drought-stricken

communities nationwide.

National Climate Centre climatologist, Blair Trewin, told *Reuters* news agency that while El Niño had shown no signs of ending at present, historical data suggests it should begin to break down by the end of March 2003.

'If we were to get to the end of March and there had been no significant break, that's when you could really start to talk about it going on much longer than anyone expected,' he said.

The drought has affected all areas of Australia's primary farming industries, with grain production halved to less than 10 million tonnes to the end of 2002.



The extended drought has put vegetation under extreme stress. The figure on the left shows the need for rain all over the continent.

Lobby for MRET

With the federal Mandatory Renewable Energy Target (MRET) review due to start any time, the Australian Wind Energy Association (AusWEA) has launched a campaign to see MRET increased from less than one per cent up to 10 per cent of electricity generation. The wind industry has stated its intention to be supplying enough power for a quarter of all Australian houses by 2010, provided the MRET constriction is fixed. 'The Australian public are central to winning clean power and we are asking anyone who wants renewable energy take a stand,' said Karl Mallon, co-ordinator of the campaign. AusWEA has set up and mechanism for the general public to fill in submissions to the government at www.thewind.info

Sustainable renovation seminars

ATA, publishers of *ReNew*, and the Australian Greenhouse Office are holding a national seminar tour on sustainable renovations in major capitals in 2003.

The seminars, 'Sustainable Houses: Renovating Your Home', will be held in capital cities from 26 May to 5 June. They will feature tips and advice on how to incorporate a range of sustainable features into any renovation project, including optimal insulation, strategic orientation on a site, passive and active solar design and the re-use of grey water. There will also be a small trade exhibition.

The seminars will feature architect and prominent speaker on sustainable design, Andreas Sederof, and leading building and design professional Chris Reardon, principal author of the *Your Home* website, www.yourhome.gov.au

Seminars will be held on:

Monday 26 May ..... Brisbane (Brisbane Convention Centre)
Tuesday 27 May ..... Sydney (Castle Hill RSL)
Wednesday 28 May ..... Sydney (Wesley Conference Centre)
Thursday 29 May ..... Canberra (National Convention Centre)
Monday 2 June ..... Melbourne (The Whitehorse Centre, Nunawading)
Tuesday 3 June ..... Melbourne (Melbourne Exhibition Centre)
Wednesday 4 June ..... Adelaide (Capri Theatre)
Thursday 5 June ..... Perth (Burswood International Hotel Ballroom)

The cost of each seminar is $27.50 (including GST). For bookings and further information contact the meetings manager on (02) 9241 2955 or email: meetings@tmm.com.au

Central Victorian Greenhouse Alliance

A coalition of regional Victorian councils, local organisations and CSIRO scientists are planning to eliminate all net greenhouse emissions in the region by 2020.

The Central Victorian Greenhouse Alliance (CVGA) includes nine local councils—Ballarat, Greater Bendigo, Buloke, Campaspe, Central Goldfields, Gannawarra, Loddon, Macedon Ranges and Mount Alexander, together with the Bendigo Bank, Latrobe University, Loddon-Campaspe-Mallee Education Region, Department of Primary Industries, North Central Catchment Management Authority and St Lukes Anglicare. They plan to reduce and eventually eliminate emissions via a number of means.

These include:

•Reducing emissions and energy costs from homes and businesses by 20 per cent

• Raising energy efficiencies by 80 per cent by co-generating heat and electricity locally
• Developing transport systems that produce up to 70 per cent less green house gas, and
• Exploring the use of hydrogen as a fuel for zero emission transport and power generation.

The CVGA has gathered data on energy use for each municipality in the region and has identified key targets for co-generation installations allowing onsite power production.

Hornsby Central Council in NSW is working with CSIRO to install a greenhouse gas reduction demonstration project using a 60 kilowatt microturbine in the local library. The project, partly funded by the Australian Greenhouse Office, should cut greenhouse emissions by 250 tonnes per year.

The project will redesign the air conditioning system in Hornsby Central Library to exploit waste heat from the gas-powered microturbine, which also provides electricity to the building.

CSIRO has identified onsite power generation as a key component of greenhouse emission reduction.

Britain to build giant wave-power project

Britain may revisit 20-year-old plans to build a massive tidal-estuary power station capable of supplying six per cent of England and Wales' power needs.

The barrage would tap into the Severn estuary's 12-metre tidal range. The 8640 megawatt barrage could be in full operation by 2014 and is predicted to cost up to 8 billion pounds.

The project could contribute significantly to British plans to increase renewable energy sources to 10 per cent and cut greenhouse gas emissions by 20 per cent by 2010.

It would form the largest tidal power project and one of the single largest energy generation projects on the planet.

Methane rising

Parts of the deep-ocean floor are covered by ice, rich in carbon in the form of methane. *Nature* reports the ice sheets are beginning to break up with potentially disastrous results for the planet.

It is estimated there is around 10 trillion tonnes of carbon locked up in the undersea ice as methane hydrates, which form when water containing natural gas freezes. As global oceans warm, scientists fear these hydrates will melt and contribute to global warming.

New tungsten globes shine coolly

Light bulbs generating more heat than light may be a thing of the past following the production of a new tungsten-filament bulb that emits hardly any heat.

A microscopic tungsten lattice developed at the US Department of Energy's Sandia National Laboratories could potentially increase the efficiency of ordinary incandescent bulbs.

Currently, globes are about five per cent efficient, with most of the energy used to power them converted to infrared radiation, or heat. The tungsten lattice could increase efficiency to greater than 60 per cent, having an enormous impact on energy production needs worldwide.

Presently, the excess energy output needed to power electric lighting adds enormously to capacity, while most of the energy used is wasted through conversion to heat.

The advance could also lead to increased efficiencies in thermal photovoltaic applications from 12 per cent to over 50 per cent.

Computers make a mess

While the benefits of computers as useful and labour saving devices in the home and workplace are well known, the environmental cost is not so well documented. Energy analysts in Japan, France and US have traced the lifespan of a chip through every stage of the production process.

Hydrogen powered SUV

In an attempt to cater to the US love of sports utility vehicles, Ford has designed a hydrogen powered SUV which produces almost no emissions.

The Ford Model U was presented at the Detroit motor show in February this year and the company claims it uses green materials and processes in its manufacture and lifecyle. They say it incorporates ecological principles and cradle-to-cradle reuse design.

The car is powered by a supercharged hydrogen, internal combustion, 2.3-litre engine and boasts a fuel economy of 54 miles per (Australian) gallon, has a range of about 300 miles and has near-zero regulated emissions.

Writing in the American Chemical Society's *Environmental Science and Technology* journal, they found that while a single 32-megabyte memory chip weighs only two grams, it takes at least 1.6 kilograms of fossil fuel to provide the energy for its manufacture and use over a four-year timescale. They also found that production and use consumes at least 32 kilograms of water and 72 grams of toxic chemicals such as ammonia and hydrochloric acid.

CO_2 build up in African lakes

Engineers in Cameroon have begun work on a project to remove huge amounts of carbon dioxide from the bottom of a lake. If allowed to build up, the CO_2 under the surface of the lake can be shifted by any large disturbance, rise to the surface and cause an eruption-like event.

The African nation has experienced two such eruptions of the deadly gas during the 1980s that killed by suffocation around 1700 people. The project should take around 18 months to draw off the CO_2.

The case highlights one of the issues with carbon geosequestration, a technology being pursued by the mining industry in Australia as a means of avoiding CO_2 emissions into the atmosphere.

From little things...

Scientists may have found a way to generate electricity from microscopic nanotubes. They've found that simply running water past a bunch of tiny nanotubes can produce a current.

New Scientist reports the discovery could pave the way to develop miniature power sources for implants such as pacemakers that are powered by the flow of body fluids.

Food in plastic

We're familiar with food that tastes like plastic, some people say it's the secret ingredient of the fast food chains. Now scientists in Hawaii have found a way to turn wast food into plastic. This will now provide a way use the obscene quantities of food that rich countries throw away every year, and reduce greenhouse pollution.

New Scientist reports biochemical engineers at the Hawaii Natural Energy Institute have developed a biological reactor that converts a slurry of food waste into biodegradable polymer plastic. While the idea of turning food waste into plastic has been around for about 10 years, the process has been refined to convert any general food waste into the plastic.

The US alone produces 22 million tonnes of waste food annually. US statistics suggest there are 31 million people in the US who face hunger daily. Around 1.5 billion people annually could be fed on the grain fed to US cattle.

ATA sustainability workshops, Brisbane 2003

ATA is running workshops in Brisbane on a range of sustainability topics

Date	Time	Topic
April 5:	10am-12pm	**Reducing your electricity bill**
	1pm-3pm	**Solar water heating systems**
May 3:	10am-12pm	**Building or renovating for energy efficiency**
	1pm-3pm	**Solar power for your house**
May 31:	10am-12pm	**Reducing your electricity bill**
	1pm-3pm	**Building or renovating for energy efficiency**

Length: Each workshop will be 2 hours; bookings essential
Cost: $25 single / $40 couple
Contact: Wendy Miller Email: ecco2sol@bigpond.com
Phone: 0428 734 316

Workshops will be held at the Renewable Energy Centre, Brisbane and North Point Institute of TAFE, Ithaca Campus, Fulcher Rd, Red Hill. More workshops will be planned for other locations later in the year.

Compact fluoro interference

My advice to Mr Laurie Kemp, who has problems with compact fluoro interference (Q&A, *ReNew* issue 82):

It depends at what frequency the interference happens. The higher that frequency, the easier it is to filter out. The noise signal most likely travels via the power lead to your Panasonic stuff, rather than radiating from the lamp.

It is easy to try with some clip-on noise surpressors, as being used on computer equipment. They can be clamped on the power lead to the lamp. For a better effect, a few of these can be combined. To filter out lower frequencies (the base and/or the lower harmonics), an expensive line filter can be used. Such filter is far more expensive than the lamp, so it makes sense to try another brand. You could try to put some surpressors on the lead to your TV and video recorder as well.

Cheap lamps, as the ones for sale here in Indonesia have no internal filtering at all. Better brands have a small coil and capacitor mounted inside in order to comply with CE and other radio interference standards.

Jozef Steenhout,
steenho@attglobal.net

For information on re-useing dead compact fluoros, see Jozef's article in this issue.

Ed.

Green power?

I would like to add to Glenn Lawson's letter on 'Green energy too expensive' in issue 82 of *ReNew*.

We have just moved into 'Country Energy's' zone in NSW and find their green scheme also lacking. Instead of charging by the kilowatt-hour of energy used, the green energy charges are a set amount per day on top of your energy usage (from part-green at 20c/day to pure green at $1/day).

As we are energy conscious and use little energy, this charge doubles our bill. If we were energy-extravagant, it would be a small increase. This payment method 'rewards' extravagant users and penalises energy conscious households. How 'green' is that?

Could *ReNew* run an article comparing current 'green' offerings by energy companies?

Heather Powell, Nelligen NSW

Power pricing

Glenn Lawson's letter about green electricity pricing (Letters, *ReNew* issue 82) deserves a response.

It is understandable that people should resist paying more for electric-

ity generated from renewable sources, than for the usual product which is generated without regard for sustainability or long term climate effect. We have been trained by our consumer culture to look at price and value in a very simplistic way.

Traditional 'value for money' ways of looking at energy are, however, a big barrier to introducing a sustainable economy. Energy from damaging and unsustainable sources (that is, nearly all the energy we buy) is far too cheap. Our whole energy hungry economy is based on the extraction and combustion of huge, but one-off, resources of fossil fuels.

The convenience and energy density of fossil fuels, coupled with our 'cleverness' at building the technologies for distribution and consumption, have made energy cheaper for us now (in the rich countries) than it has ever been, and, I expect, than it is likely ever to be again.

There is no reason why renewable energy should ever be as cheap as fossil fuel, indeed it is likely that such dispersed forms of energy as sunlight or wind will always be more expensive. Those of us living with remote area photovoltaic electricity are already paying around $1.00 per kWh, which is around 10 times what coal fired electricity costs. This doesn't mean we pay 10 times as much to satisfy our electricity needs, it means we are 10 times as thoughtful about how we use electricity.

By using high efficiency refrigeration, lighting, computers, and providing our heat needs from non-electric sources, our busy household uses less than 1.5kWh of electricity per day—less than one-tenth of the state average. At this level of consumption, Pure Energy at 17.9c/kWh is a bargain.

The problem of our unsustainable use of energy isn't going to be solved by waiting for renewables to be as cheap as we feel like. It requires the pricing of energy to reflect its true long-term cost, and for energy consumers to get the right price signals to encourage efficiency instead of waste.

Bruce Teakle, Mt Glorious QLD

Renewables for renters

I guess this is probably quite a common situation, but one I have not been able to find any suggestions, solutions or products to help with.

I have lived in Australia for six years, and as I move around a lot, have always been in rental apartments or houses. Landlords have varied from the helpful (one brought fresh flowers round for my partner and daughter and helped hang pictures) to the current who won't even go halves to install greywater diverts on the kitchen and laundry sinks in the small house on the Gold Coast where water is a real problem at the moment.

With money tight, as for many people, and in a situation where any changes we make would need to be remedied before we leave a property it is very difficult to find ways to even start making changes to a more sustainable approach. Currently we bucket bathwater onto the garden and have installed AAA rated showerheads (keeping the old ones to refit when we leave) and have fitted a small bench-top dishwasher (it uses less water than doing it by hand and the outlet goes into the garden, not down the drain).

I guess the challenge to throw out is for the development or promotion of technologies that can help others in our situation…be it easy fit/remove plumbing modifications or dedicated solar collectors that can be easily hung on an outside wall or fence (or roof) to feed a battery that can also be connected to the mains and used to run a stereo or a PC or recharge the mobile et cetera.

I don't know how much benefit there is in providing ways for the huge rental population to reduce their impact. Would manufacture of these devices actually do more damage than the good they do, or be costed out of contention? Would your efforts be better spent lobbying our head-in-the-sand Federal and State governments to do something about it, or perhaps approach individual organisations (for instance the theme parks here in QLD) to convert to a more sustainable mix—providing education and awareness?

Jeremy E Cath,
jeremy@rufan-redi.com

Solar trams

An engineer on a recent Radio National program suggested that Victoria's current public transport (especially electrified trains and trams) was not as energy efficient or environmentally friendly as generally agreed because of the need to generate electricity from coal and then transfer it over long distances. Thinking about this (while a tram rumbled past) while walking to work today, I imagined light-weight, quiet, solar powered trams trundling happily around Melbourne's extensive tramline network. A Google search revealed that a solar powered tram may exist in Hamburg, Germany and that a solar tram project exists in Auroville, USA. Can Melbourne get in on the solar tram act? Do readers have any knowledge about solar trams?

Ray Peck, peck@acer.edu.au
Australian Council for Educational Research (ACER)

SHW woes

Your solar hot water system sits on your roof, out of reach and beyond your ability to control and monitor. So do you know how much gas or electricity it is

Continued on page 92

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Recycling household water via a home-made system

Greywater systems can be simple or complex, made from new or recycled materials and can be high or low-maintenance in design. Their very flexibility and relative low cost is why so many Australians are incorporating them into their own homes. Heather Pemberton describes the simple systems installed at her home which diverts bathroom and laundry water to her thirsty garden

Water from the bathroom filters through this reed bed system (made from objects reclaimed from landfill) and is used to irrigate the garden.

Many moons ago, I went on a camp with some university friends and one of these friends, in a moment of madness, drove his car off road into dense bush, down a steep rocky mountainside and got stuck there. About 10 of us went out to the car and, for the next several hours, pushed that car back up the hill one metre at a time. It was dark, raining and very, very muddy but we enjoyed every minute of it and returned to camp exhausted but beaming with our achievement.

Recycling can be a lot like pushing a car up a hill. It takes extra time and effort but, because there is personal involvement, there is also great personal satisfaction. My husband Bill and I are passionate recyclers—maybe a little too passionate at times, as will become apparent.

Reed bed greywater box

One of our first major recycling projects was the construction of a reed bed greywater system that I had seen described on the internet. Accessing greywater from the laundry and bathroom is relatively simple for us because we live in a timber house on stumps built back in 1918 and the pipe work is easily accessible. Unfortunately, greywater cannot be accessed in many new homes because the pipe work is embedded in a concrete slab. Some room for improvement in plumbing codes there.

We began our reed bed greywater system by making a box out of plywood sheets that were packaging crates in a previous lifetime. Next, we needed a waterproof lining and, although butyl rubber was suggested, this was expensive and did not involve our motto of recycling. So, instead, I collected hundreds of used supermarket bags and sealed them together using a hot iron (possibly just a little extreme). Amazingly, this idea very nearly worked. A few minor but constant leaks, however, meant that we

Reed bed system images and explanation

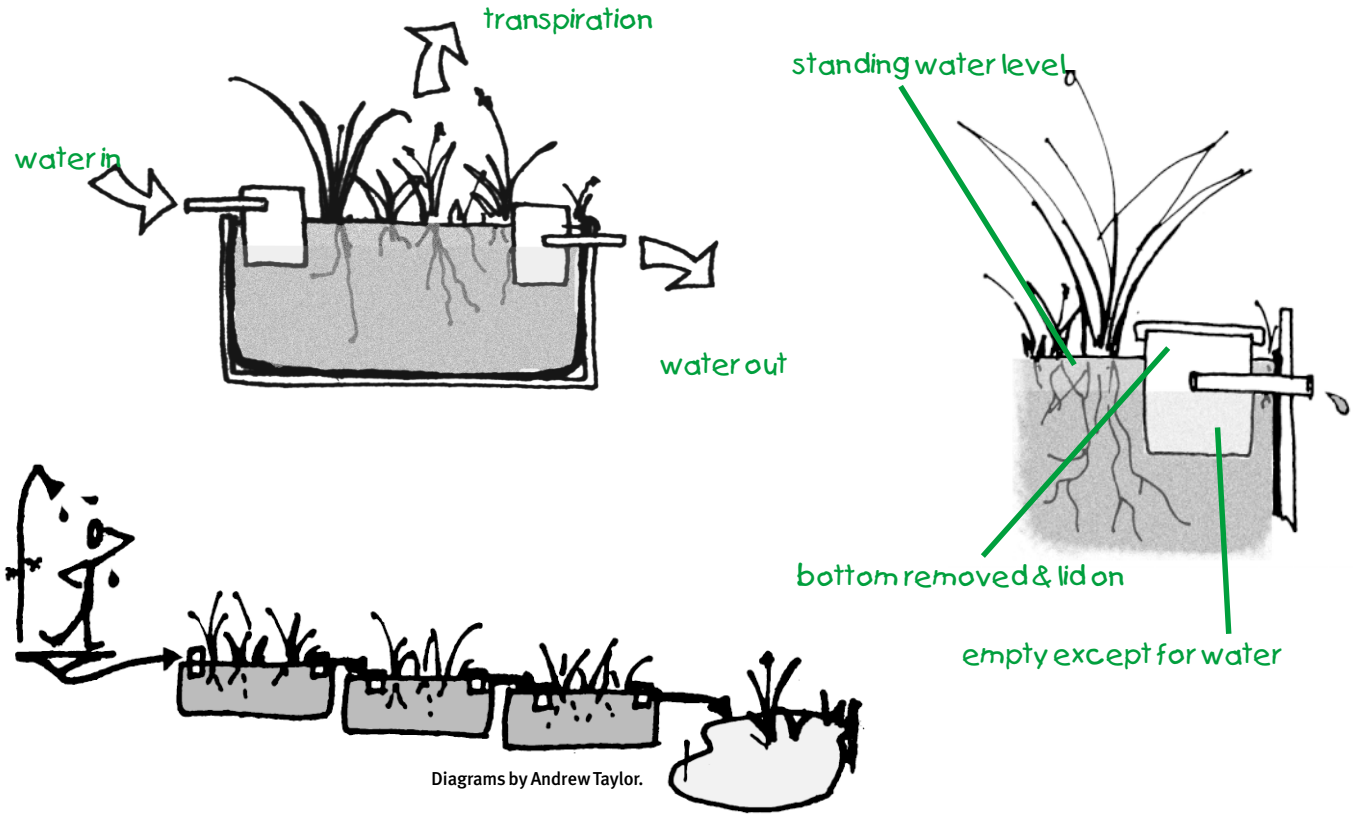
This simple and effective reed bed system is constructed of three compartments set end to end (one lined box and two baths). The pipes which normally take shower water to the sewer were interrupted and now deliver greywater directly into the reed bed system outside. As seen in the image at left, the pipe from the shower empties into a 20 litre bucket with the bottom removed and this protects the pipe outlet from being blocked by reeds. Water flows from one compartment to the next via sections of PVC pipe each protected by bottomless buckets (middle image). After having passed through all three compartments, water flows into a pond (image at right). A small pump located on the floor of the pond allows good quality water to be pumped to trees and shrubs in the garden. A high level of evaporation from the reed bed system during summer has significantly reduced the amount of water available for the pond and garden irrigation, and, for this reason, it is likely that the reed bed system will be reduced from three compartments to one. See the diagram on the next page for further details of this system.

eventually bought the butyl rubber.

We then needed to fill the box with a packing material that would hold the plants in place. River pebbles are generally used for this but we tried charcoal waste from a wood-fired bakery, broken pieces of polystyrene, and used film canisters. Unfortunately, most of these materials floated and are not particularly attractive. Nevertheless, the system still works.

Finally, the box was planted out with indigenous grasses we had grown from locally collected seed, mainly Carex and Juncus species. Handyman hubby connected an old piece of PVC pipe from the shower to the reed box and then some flexible pool hose from the outlet of the reed box to a pond that we had made using left over butyl rubber. Several months later, we extended the reed bed with two bathtubs full of reeds as well. In the base of our pond sits a small pump connected to irrigation pipe that can take the water uphill and into the garden about 6 metres. We also have an overflow pipe in the pond that empties into a nearby garden.

See the diagrams on the next page for more information on how to construct this reed box system for yourself. The original article is no longer available on the internet but it can be found in issue number 64 of the *Permaculture International*



The top diagram shows the bathtub reed bed and the placement of the 20 litre buckets and pipes. The diagram at right is a closeup of one of the buckets in the system—rocks are used directly below bucket to aid filtration. The bottom left diagram shows the three-bath reed bed system from the initial water source to the pond from which water is finally pumped to the garden.

Journal (the ATA library holds a copy). The article is by Glenn Marshall, a regular contributor to *ReNew* magazine.

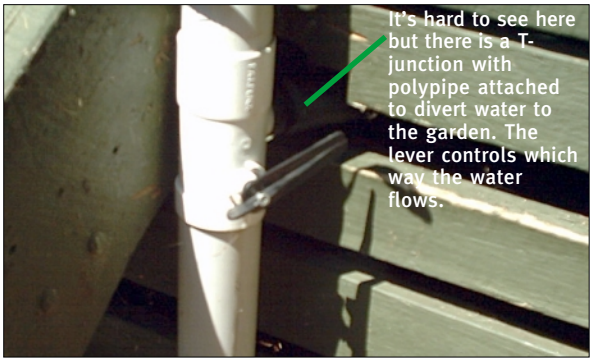
Although the reed box has been fascinating to build and use, its usefulness has turned out to be very limited. The roots of the reeds certainly do clean the water well—there are no soap bubbles in the pond and our cat and chooks drink the water regularly. However if safe cleaning products are used and kitchen wastewater is not included, greywater is fairly clean and does not require further cleaning by reeds before going on to the garden. More importantly, we have found that a lot of our precious greywater is lost via transpiration (evaporation from the leaves) during the warmer months, which is when we most want it for use on the garden. Chopping back the leaves does reduce the amount transpired but within a couple of weeks the leaves have grown back again. In winter, of course, there is a glut of greywater.

The most obvious solution to this conundrum is to store greywater during winter months for use in summer months but this is fraught with health and safety concerns. Storing greywater for a mere 24 hours can be enough time for bacteria to thrive and render the water dangerous and smelly. The simplest and safest option for reusing greywater is therefore to divert it directly to the garden and at only those times you actually want to.

Direct greywater diversion

Bill and I have also put together a direct diversion system, this time from our laundry. We initially used a rubber funnel inserted into the inspection hole and connected this to a length of old garden hose. However, we quickly discovered that the width of the garden hose was too thin to allow the free flow of water and caused washing water to backlog in the laundry trough, overflowing into the room on a regular basis (this may not be a problem for smaller or front-loading machines). So, we inserted a PVC wastewater diverter into the external wastewater pipe and this allows us to divert water either to the sewer or to an irrigation hose with the flick of a lever. The irrigation hose outlet on this diverter is wider than on the rubber funnel and requires 25mm black polypipe, which is available from hardware stores. With this extra wide irrigation hose, we no longer have problems with washing water backlogs.

You could use the polypipe much like a hose and water your garden with greywater while the washing machine is going. Although I have done this and can recommend it, we liked the idea of an irrigation system that we could connect up to the diverter and not have to attend to it. On some sections of the garden, then, we have lengths of black polypipe with skewer holes in it and a cork stopper in the far end. When re-



Simple greywater diversion system

Bill and Heather Pemberton have more than one greywater re-use system in operation. The system shown in these images takes washing machine water to their vegetable garden and is constructed from a number of off-the-shelf plumbing items which are available from most hardware and specialist outlets. Firstly, a wastewater diverter (top left) was installed into the existing water pipe and this has a lever to allow you to choose whether water from the laundry sink goes to the sewer or via a hose to the garden. Next, 25mm polypipe was permanently fitted to the diverter and this takes the greywater to lengths of old guttering that sit in garden beds. You can see the water flowing into the system in the image at left. Lots of slots have been cut into the guttering to allow water to seep into the soil (middle left). Polypipe connectors and T-junctions allow further lengths of piping to be attached when required, extending into the garden.

In brief: other water-saving systems at Heather and Bill's

Gutter guard rescued from landfill was placed over the gutters to reduce the amount of leaf litter collected. Water from the roof is filtered before water it is collected in their rainwater tank.

Heather and Bill's happy chooks live in a home-built strawbale pen. Water is collected from the roof of the pen and stored in the suspended drum and automatically delivered via the hose to the chook's water bowl.

quired, we can connect the polypipe from the diverter to these sections. The problem with this system is that the holes in the polypipe block with lint unless the greywater is filtered in some way. We have tried attaching pantyhose to the washing machine outlet that empties into the laundry trough but this was messy to clean and the pantyhose would sometimes stretch so much that it plugged the hole in the trough (more overflows into the room).

Another, more successful, option we have tried is the 'gutter trench system'. We picked up some old pieces of guttering thrown out by neighbours, sealed off the ends with rivets and silicone, and cut numerous holes in it using an angle grinder. This piece of gutter sits on a garden bed with a row of tomatoes growing along either side of it. On washing days, I just unravel the polypipe from the diverter and sit it in the gutter. If the gutter fills with laundry lint or debris thrown in by the blackbirds, I can just flip it over and give it a shake.

Safe cleaning products

When using any greywater, it is incredibly important that you use cleaning products that will not damage your soil or plants. Laundry water, in particular, is often high in salt which can be toxic to soil and cause plants to look burnt and drought affected. Interestingly, when the salt level in greywater (from Jeppersen and Solley (1994)) is compared with acceptable salt levels in irrigation water for agriculture (from the Department of Natural Resources, Queensland), greywater consistently has a salt level that falls in the range of 'likely to cause soil structure problems'.

A list of laundry detergents and their sodium (salt) content can be found in *ReNew* issue 81 or go to the website www.lanfaxlabs.com.au, select *Publications* and then scroll down and click on *Laundry Products, which one to choose?* We use a low salt laundry liquid and, even then, only use half the recommended amount. Remember, it is the agitation action of the washing machine that cleans the clothes far more than the laundry detergent. UV rays in sunshine will kill many of the germs.

Further information

Marshall, G (1997) How to construct a reedbed for on-site wastewater treatment. ***Permaculture International Journal*****, 64:35-37.**

Resource Sciences Centre, Department of Natural Resources, Queensland (1997) ***Irrigation water quality: salinity & soil structure stability.***

www.nrm.qld.gov.au/factsheets/pdf/water/w55.pdf

Department of Health, Government of Western Australia (2002) ***Draft Guidelines for the Reuse of Greywater in Western Australia.***

ReNew **issue 81.**

High-performance styrofoam house

Ian and Dorothy Chatwin write about their unique, yet inconspicuous energy-efficient home

For less than the cost of a standard brick veneer, this Melbourne home is comfortable without the need for regular heating and cooling systems. The home also uses an Energy Recovery Ventilation unit to make use of the home's waste heat.

In the mid-nineties our children achieved independence. At the same time, my wife and I became more aware of the growing 'greenhouse' problem and the need to do something about our future. Much as we loved our large house and garden, they were becoming a chore to maintain.

In 1996 we started to take an interest in new housing units, and even though we found some that were generally well designed and comfortable, they all lacked the essential elements of ample insulation, double glazing and low air exchange—so we decided to design our own low-energy dwelling.

The site

After quite a search, we found a small dual-occupancy site with a northerly aspect to the rear. The block to be subdivided was on a corner, which therefore gave us a frontage to the adjacent street. This was ideal, since this position allowed our planned home to blend with its suburban environment. It was important to us, for a variety of reasons, that even if it were technically different, our house should not look out of place in its streetscape.

Design considerations

We decided that the house should be straightforward to construct, using standard materials. I decided that, contrary to the accepted wisdom, the building should employ low mass and additional insulation to obviate the need to heat a concrete slab in winter, or cool the brick walls in summer. With all this in mind, we set about designing our two-storey home of about 27 squares, including the garage. Important considerations were that it should be timber framed, well insulated, styrofoam clad and render finished. We discussed our plans with various local builders, and on the basis of cost and the builder's acceptance of our somewhat novel design ideas, finally chose Dellingsleigh Homes.

Construction

Standard foundations, comprising poured concrete with concrete brick extensions and concrete stumps were used to support regular hardwood bearers and floor joists.

Strapping was stretched and stapled under the joists to support the R3 Rockwool batts placed under the Structaflor. The two-storey timber frame employs smaller than usual studs, staggered and set in the wall plates. Foil sarking was threaded between the studs and tape sealed, so that, for each section of wall (a few metres), two sealed air cavities were formed. In this way, we achieved an internal line of studs on regular spacings for the plaster board lining and a

staggered, external line of studs on standard spacings for the outer construction materials.

The whole frame was then externally wrapped with foil-backed sarking and covered with construction ply. Double glazed windows, incorporating internal timber reveals to eliminate condensation, were then installed with care to ensure that there could be no air leaks at the edges of the frames.

Fifty millimetre styrofoam panels, 3000 x 1200mm, were affixed using long springhead nails/screws, which also attach a layer of poly-fibreglass mesh. This is used to retain and support the acrylic based levelling render, smoothing render and pre-coloured render finish, all totalling about 7mm.

Ceiling Batts rated R3.5 were carefully installed and hence the whole external surface area of the dwelling has an insulation factor of about R3.5, apart from the windows. Light coloured concrete tiles with foil placed under them help to keep the roof space temperatures down and hence reduce the temperature gradient across the ceiling batts.

Energy saving aspects

Because the dwelling is effectively airtight, an Energy Recovery Ventilation unit is connected into ducting to control the internal atmosphere. The ERV monitors the air purity and sets the humidity to the selected percentage, with air changes being automatically adjusted in the range from once an hour to once a day. Virtually all of the energy used in household appliances eventually ends up as heat. In a well-sealed home this can have a considerable effect on the internal temperature. The ERV's heat wheel conserves the waste energy generated by typical household appliances.

Three solar collectors, frame mounted and angled for best winter efficiency, utilise glycol/water in a Powerpak heat exchanger configuration. The hot water output is connected to a stainless steel, 315 litre domestic electric hot water tank, via the lower element port. The system provides ample domestic hot water during the summer and we turn the booster off from about November to April. Off-peak power applied to the upper element provides adequate hot water during the winter, except on cloudy days.

Early in the planning stages we took a punt and chose not to install a regular heating or cooling system. However, we did install a 'single wire' data logging system (hosted by our PC) and an analysis of the data has provided some interesting results. When the house is unoccupied and no appliances are operating, internal temperatures throughout are in the range 13 to 15°C. During the almost four years of our occupation, we have learned that the waste energy from appliances will normally hold the internal temperature in the range of 17 to 19°C on sunless days. Through the winter months, a small 'Tangi' fan heater set on 'Low' or occasionally 'Medium' (<1 to 1.5kW) for an hour or so, is all that is required to raise the internal temperature into our preferred range of 19 to 21°C. One interesting observation is that temperatures on the ground floor are frequently higher by one degree or so than on the upper floor. Two factors contribute to this anomaly. The two storey design of the entrance and staircase allows air to circulate freely between the floors. Secondly, most of the waste energy from the fridge and other appliances, is produced in the ground floor, family room and kitchen areas.

Down the track

In high summer, apart from the early morning, the extended eaves prevent sunshine from penetrating the dwelling. During the periods of late spring and early autumn, when the extended eaves are no longer helpful, we have experienced temperatures which exceed our preferred range, rising as high as 27°C. Now, as a result of extensive investigation, we have opted, when funds are available, to design and build a small prototype ground source heat pump (GSHP) of about 7kW nominal heating/cooling rating. This unit will draw about four amps, that is, one kilowatt of power. GSHPs are widely employed overseas and this technology is sometimes known as 'geothermal' heating and cooling. For cooler periods, the GSHP will be employed to produce the small amount of ducted heating, with the bulk of its output going to pre-heat the domestic hot water. At other warmer times, all of its output will be applied, when required, to cooling.

One of the remaining tasks is to complete the design and construction of the external sun shades for the upper storey northerly and easterly windows. If and when funds are available, we would like to install Solar Photovoltaic power facilities. But, this will probably have to wait. A 3000 litre tank, set in the garage floor, will be connected to guttering down pipes, so that rain water may be stored for garden and perhaps toilet flushing applications.

Economic advantages

During the building process in 1998, we discussed the cost of the whole project with our builder and came to the conclusion that our total cost was to be about the same as if we had employed standard brick-veneer construction. Now, four years later, we have confirmed that due to the rising cost of bricks and brick-laying, traditional building methods would be comparatively more expensive by about 10 per cent. This is in spite of the 50 per cent greater cost of double glazing and the expense of additional insulating materials in our home.

Even though both the double glazing and additional insulation added to the building cost, they have made a significant contribution to the reduction of subsequent running costs. ✲

Where old meets new...

On its 25th birthday, Going Solar moved into the 60L Green Building in Carlton. Retail manager Amadis Lacheta describes Going Solar's strong environmental and community focus and looks forward to a new era inside one of Australia's premiere commercial buildings

Going Solar is one of Australia's oldest renewable energy and sustainable living ventures. Based in North Melbourne for over 20 years, the business has recently moved to the 60L Green Building in Carlton. The move to 60L is significant for Going Solar, as for the first time it places the organisation within a building that embodies its sustainable roots, and comes at a time when the business celebrates its 25th birthday. 60L is already a hub for sustainability, celebrating the creativity and ingenuity of people to meet the environmental and social challenges ahead.

The big move! Going Solar staff Maree Grenfell and Haydn Fletcher move the first of the solar panels into their new shopfront and office on the groundfloor of 60L.

A history of Going Solar

One of Australia's renewable energy pioneers, Going Solar owner Stephen Ingrouille was one of the founders of the Alternative Technology Cooperative (ATC) in 1977, a community group keen on promoting renewable energy. Going Solar was established near Victoria Market the following year. It was initially started as a partnership, a retail arm of the then embryonic ATC (now known as the ATA). By 1979 Going Solar had linked up with three similar shops (in Newcastle, Lismore and Brisbane) and the Appropriate Technology Retailers Association of Australia was formed. In due course Going Solar also became a leading member of the Solar Energy Industry Association (now the Business Council for Sustainable Energy).

By 1980 Going Solar had moved to its renowned location in Victoria Street, becoming one of Victoria's major retailer and wholesaling outlets for renewable energy and sustainable living products. From the North Melbourne premises, Going Solar spent the next 22 years pioneering new products and continuing to expand its network of agents across Victoria, Southern New South Wales and Tasmania.

Going Solar, as part of its work to assist with promotion and dissemination of new technologies, initiated the Renewable Energy and Sustainable Living Fairs which are now the responsibility of the non profit Sustainable Living Foundation.

Sale of the building in Victoria Street in 2002 prompted an opportunity to rethink the future direction of Going Solar. As well as the retail and wholesale arms, the business is now involved in consulting and projects, and the 60L Green Building is as timely as it is perfect as the organisation's new home.

60L Green Building

In October 2002, Melbourne celebrated the long-awaited opening of the 60L Green Building in Carlton. 60L is the first commercially sustainable building of its kind, setting new benchmarks for environmental performance in the business sector. The building has already attracted a number of tenants other than

Going Solar, including the Australian Conservation Foundation, the Australian Business Council for Sustainable Energy, Environment Victoria, the Victorian National Parks Association and wind turbine manufacturer NEG Micon. The environmental and ethical parameters are strict, and tenants have come up with a number of innovative ways to meet the fit-out and management criteria. Situated within close proximity to Melbourne University and RMIT, 60L promises exciting collaborations between leading research organisations and business, setting a precedent for future sustainable projects.

In late 1998, the Green Building Partnership (GBP)—a formal partnership between two ethical investment companies—purchased the property at 60–66 Leicester Street Carlton. Originally constructed in the 1870s and last upgraded in 1990, the building consisted of a three-level office building with warehouse at the rear.

The GBP financed and developed the 60L Green Building project and invited the Australian Conservation Foundation to contribute to the leadership, development and implementation of the project's environmental objectives. A consortium of designers, consultants and architects was engaged to undertake the redesign of the existing building and create an exemplar of a significantly more sustainable commercial office building—part of the ACF's objective to encourage positive outcomes for its Sustainable Cities Campaign.

In order to set a new benchmark for commercially sustainable development, it was imperative that 60L be commercially viable. The total project cost was only five per cent above that of a conventional building of a comparative standard, much of which is directly attributable to the cost of research and development. The building design principles can be reproduced in any south-

With a rooftop garden, on-site rainwater collection and an abundance of natural light, the 60L is not only a great example of a superb energy efficient building, but a lovely place to work.

60L's homage to the elements

Air

- Passive ventilation systems
- Openable windows in all tenancies
- Automated louvre controls
- Large atrium and light wells increase light penetration and air flow
- Night purging to eliminate summer heat
- Computerised building management systems use data from 60L's own weather station to adjust airflow.

Water

60L has achieved a benchmark in water consumption for commercial buildings due to:

- Two 10,000 litre water tanks harvest rainwater which is filtered and UV sterilised for taps and showers
- 100% on-site treatment and re-use of greywater and sewage for flushing toilet pans and irrigating landscape features
- 100% on-site treatment of sewage prior to discharge
- Waterless urinals and water-efficient appliances and fittings.

Earth

- Bricks, steel and timber from original building re-used
- Concrete composed of 60% recycled aggregate
- Recycled timber windows and doors
- Toxic glues, sealants and fillers minimised
- 50% less PVC than similar traditional buildings
- Rooftop garden
- No new bricks were used in construction.

Fire

- Atrium, light wells and light shelves bring daylight into the building core
- 80% reduction in energy used for artificial fluorescent lighting
- 60% reduction in energy used for heating and cooling
- 100% green power augmented with rooftop solar array
- Energy-efficient appliances—close to zero greenhouse gas emissions from the building.

ern Australian location, and the design process itself is applicable anywhere.

Major improvements in resource consumption include a total energy use that is 65 per cent less than a traditional office building of the same size, a reduction in the need for mains water of 90 per cent due to the harvesting, treatment and re-use of rainwater, and a natural ventilation system that minimises the need for artificial heating and cooling for a large part of the year. Computer-based monitoring systems have been established to provide data on energy and water use for tenants and visitors to the building. A small rooftop solar array demonstrating solar possibilities generates about 10 per cent of electricity consumed. Not only do the design choices reduce environmental impact and energy consumption now, they also ensure against the rising cost of energy, water and waste disposal.

60L has created a working environment that involves and empowers its tenants. The people who work in 60L are encouraged to make choices that can further reduce the environmental impact of the building, like cycling to work or taking public transport.

The water from two 10,000 litre rainwater tanks is treated via the filtering system at left and supplies the drinking and shower water for 60L. Greywater from the on-site biological sewage treatment system is used for toilet flushing and on the gardens.

In April 2003, Going Solar will celebrate its 25th birthday. To explore the many ways you can reduce your environmental impact, we invite you to come and visit our new premises and share in the celebrations!

Renewable system rebates

State and Federal Government rebates are an excellent way to reduce renewable system installation costs. We show you what's on offer and highlight which schemes have an uncertain future. Tables by Maree Grenfell

Photovoltaic arrays can be a cost-effective method of reducing reliance on diesel generation in remote areas of Australia. This array on an Aboriginal community north of Broome was funded under the Western Australia RRPGP rebate.

Many of the solar hot water and solar electricity systems—stand alone and grid interactive—that have been installed over the past three years have received financial support from federal and state governments in the form of rebates.

The rebate system has allowed many householders, community groups and businesses to realise their dream of generating a proportion of their energy needs without contributing to the greenhouse gas problem. Rebates have also been a significant driver in the growth of the emerging renewable energy industry both in moving product and in profile raising.

While rebates on renewable energy systems are not necessarily the most cost effective means of reducing greenhouse gas emissions—and certainly the arguments for using government funds on energy efficiency measures win out on the dollar cost per tonne of CO_2 abated—where rebates have come into their own is that they provide a visible and accessible method that individuals and households can demonstrate to themselves and others that they are 'doing something'. The feelgood factor has proven to be an intangible, yet important benefit of government rebate programs.

Research published in the *Renewable energy roadmap* demonstrates that a major reason why more Australians do not better utilise solar technologies is not necessarily because people don't care about their environment or where the electricity is sourced from, but due to relatively high upfront costs, particularly with solar photovoltaic systems. Other impediments to growth include user inexperience with the technology and difficulty finding suitable information and assistance during the purchasing and approval processes. Rebates have helped address all of these issues and more. As all systems need to be approved by a suitably qualified installer, recognition of RE industry standards has increased—and on the approvals front rapid uptake of renewable technology means all of Australia's electricity retailers now have grid-connect policies. There is still some way to go before these technologies are the 'norm', but certainly that day is closer due to government assistance.

Available rebate programs

The tables that accompany this article outline the great number of rebate programs available around the country. The tables show rebate programs available from state and federal governments only (there are incentive schemes available through some local councils and electricity retailers but these are not included here) and are divided into two categories: *solar hot water rebates* and *renewable generation rebates*.

All of the solar hot water programs are state initiatives and differ from each other. The renewable energy generation rebates are funded mostly out of the federal pocket, but delivered by the state and territory governments. The two main federal programs supplying the funds are: the $31 million Photovoltaic Rebate Program and the up to $264 million Renewable Remote Power Generation Program. Both of these programs are managed by of the federal Australian Greenhouse Office.

The PV Rebate program is national and is for solar PV panels only, and is likely to be exhausted this year. Australia wide 3754 solar PV systems of an average size of 1kW have been installed using PV Rebate Program funds over the first three years of the program, and 4887

Location	Program	Eligibility	Incentives	Timing	Conditions	Contact
Australia wide	Mandatory Renewable Energy Target (MRET)	New Solar Hot Water Systems (SHWS) and renewable generation.	New SHWS and renewable generation can earn Renewable Energy Certificates (RECs) which can be traded.	MRET legislation expires in 2020	Only available for SHWS displacing electric hot water systems and accredited renewable energy generation. RECs must by claimed within 12 months of system installation.	Office of the Renewable Energy Regulator www.orer.gov.au Ph:(02) 6274 2192
Solar hot water system rebates						
NSW	SEDA's Energy Smart Hot Water Discount	Households building or renovating, in Energy Smart council areas can receive discount off a solar or heat pump hot water system.	$700 discount for gas boosted SHWS. $500 discount for electric boosted SHWS and heat pump hot water systems.	Until June 2003	Made by a participating manufacturer (Beasley, Rheem, Solahart, Solar Edwards, Quantum).Must be installed at a private residence where a development approval has been obtained. Must be in a energy smart council area. System must be able to produce at least 200 litres of hot water per day.	Sustainable Energy Development Agency (SEDA) www.seda.nsw.gov.au Ph:1300 138 638
NT	NT Government and manufacturers' Solar Hot Water Assistance Package	First homeowners who install a new SHWS within 3 months of purchasing or building a home.	NT Government contributes $250 while the industry contributes up to $150.	From 1 July 2000	Must have first home owner stamp duty concession. Installation must be within 3 months of date of settlement or purchase of property. System must deliver at least 160 litres of hot water per day. Must have solar contribution of at least 50%.	Northern Territory Government www.nt.gov.au Ph:(08) 8999 7949
SA	SA Government's Solar Hot Water Rebate Scheme	For households purchasing a new SHWS.	$700 for a system with panel collector of 3.5m^2 or greater. $500 for a system with a panel collector of 1.75m^2 or greater. $700 for a heat pump system. $500 for a solar retrofit kit.	From 1 July 2001	Installation must result in a reduction of greenhouse gas emissions. Electric boosted SHWS on a new home is not eligible in areas with access to reticulated gas. Must be principal place of residence. One application per residence.	Energy SA www.energy.sa.gov.au Ph:(08) 8204 1888 Country callers only 1800 671 907
VIC	SEAV Solar Hot Water Rebate Program $18.5m	New SHWS for residential use, farms, community facilities and retrofits.	Up to $1,500 for new SHWS and retrofits. Rebate amount is determined by the performance of the system and the type of system being replaced. Accredited systems and amounts are listed on the SEAV website.	Until funds are committed	SHWS must achieve greater than 50% solar fraction. Installation must result in reduced greenhouse gas emissions. New homes with reticulated gas must install a gas boosted system to be eligible. Existing homes with gas connection must boost with gas unless they have specific off-peak electricity tariff. Retrofits to existing systems must be installed on a system with a warranty for at least another 3 years.	Sustainable Energy Authority Victoria www.seav.vic.gov.au Ph:(03) 9655 3222
QLD	EPA Solar Hot Water Scheme	New domestic SHWS or heat pump hot water systems installed at the applicant's principal place of residence.	Maximum total rebate per household is $750. Rebate of $750 with a panel collector area of 3.5m^2 or greater. $450 for panel collector area of 1.75m^2 or greater. Rebate of $150 to replace panel or tank of existing SHWS.	Until June 2005	Must be primary place of residence which is owned and occupied by the applicant, or subject to a long lease. One rebate per household. System must be certified as satisfying Australian Standards. Gas or off-peak electricity boosting is allowed.	Environmental Protection Agency Ph:1300 369 388
WA	SEDO Solar Water Heater Subsidy $2m	New SHWS for home owners and first new home buyers.	Subsidy of $500 for systems with a panel collector area greater than 3.5m^2. Subsidy of $300 for systems with a panel collector area greater than 1.72m^2.	Until June 2005	Home owners must install a new accredited gas boosted SHWS. First new home buyers can install a new accredited electric boosted SHWS with a boosting timer. Commercial or Government premises, replacement parts and heat pumps are not eligible.	Sustainable Energy Development Office (SEDO) Ph:1300 658 158 sedo@energy.wa.gov.au www.sedo.energy.wa.gov.au

systems (including installed systems) had been approved up to December 2002. This program has demonstrated that providing a rebate which reduces in real terms the costs of adopting the solar technology has expanded the market.

The RRPGP's intention is to reduce reliance on diesel generation with renewable generation and is funded from the diesel fuel excise tax paid by diesel electricity utilities. The more diesel generation in the state or territory, the more excise collected in those regions—that is why some states receive such a large proportion of the funds and Victoria gets none. The various state government rebate programs approved under this scheme are likely to run until 2006, and many will run beyond 2006, as they will continue until the funds are exhausted. Up to last December, 1575 systems had been approved under the programs funded under the RRPGP—1042 of which have been installed. Most of the systems are PV systems, but there are a number of wind and micro-hydro projects that have received funding. Major projects which have been approved under the RRPGP include: $5.32 million for 3.6MW of wind at Esperance (WA), $1.26 million for 0.28MW of PV at Bulman and Kings Canyon (NT) and $1 million for 0.6MW of wind at Rottnest Island (WA).

Future of rebates

It is important to note here that the Federal government has not demonstrated a strong in principle support for rebate programs—even though they were introduced by the Howard Government and have proven to be well supported by the public and has strengthened the fledgling RE industries. The rebates were requested by the Democrats in the infamous 1999 GST negotiations which secured $800 million more funding for the AGO, and saw the office become a billion dollar department over night.

More than three years since the programs were announced we are now seeing many of the rebate programs winding down, and some have already exhausted their funds. At the moment there is no guarantee, and some say it seems very unlikely, that further federal funds will be allocated to extend these rebate programs, especially in the current climate where defence spending takes priority.

Market drivers

Another driver for the domestic uptake of technologies is the Mandatory Renewable Energy Target (MRET) which has created a trading market for Renewable Energy Certificates (RECs). Although designed to benefit large renewable generators, domestic systems can also participate.

For every megawatt-hour (MWh) of electricity generated or abated RECs can be created then traded. Prices range from $25 to $35 per REC and sometimes higher, depending on supply and demand

Location	Program	Eligibility	Incentives	Timing	Conditions	Contact
RE generation rebates						
Australia wide	Photovoltaic Rebate Program (PVRP) $31m	Home owners who install grid connected or stand alone solar power systems. Community groups installing solar power on, or adjacent to community use buildings.	$5 per peak watt up to $7,500. Extensions to existing systems $2.50 per peak watt up to $2,500. $5 per peak watt up to $10,000.	Started 1 Jan 2000. Available until all funds are committed. Presently expected to end mid to late 2003	Minimum 450 watt peak output solar array. Must be installed at primary place of residence which is owned by applicant. Can be eligible for other government rebates. Major equipment used must be new. Eligibility is determined by the educative/interpretive merit of the applicant.	Australian Greenhouse Office www.greenhouse.gov.au PVRP information line Ph:1300 138 122
NSW	SEDA solar rebates	For new solar power systems in households and businesses in NSW as grid connected or stand alone	Tops up PVRP rebate by $2.40 per peak watt installed over 1500 peak watts up to 5000 peak watts. Businesses and investment properties from 450 watts to 5000 watts $2.40 per peak watt.	PVRP top up available as long as PVRP continues. No end dates identified for other rebates	Applications must be lodged and approved before installation. Major equipment must be new.	Sustainable Energy Development Agency (SEDA) www.seda.nsw.gov.au Ph:138 122 or 1300 138 638
NSW	RRPGP in NSW $0.78m	For any renewable generation above 10 kW that displaces diesel generation	Up to 50% of the initial capital costs of renewable energy generation equipment.	Until June 2004	System must be shown to be working for at least 5 years with monitoring. Applications only accepted from entities with an ABN.	Sustainable Energy Development Agency (SEDA) www.seda.nsw.gov.au Ph:138 122 or 1300 138 638
NT	Renewable Energy Rebate Program $36m	New renewable energy generation that displaces diesel generation.	Up to 50% of the initial capital costs of renewable energy generation equipment.	Until June 2006	Installations must displace diesel generation. The RAPS system must demonstrate the cost effectiveness of the use of renewables. Applicants requiring a diesel generator of 100kW or greater must complete an energy audit. System must be shown to be working for at least 5 years with monitoring.	Department of Business, Industry and Resource Development www.dme.nt.au Ph:(08) 8999 5440
NT	Renewable Energy Water Pumping Rebate Scheme $2.2m	For installation of renewable energy water pumps that displace diesel powered water pumping.	50% of eligible system costs of renewable energy systems for water pumping capped at $10,000 per application.	Until June 2006	Projects applying must lead to replacement of diesel powered water pumping in off-grid areas with renewable energy. System must deliver a minimum of 8000 litres per day at total head of 20 metres. System must have new components.	Department of Business, Industry and Resource Development www.dme.nt.au Ph:(08) 8999 5440
QLD	Renewable Energy Diesel Replacement Scheme $22.3m	Rebates for initial capital costs and upgrades of renewable energy installations for non grid-connected homes, indigenous communities and businesses.	Up to 50% of the initial capital costs of renewable energy generation that displaces diesel generation.	Until June 2006	Must not be connected to the main electricity grid. Building must satisfy appropriate building codes. Principal place of residence. Expenditure on renewables must be at least 30% of total system cost. Fitted with data logger for monitoring over 5 years.	Environmental Protection Agency www.epa.qld.gov.au Ph:1300 369 388
QLD	Working Property Rebate Scheme $12m	Family owned working properties installing new renewable generation.	Up to 65% of the initial capital cost (up to $175,000) of renewable energy installations that displace diesel generation.	Until June 2006	Must be a family owned working property not connected to the main electricity grid. Available in the 14 most western and northern shires in Queensland.	Environmental Protection Agency www.epa.qld.gov.au Ph:1300 369 388
SA	RRPGP in SA $7.6m	Pastoral properties and homesteads. Indigenous communities. Public Generators. Tourist facilities, roadhouses and small communities.	Up to 50% of the initial capital costs of renewable generation that displaces diesel generation.	Until June 2004	Applicant must be the owner of the renewable generation. Must be remote from the main power supply. Minimum size of is 500 watts peak output. Major equipment must be new. System must be monitored and energy audit report supplied. Installation must occur within six months of pre-purchase approval. To ensure funds are not expended faster than relevant Diesel Fuel Excise is collected, SA prioritises applicants in competitive rounds. Unsuccessful applicants may re-apply, (but are not given higher preference).	Energy SA www.energy.sa.gov.au Ph:1800 777 472
WA	Remote Area Power Supply Program $20m	Indigenous communities, households and businesses installing renewable energy power systems displacing diesel generation in off-grid areas.	55% of the initial capital costs of renewable energy power systems up to $550,000.	Until June 2006	Must displace diesel generation. Must not be connected to main electricity grid. Applications must be approved before systems are purchased and installed. New equipment must be used. Expenditure on renewable generation equipment must be at least 30% of total eligible system costs.	Sustainable Energy Development Office (SEDO) Ph:1300 658 158 sedo@energy.wa.gov.au www.sedo.energy.wa.gov.au
WA	Renewable Energy Water Pumping Program $3.5m	Businesses and other organisations installing renewable energy pumping systems displacing diesel pumps.	50% of the initial capital costs of the renewable energy component of solar pumps and windmills up to $10,000 per site.	Until June 2005	Must be a business, government agency or other organisation registered for the GST. Must replace or be used instead of a diesel pump. Applications must be approved before systems are purchased and installed. Complete new pumping systems must be used. Pump must be guaranteed to deliver a minimum annual average 8,000 litres per day at a static head of 20m (or equivalent).	Sustainable Energy Development Office (SEDO) Ph. 1300 658 158 sedo@energy.wa.gov.au www.sedo.energy.wa.gov.au

Many of the RRPGP programs are likely to be operating beyond June 2006—as they will end when funds are exhausted. Information provided in these tables is correct as of February 2003. For current information we suggest you contact your state energy agency.

tensions. In the case of solar water heaters, the RECs that will be created over the life of the system can be 'deemed' and the owner can choose to 'sell' them to the SHW system manufacturer at point of purchase, significantly discounting the system cost. This also can be done with PV systems, however this is a lesser incentive as the cost advantage is lower. For more information on this contact the Office of the Renewable Energy Regulator.

The MRET legislation is currently being reviewed and its future is uncertain, especially following a Council of Australian Government's review which recommend it be scrapped. If you would like this scheme and the rebate programs on renewable technologies continued, it is important you make yourself heard. Write to your local Federal member or to the Federal Environment Minister David Kemp with your concerns, or support those organisations lobbying for their continuation.

Biodiesel on the farm

Steven Hobbs is a farmer from the Wimmera region of Victoria who works with alternative fuel systems. In this article he details his experiences producing and using biodiesel and straight veggie oil fuels on his farm, and outlines plans to grow and press his own fuel crops

My initial interest in biodiesel began while eating dinner one Saturday afternoon. My wife called out, 'Come in here and look at this'. On the television was a segment showing a person making fuel out of used vegetable oil.

Fuel from used vegetable oil—what a fantastic idea. And being a farmer I use about 20–30,000 litres of diesel fuel a year. The seed was planted, so to say!

After much research and work with biodiesel, I believe there are too many problems associated with making it from waste as opposed to new oil. Waste Vegetable Oil (WVO) is a prescribed waste and can only be collected by certified collection agencies. Heavily used cooking oil requires more processing to turn it into biodiesel than new oil and there are higher processing costs. If you use a lot of fuel, then you also need to collect a lot of WVO.

Biodiesel is simple to make from fresh oil, and besides, I can use all the by-products in my farm operations. Press cake or meal is a high protein feed supplement and can be fed to cows, pigs, chooks or sheep. Instead of using sodium hydroxide (NaOH), I prefer to use potassium hydroxide (KOH) as my alkaline reactant because I have a hunch that I could also take the water used to 'wash' the biodiesel for use as a foliar fertiliser—washing biodiesel is discussed in the box on the following page. Test results indicate there is nothing that would prevent me from using the wash water for that purpose.

To make biodiesel I needed a supply of oil. I rang a few people about getting my hands on a large supply of fresh vegetable oil. Glenn Ryan at Ag-seed Research was very helpful and gave me my first big break with 700 litres of cold-pressed oil from evaluation lines. I had decided that I was a farmer and could grow my own oil, but I needed to be able to crush it.

Steven Hobbs' mini biodiesel plant in the shed at his farm.

Another consideration was what oil crop to grow. Even though canola is the most common oil crop grown, it has its drawbacks. Canola has a low water use efficiency—in other words, its ability to maximise yield from available moisture is low. As everyone is aware, over the past six years we have had extremely variable rainfall which, combined with late season frost events, has resulted in yield losses. I had actually removed canola from the crop rotation simply because the risk of crop failure was too high. Speaking to plant breeders at VIDA (Victorian Institute of Dryland Agriculture), I soon began to appreciate the potential benefits of growing and using Mustard seed oil, but, at the moment, canola-quality mustard lines are still only in the pipeline. It seems there will be something released in the next 18 months. Another alternative crop is safflower. It is a summer crop, and once it is established, doesn't need substantial rain to realise a crop (it has a very robust root system that is able to source its water demands adequately from the sub soil). But the two main drawbacks are lack of moisture in the sub soil for next year's crop, and it is a mongrel to

Steven Hobbs' tips on biodiesel production

Getting started

There are some basic pieces of equipment that you need to manufacture biodiesel and also to check the quality of what you are producing. You will need:

- A glass kitchen blender, because sodium methoxide will react with plastic ones and cause them to crack and leak—used only for making biodiesel.
- A set of scales—capable of weighing 3.5 grams if using sodium hydroxide (NaOH) or 9 grams if using potassium hydroxide (KOH)
- A pH indicator or indicator solution (for use when washing and making biodiesel from used oil)
- A filter of some description (such as a sock filter or coffee filter papers)
- Methanol (try a member of a motor racing club)
- A tub of NaOH or some KOH.

You will need a system to wash your fuel, either an aquarium pump or a pump-up sprayer. A hydrometer to test the specific gravity of the biodiesel can give an idea of the quality of the product. You should end up with fuel that has a specific gravity of 0.885. Sodium hydroxide (more commonly known as caustic soda) and potassium hydroxide are available from chemical suppliers. Caustic soda is also available at supermarkets.

Be careful

Before you start, you need to realise that Methanol and NaOH are dangerous substances. Methanol can irritate the skin and respiratory tract or blind or kill you if ingested. NaOH has the capacity to inflict severe chemical burns to the skin or the mouth, throat and digestive tract if swallowed (and probably even worse). Wear safety gear (glasses, PVC gloves and apron), keep supplies of running water and vinegar nearby and use the chemicals with caution and in a safe and responsible manner. I will also add that I will not be held responsible in anyway for any damage or injury that may result from readers making biodiesel.

Method

For every one litre of fresh vegetable oil you will need 3.5 grams of NaOH, and 200ml of methanol. With safety gear on, measure 200ml of methanol into your glass blender. Then weigh 3.5 grams of NaOH and carefully tip into the blender. Place the lid on the blender and mix until the caustic soda has dissolved. You have made sodium methoxide. Be careful as this is a very dangerous chemical. You then carefully pour the one litre of fresh vegetable oil into glass blender containing the sodium methoxide. Mix for 10 minutes and then let stand for six hours. During this time you will see a dark layer on the bottom with a clear layer on the top.

The glycerine, having a higher specific gravity, will settle to the bottom and the biodiesel will be on top of the mixture. Decant the biodiesel carefully to ensure that you don't mix any glycerol back into the mixture.

Washing

You will first need to wash your biodiesel before using it. Even though it won't look like it, you will have soaps suspended in your biodiesel. The easiest way to get rid of soap is to add water and turn it into an emulsion. There is a lot of debate about the best way to wash biodiesel, but the simplest way is to wash with an equal volume of water and gently spray onto the top of the biodiesel through a pump up sprayer. Leave it to settle and again the biodiesel will be on the top of the mixture, with soapy water on the bottom. Test the pH of your biodiesel and continue to wash it until the pH is close to 7.5. To ensure there is no water in your biodiesel, heat it up to 100 degrees and evaporate any water. Hey presto, just filter and then add to your diesel tank.

By now, if you aren't put off making biodiesel, then like me you will want to go onto doing reactions with used vegetable oil (because it's cheap!) from the local fish'n chippie or roadhouse.

Unfortunately, the process is a bit more complicated and will require a titration to determine the amount of catalyst needed to successfully remove the glycerol from the oil. If you are going to process heavily used oil, you may even need to consider using acid. I looked at this and even made a few batches, but it is really a lot simpler to use fresh oil.

On the Web

www.journeytoforever.org
www.journeytoforever.org/biodiesel_processor.html
www.webconx.com
www.biofuels.fsnet.co.uk
www.biodiesel.org.au

crush. Safflower has a lot of husk and lower oil content, so you need to apply more pressure and less speed. Canola is far easier to crush. I'm hoping the canola quality mustard will be the answer in the future.

Oil extraction

The internet was a great source of information about extraction. There are a number of companies that manufacture oil expellers but, because of my location, press size was limited to the available power supply—240 volts single phase. I also wanted a press assembled from easily available spares and made from machine steel, so that I could carry out any repairs or maintenance in the farm workshop. I eventually settled for a press made by a company called Egon Keller KEK in Germany. The press is a laboratory model and is the smallest unit they manufacture. It is a KEK P0015 and has a capacity of approximately 15 to 20kg per hour on canola, depending on moisture content and seed temperature. Importing items like this can be a challenge so be sure to check with the manufacturer.

Harvest came and went and my oil press arrived. A few weeks later I completed my new biodiesel processor. It is constructed from a couple of used water pressure units, some downgrade steel, recycled plastic drums, bearings, washers, shafting, couplings, fittings and hoses. I used whatever I could scavenge from the smithy heap at the back of the workshop and paid a visit (or three) to the hardware, plumbing and engineering shops.

Construction of processor

Before you construct a processor, I strongly suggest you spend some time on the internet and have a good look at what other people have built. There are some real fancy units and then there are some not so fancy.

Construction will be determined by cost, parts you have on hand, what you can scavenge and by what you can manufacture yourself.

My biodiesel processor Mk1 is constructed from a 30 litre conical bottom foam marker tank. The mixer uses a second-hand motor from a stuffed water pressure pump with a shaft, bearings and stirrer, and the frame is made from recycled RHS from the scrap heap. For heat, I purchased an immersion element, and I bought a preserving thermometer to keep an eye on the temperature. I guess I have made approximately 800 litres with this unit.

Biodiesel processor Mk2 is a little

more elaborate. For my reaction vessel and cooker, I used a 1200mm cylinder, with the ends caps made from a 30 litre pressure unit cut in half. Downgrade 40mm RHS was used for the legs. A 3.3 kilowatt hot water element is fitted in each unit. I made a mixer unit from a second-hand motor coupled to a shaft with blades for agitation. On the side of the reaction vessel, I have used a closed transfer system, made from another 30 litre foam marker tank. The methanol and KOH are put into the mixing vessel, agitated using an agitator coupled to a pneumatic drill and then transferred from the mixing vessel to the reactor with the assistance of compressed air. After removing the glycerol, a pneumatic diaphragm pump is used to transfer the biodiesel from the reactor to the first washing tank. Air is used to bubble wash the biodiesel. Washing is necessary to remove any soaps suspended in the biodiesel.

After settling, the biodiesel is pumped from the first washing tank to the second washing tank. Again, air is used to bubble wash the biodiesel. After settling, the biodiesel is transferred to the cooker where the biodiesel is heated to 100 degrees and held for 15 to 20 minutes. Once cooled, the fuel is pumped and filtered into storage containers.

I have now processed over 1000 litres of biodiesel from predominately cold-pressed oils. My Nissan ute has been my guinea pig and has done nearly 10,000km on blends as high as 40 percent biodiesel and as low as five percent biodiesel. At the risk of sounding biased, the ute is running better than it ever has. It had 220,000km on the clock when I bought it, and it was your average, rattly Nissan SD25. I have had comments on how quiet it runs, with people being surprised at the lack of smoke, especially when you rev the motor up. There is no soot around the tail pipe and I have noticed it starts easier.

The use of biodiesel as a lubricity enhancer will enable me to continue to farm without having to update my existing machinery, and avoid costly repairs. If I had to change over my farming plant to the newer style electronic diesels I would need $500,000.

Straight Vegetable Oil

While biodiesel modifies the fuel to run in the vehicle, another approach is to modify the fuel delivery system to use Straight Vegetable Oil (SVO). In a SVO system it is necessary to reduce the viscosity of the vegetable oil by heating it. There are research projects currently being conducted to establish a standard for the use of SVO as a fuel but at the moment the use of SVO systems should be considered experimental.

The main components of an SVO system are: a second fuel tank, a fuel solenoid valve to switch between tank one (diesel/biodiesel) and tank two (vegetable oil) and a method for heating the oil.

There are a number of SVO systems available worldwide, that have been in use for a number of years. The idea of using heated vegetable oil as an alternative fuel is not a new one and has been used successfully in Europe for a number of years. In Germany, there are actually small groups of farmers who grow rapeseed, crush the oil themselves with their own oil expeller, feed the meal to their own livestock, and then use the oil in their farm machinery.

In his book *From the Fryer to the Fuel Tank*, Joshua Tickell outlines the operation of a SVO kit, what parts are necessary, and how to install a kit in a car.

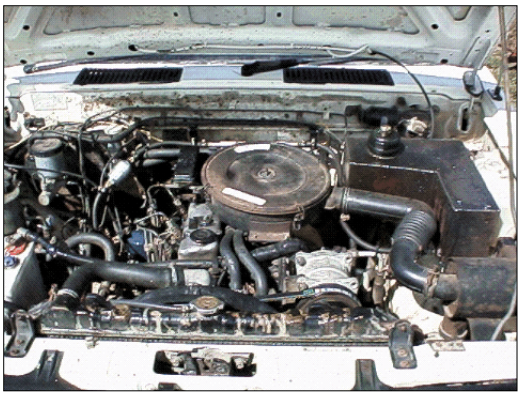
I became interested in fitting an SVO (dual fuel) system in my ute, primarily because I believe there are appropriate applications for both systems. Biodiesel has the convenience that you use it just the same as diesel. SVO, however, requires a little more effort. To successfully use vegetable oil as a fuel, you first need a warmup stage and then also a shutdown stage. To use an SVO system, you start your engine on diesel, and then once the engine has reached operation temperature and the oil is hot, you change from diesel to vegetable oil. You continue on vegetable oil until you are 10 minutes or so from your destination and then switch back to diesel to allow the lines to clear. Shutting down too late will leave more vegetable oil in the fuel system, which may make it harder to start the engine once it has cooled.

I use a simple system that utilises an inline electric heater to heat the oil. An inline heater is simple to install and it keeps the oil at a regulated temperature. The downside of an inline electrically heated system is that you are limited to using oil that is liquid at room temperature. You are unable to use solid oil, tallows or fats as a fuel.

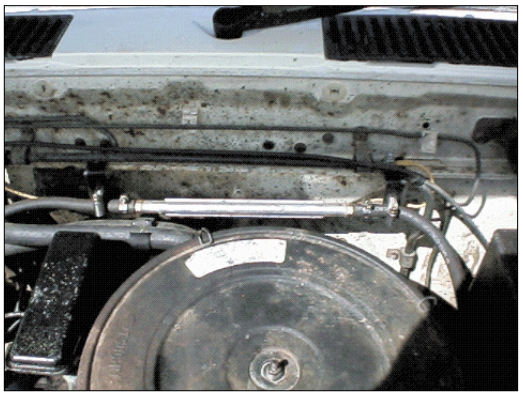
There is a lot of debate about the long-term effects of SVO on diesel engines. Some research has shown poor engine performance, coking, engine wear and engine failure, while other research has shown that properly heated oil is quite suitable as an alternative fuel. There are a large number of people using SVO systems quite successfully, both in Australia and internationally.

Recently, I have become a stockist of the 'G3' SVO kit. This kit is the result of a thesis by Edward Beggs, examining renewable oil fuels and diesel engines as components of a sustainable system design. The heart of the SVO kit is a self-regulating, inline electric heater. This inline heater heats to and maintains a constant 70°C, which is very close to the recommendations of the ACREVO report. To date, I have travelled a few thousand kilometres and have had no instances of poor performance. I am quite confident in the suitability of both biodiesel and SVO as legitimate diesel fuel alternatives. ☆

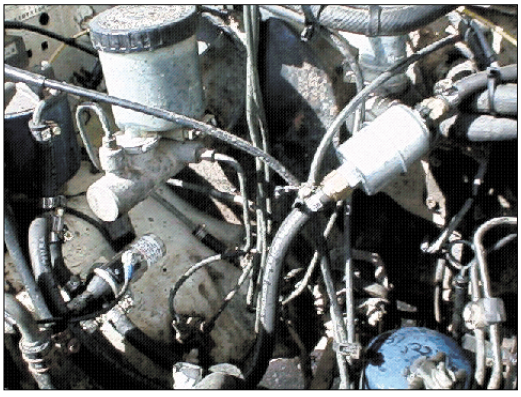
Under the bonnet of Steve Hobbs' vehicle



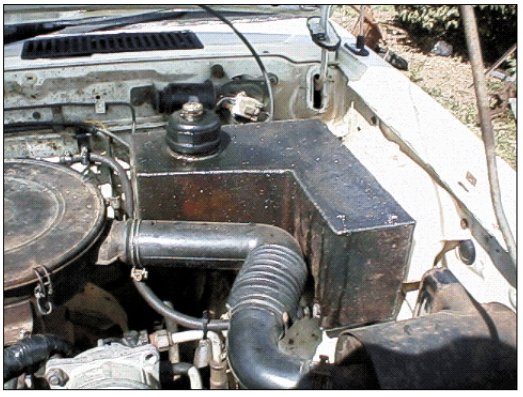
Under the bonnet of Steve's ute with SVO kit installed.



Close up under the bonnet. Note the 'G3' inline electric heater at centre.



Veggie-oil prefilter and 3–port solenoid valve.



Nine-litre SVO tank under bonnet. This will get you approximately 60km.

ATA biodiesel seminars

Biodiesel is fuel growing in use and popularity worldwide. Michael O'Connell and John Kelly of ATA report on last summer's biodiesel events

Australia has a growing community of people interested in alternative fuel sources for vehicles and machinery.

Biodiesel is one such technology growing in recognition and popularity as a viable alternative fuel. Hundreds of Australians use biodiesel as a means of powering their vehicles and they form a strong community committed to fostering biodiesel use. Recently ATA, publishers of *ReNew*, held a series of seminars around the country to discuss its use and bring together some of the hundreds of people working with it.

Biodiesel is manufactured from new or used vegetable oil and can directly replace regular fossil diesel, without engine modifications.

Biodiesel was developed in the 1970s as a chemical process to lessen the viscosity of vegetable oil by mixing the oil with alcohol in the presence of a catalyst, usually sodium hydroxide—caustic soda. This breaks down the larger molecules in the vegetable oil to a smaller molecule, a process known as transesterification.

Three ATA seminars

The three seminars that were held were sparked by the visit of Joshua Tickell, author of the definitive book on biodiesel, *From the Fryer to the Fuel Tank*, who was visiting Australia researching his upcoming documentary on biodiesel. As the Australian distributor of *From the Fryer to the Fuel Tank*, ATA saw the seminars as an opportunity to bring together people interested in biodiesel.

Over 60 people attended the first seminar at the CERES Environment Park in East Brunswick, Victoria.

At the this seminar ATA President Michael O'Connell gave a brief introductory talk on biodiesel and ATA's involvement in promoting its safe production and use. He outlined ATA's part in setting up a new biodiesel plant at CERES to produce fuel for the CERES biodiesel van and for educational purposes *(people who wish to be involved in this project can contact the ATA for details–Ed)*.

CERES is planning to use the biodiesel plant to develop end-to-end processes to enable complete reuse of all materials and waste products. Almost all materials used in the production of biodiesel can be reused. Leftovers such as glycerine can be turned into hand soaps and other products. CERES also sees the plant as an opportunity to promote self-reliance in local communities.

Joshua Tickell spoke of his experiences growing up in an area where there was a strange correlation between the operation of local oil wells and the incidence of cancer among his family, friends and the local Cajun community. He developed an interest and passion for environmental issues and a determination to find a better way.

Charles Curtayne and Krysta Blake from Goldiesel demonstrated their prototype biodiesel plant which they are manufacturing for sale. It is small enough to fit in the back of a ute and can process 150 litres of biodiesel at a time. Both Charles and Krysta drive diesel cars and have been making and using biodiesel for some time. They provided a wealth of practical experience and dos and don'ts.

Robert Underhill brought his biodie-

Straight veggie oil is another popular alternative fuel for those who don't want to manufacture biodiesel.

sel-powered '94 Mazda Capella station wagon to demonstrate that any diesel car is suitable for biodiesel.

People were also very interested in the Straight Vegetable Oil (SVO) truck demonstrated by B and Tara. The modified vehicle includes a second fuel tank filled with SVO which is heated from the engine. The truck is started on diesel or biodiesel and then, when the oil is hot, switched to SVO. Before switching off the engine, the driver switches back to diesel for a few minutes to flush oil from the fuel lines. Running on SVO avoids the need to make large quantities of biodiesel, and saves on cost and time.

A seminar was also held in Kaniva, Victoria by ATA's Wimmera branch. Local ATA convener Robert Binns introduced the speakers and gave a short presentation on the role Longeronong College hoped to play in the biodiesel field, developing expertise and encouraging local enterprises. Longeronong College is developing an oil extracting plant and wants to make biodiesel for its own tractors and vehicles. The College is also working on fuel standards for biodiesel.

Joshua Tickell's presentation at this seminar focused on the production side of things. Joshua emphasised the scalability of biodiesel production and how it could be used to enable individuals and communities to become largely self-sufficient in fuel and energy production.

Local Ben Hargreaves explained his simple and accessible biodiesel set-up and then the group visited Steven Hobbs, a local farmer who is producing biodiesel for use on his farm. (See Steven's article, starting page 29.)

The ATA's Coffs Harbour held its event in early January attended by the area's burgeoning community of biodiesel enthusiasts. Local ATA branch convener Peter Hallam attributes the strong interest to the current the economic climate, high local fuel costs and the branch's active promotion of biodiesel in the area over the past two years.

The common thread running through all the presentations was that biodiesel production is a technology that is available to everyone, from individuals and small communities through to national enterprises. Biodiesel is an enabler for communities and individuals to take direct control in the development and application of sustainable practices within their sphere of influence.

There are many people developing biodiesel in Australia. Groups such as the Biodiesel Association of Australia and WA Renewable Fuels Association promote biodiesel use, while others, such as the Australian Biodiesel Consortium, explore the commercial possibilities. Councils such as Moreland and Nillumbik in Melbourne, and Newcastle, NSW, are also developing policies on biodiesel use.

Renewables boom (overseas)

Danny Kennedy, coordinator of the Climate Action Network Australia, looks enviously at renewable energy exploits overseas, and wonders why the Australia Government wants to lose the race to clean energy

While the winds of war build around Iraq, winds of change gather in other corners of the globe from the development of renewable energy industries. It is a race for world domination of a different kind, as clean power technologies challenge the several hundred year reign of oil and other fossil fuels as the key strategic resource.

Victory in this race should make Bush's war for oil unnecessary, from a conventional energy and security policy point of view. Sadly, Australia stands to be a loser in the rush for clean energy, and a garrison town on the edge of the American Imperium, unless we challenge the conventional wisdom and commitment to coal.

Photo: Lara Denison

This photo shows the Toora wind farm in South Gippsland—notice the tree at right!

Power shift

Many pressures exist on nations and corporations to switch fuels for their electricity grids and car fleets from 'dirty' to 'clean'. Among them are the need to reduce cost, create energy independence from imports and clean up local pollution. Increasingly, policy is driven by the demand to 'decarbonise' the economy in order to protect the climate. By reducing carbon dioxide emissions, the major greenhouse gas, we hope to avert even worse climate change than that to which humanity is committed.

Countries such as Germany and Japan have led the way with huge research and development projects and incentive systems to promote the manufacture and uptake of photovoltaics and wind power. Japanese companies in the last few years have built over 100 megawatts of PV manufacturing capacity, nearly doubling previous gross world output in their own country. Germany has committed to be 25 per cent wind powered by 2030—an incredible feat for a nation of 80 million with a high standard of living.

The motivations are many. In Japan, some of it has been to develop a new silicon-based mass manufacturing enterprise, as the IT sector has cooled down. For Germany it is due in part to the need to replace coal and nukes due to local political concerns. But it is also because they plan to use wind to meet their commitment for greenhouse gas reductions under the Kyoto Protocol. And these industrial giants are not alone. From Denmark to Niue in the South Pacific—the first nation to be fully wind-powered—it is becoming the only choice.

In late 2002, over 24,000 megawatts of wind power capacity had been created around the globe. Almost a third of that was installed in the previous calendar year. This shows the incredible ramping up that the technology has gone through, and the steep side of the exponential curve it is now climbing. Wind's growth rates, of 52 per cent per annum, are unheard of in most major manufacturing industries, certainly for such key assets on the commanding heights as energy sources.

If these trends continue, and other solar and biomass power systems can follow the way of wind, they are great reasons for hope. The decentralised and clean nature of these technologies portend the soft energy pathways we have all hoped for, for so long. Spawned by their success it is likely we will develop hydrogen fuel cells as an energy storage solution, and replace most of the polluting, climate changing technologies we are dependent on as well as go through one of capitalism's great creation-destruction cycles by displacing coal, gas and oil.

Fossil fuels

But in the other corner, arrayed against this hope in the battle for the heart and

soul of the global economy, lies the fossil fuel industry and its allies in the United States, Saudi Arabia, Australia and elsewhere. This is the classic tussle of new 'forces for change' versus the status quo. The carbon wars played out in the UN Framework Convention on Climate Change negotiations, between the enlightened many and those that would wreck the process by abandoning the Kyoto Protocol commitments, is but one example.

Here, the United States—ably advised by the likes of ExxonMobil and the USA's Petroleum Institute—have worked well to scupper hard targets and mandatory obligations to reduce greenhouse gas emissions. Australia, under the Howard government, has either decided to become party to their strategy of 'delay, divide, destroy' or at least be party to it. This is despite the fact that our government won itself a sweetheart deal in the negotiations, and the reality that we are at odds with 90 per cent of our trading partners, who are now Kyoto compliant.

Another real measure of a nation's standing in the struggle for climate protection is its commitment to fossil fools versus the commitment it makes to new renewables. Again, Australia is woefully wanting. While other nations not only have major, state-sponsored research and development but also big commercialisation programs for wet and dry renewables, we have some small programs administered by the Australian Greenhouse Office that underspent its budget by nearly half in the past year. And our loyalty to fossil fuels, despite mechanisation, export orientation and job shedding in recent years, is legendary.

Australia's task-master is not so much oil as old king coal and its export markets. Coal should be sunsetted as a major source of power if we are to meet the need for deep cuts in carbon dioxide emissions that the Howard government claims it is about. This should be done with just transition strategies for the communities and workers implicated. But in recent months the government has made clear it wants a continuation of coal-powered 'business as usual', albeit with a climate technofix called geosequestration.

Geosequestration

This pipedream is the great hope of Rio Tinto and others to suck carbon dioxide out of coal at combustion, liquify it and then ship it cross country where it will be buried underground. If the proponents can overcome the risks entailed in this exercise, the cost will certainly make it much more expensive than wind power, which can already compete head to head with coal-fired power. Nonetheless, 'our' Chief Scientist, an honorary adviser to the Prime Minister who also happens to be the Chief Technologist at Rio Tinto, has convinced Howard that we can bury all our carbon problems.

Consequently, the government has committed $35 million to a new 'Rio Tinto Foundation' to do research and development work on carbon capture and sequestration technologies, and tens of millions more have been given over to other 'CO_2 CRCs' to work out how to clean up coal. Meanwhile, the Howard government has also cut funding to the Australian Centre for Renewable Energy (ACRE) and is considering killing both the Mandatory Renewable Energy Target and the Photovoltaic Rebate Program, which will exhaust its funding this year. The challenge for advocates of alternative technologies will be to keep these programs alive and to expand them.

Renewable response

The threat to the MRET came in the Energy Market Review prepared by Warwick Parer for the Coalition of Australian Governments (CoAG) in December 2002. Described as an inefficient way to reduce greenhouse gas emissions, this study discounts the importance of MRET in the development of a renewables industry, especially against entrenched interests like coal. The final report is resting with CoAG Energy Ministers and was to be considered by them in February 2003, even as Federal Environment Minister David Kemp is beginning a legislated review of the MRET and its effectiveness.

CANA and others, including the Australian Wind Energy Association and Greenpeace, are calling for the MRET to be expanded to a minimum of 10 per cent by 2010, not abolished. We will be organising around the MRET review process to make it clear that there is a groundswell of support in the Australian community for a more mandated renewable energy supply. Over the six months of the review, and in the parallel discussion of national energy market reforms orchestrated by Minister McFarlane's Department of Industry, Resource and Trade, we will demonstrate this demand.

This year, then, is a key year in the struggle between progressive forces advancing the vision of clean power and those who represent the past. Time is running out for governments to act through regulation to begin the phasing in of renewables before the momentum in energy stock commits us to ever more climate change. Critical decisions, like the fate of the PV Rebate and the Mandatory Renewable Energy Target, can be affected in a democracy like ours by citizen action and grassroots pressure. Opportunities abound if you contact any member of the Climate Action Network Australia.

***ReNew's* publisher, ATA, is an active member of CANA. You can contact ATA on (03)9388 9311, or the author on email: danny@cana.net.au or visit: www.cana.net.au**

A man with two is never quite sure

Andy Feidbuck reviews the SparOmeter digital power meter from SL Electric

Many *ReNew* readers would be interested in their home energy use, locating phantom loads and being aware of how much electricity is used by each of their appliances. But if the relative scarcity of devices like the SparOmeter from SL Electric is any indication, the Australian market for budding home energy auditors is yet to be exploited.

Already, most electricity retailers now produce a little bar graph of your household consumption over recent months for the purpose of basic consumer awareness.

For a little more detail, but a bit of inconvenience, the power meter on every grid-connected house can be used to measure individual appliances—running around trying to switch things off until the meter stops dead can often be an unexpected challenge.

When it comes to accurately, and conveniently, monitoring an appliance's electricity consumption, I for one was a bit surprised to find that, in Australia at least, this is a relatively specialised and rather expensive field of inquiry. The cost of all these devices seems to be influenced by lack of market scale and the technicalities of dealing accurately with a broad range of currents and voltages.

There already are some power monitoring devices available with Australian sockets (plenty more are made only with overseas plugs) but for the moment it seems those available are perhaps are out of the price range of the average home auditing enthusiast.

A tale with an aphorism and a moral

When testing the meter I plugged it into most of my home's electrical appliances like the fridge, stereo and light sources. I also took it around the corner to a local artists' workshop and plugged it into an arc welder and subsequently figured out what Danish word for 'maximum' must be. Although everything apparently still worked as normal I was left feeling a little bit uncertain—what if I had cooked it and ruined the calibration? Despite being assured that such damage was very unlikely it luckily did focus attention on the issue of accuracy.

To check this out the meter was plugged into an ATA office power point and I compared the measured voltage against a different brand of energy meter, a good multimeter and the office's grid-interactive inverter's display.

Do you know the aphorism about the man with two clocks? Well, of all the different readings the SL seemed to differ the most—displaying 255V with the others closer to 250V—this amounts to about a two per cent difference. The moral, of course, is that with any measuring device you need to be aware of the error range involved and whether or not it is significant for your purposes.

It's a shame that the error range isn't explicit anywhere on the SL, but for home monitoring it still does the job in a pretty convenient fashion. ✲

What it does do

- Work by taking many current and voltage samples—and calculates the rest. This means that it does not assume a pure sinewave (as many multi-meters do) which is good with electronic devices that introduce all sorts of frequency distortions.
- Records cumulative energy [kWh] use over a specified time [1 day, 7 days and 30 days or a user-controlled time period]
- Records 'on time' across this period [for example, for fridges]
- Records the maximum and minimum instantaneous power measured within the period
- Records the cost of the consumed energy [you input the $/kWh figure]
- Displays instantaneous current, voltage and power
- Displays the extrapolated yearly cost of maintaining the instantaneous power use.

What it doesn't do

- Display power factor
- Display any information about wave shape, harmonics et cetera

log all the instantaneous readings data (that is, no history of current or voltage)

- Communicate with any other device (like a PC).

Comments on convenience

On the convenience front a couple of features are pretty good. One is the fact that after inputting your tariff [$/kWh] the meter calculates and displays the costs—thus avoiding you doing any sums yourself.

An even more convenient thing is that by setting the recording time, you can plug the meter in and forget about it until well after the 1, 7 or 30 days is up.

A minor convenience setback is the shape of the meter—you really need to plug it into an extension cord to ensure it will fit into all power points.

Tips for building using recycled materials

Josephine Vaughan is an architect in Newcastle who designs buildings using second-hand materials. She provides some methods to help you to save on waste, unnecessary expense and hassle when building with second-hand materials

Tip shops and recycled yards can throw up some amazing bargains and unique features for your new home or extension.

Outside construction sites, those huge skip bins always seem to be full of potential. Full of old building materials going straight to landfill while, nearby, loads of new construction materials arrive daily with their associated packaging, off-cuts and mistakes.

Instead of creating more waste and over-using energy and resources, we can effectively utilise this obvious loop and recycle our buildings through careful demolition and re-use.

The fringe activity of re-using buildings can easily become a more mainstream practice. This article responds to the challenges of building deconstruction/reconstruction, presenting practical information and sample specifications on how to incorporate recycling into your building project.

Many building materials have developed over time to be strong and durable, with materials such as hardwood timbers improving over time. Standard sizes of components used throughout the building industry makes buildings well suited to re-use.

The challenges of re-using building materials

The method of building with re-used materials ('reconstruction') differs to usual practice.

Usually a building is designed, plans are approved by council and then construction begins. Not until the building stage do any materials appear on site. When building with deconstructed materials, you really need to collect them *during* the design planning stages. Organising to have materials in a design from the onset requires a flexible designer, and time spent searching for and collecting those materials.

Re-using building materials is a bigger challenge than the supermarket style material shopping that most builders engage in. However, like going to a local market for your produce, the rewards can be far greater.

You will need time to find materials, possibly a way to transport them and a place to store them. You will need to spend time cleaning them up, stripping, de-nailing et cetera. Occasionally sec-

ond-hand materials can be more expensive than new products.

Benefits of reconstruction

Finding good second-hand materials can be very rewarding. Old timber has a magical quality—by exposing the rare timber beams you picked up for a song above those quirky old windows and amazing 1970s light fittings you will have built a unique and beautiful home.

According to Bell's *Waste minimisation and resource recovery,* one-third of solid waste going to Australian landfill is from the building and demolition industries.

Re-using this material not only reduces landfill, it simultaneously reduces the potential amount of raw materials taken from our depleting Earth resources.

Re-used and recycled materials are some of the most sustainable products you can build with, and producing less new product saves on the huge amount of energy required to process and manufacture raw materials. Re-used materials require a minimum of extra energy, reducing their embodied energy count. Recycling processes often use less energy than production from raw materials.

The other big saving will be to your finances. By getting out there and scrounging for materials you will save much more money than having a house built completely of new materials. Collecting materials yourself will also involve you in the building process, giving you an understanding of the real costs in the building industry.

Designing recycled buildings

Waiting to find materials during construction can be time consuming and problematic. Imagine if your approved design showed a second-hand window one metre wide. However, if you went off to the demolition yard during the building process, could only find a two metre wide window and stuck that in your building, you could have structural problems, not to mention council approval issues.

Planning ahead and finding the right fitting *before* you start building will save on time and expense during the building process.

To build successfully with re-used materials, an adaptable approach to designing and building is necessary.

Begin by engaging a designer and engineer willing to develop the plans with flexible options for materials, finishes and fittings. As the design progresses, you can go hunting for materials that fit your rough ideas (doors, windows, flooring, wall cladding, fittings et cetera). When the engineer's drawings have developed you can also find structural members by the sizes specified by the engineer. Once you have the items required, they can be confirmed in the plans. This method allows you to produce final architectural and engineering drawings which will include most of your second-hand materials. These finished plans will then meet council requirements.

Finding second-hand building materials

If you are demolishing something before building, first decide what can be re-used. Think creatively about re-use; old glass doors that don't slide anymore can be set on their side as a fixed window. Old concrete can be crushed to become your new foundation, cracked tiles can become a mosaic.

Second-hand building material suppliers (demolition yards) have a wide selection of goods. Listed in the yellow pages under 'Building Materials-Second hand'. They are usually fun to visit, with everything from taps, toilets, timber, gates, staircases, lights and always a lot of junk! Some materials may still be messy from demolition, needing to be cleaned up, de-nailed or re-milled.

The cost can vary between yards—you can usually get better prices if you are prepared to drive a bit further out of town. If you can't find what you are looking for you can often leave your name and a wish list some of which may be forthcoming later.

Landfill tips usually have an associated 'tip-shop' which will often have some building supplies. These vary be-

tween towns; some are fantastic, others tragic. Check out your local and regional tips. Costs will vary, although they are usually cheaper than demolition yards.

The local paper will have a section with building materials. You can get all sorts of things for free, if you are prepared to come and take them away.

Visit your friend's sheds (and your own shed!). People collect all sorts of building materials; ornate doors, stained glass windows, timber bits, leftover tiles, brick piles. Make an offer or do a trade—often people want to get rid of this 'junk'.

If there is a demolition happening in your local area, take a peek in their skip bin. If it looks appropriate, ask if you can take some away or organise to collect it before it hits the kerb. Usually this is good for the builder, saving them tip fees.

Don't fall into the trap of collecting everything you can get your hands on. Choose only good quality materials, and consider the amount of time required to clean or repair them.

When looking for second-hand *structural* materials, check for bending, cracking or deformities. Over time, some structural members may wear. Because of this, your engineer may want to inspect the selected materials for any kind of defect or wearing before issuing their drawings to be built.

Engineer-certified recycled structural timbers may be available from your local demolition yard—just ask.

Builders and second-hand materials

Builders are busy people who usually have a set routine that works for them. Interruptions such as searching for second-hand materials, de-nailing, cleaning and preparing materials to build with will often result in an increase in your building cost.

One way to get around this problem is to have all the materials on site, cleaned, prepared and sorted when the builder arrives. Since it is best to collect the materials during the design stage, you should already be organised for the builder's arrival.

The best way to get a builder to build your recycled home is to find a builder who loves re-used materials. Yes, they do exist! These builders are often enthusiastic about other 'unusual' ideas like rainwater tanks, solar panels and grey-water recycling.

If you can discover this builder while in your design stage, enlisting their help at the demolition yards will be invaluable. Experienced builders can pick out the best materials and sometimes get a

Materials, second hand materials

All materials shall be new, or second hand where noted. Materials shall be the best of their respective kinds, free from defects and to the approval of the Principal. Second-hand materials may generally be used in preference to new materials, when appropriate. Confirm intention to use second-hand materials (other than those mentioned in the drawings or if quality is in question) with Principal prior to purchase.

Demolished materials

Demolished materials except as otherwise specified shall become the property of the Builder/Principal (depending on how you wish to run the project).

Materials shall be sorted for recycling on site unless listed for re-use in new building work. Materials shall then be removed from the site and legally disposed of as outlined in waste management schedule in this specification.

In accordance with (the local council's) waste minimisation policy—waste to be separated on site for recycling.

Allow for tip and recycling depot fees and present receipts to Principal to verify disposal where applicable.

Disposal of material by burning on site will not be permitted.

Keep separated materials clean and dry.

Waste generally

Shall be sorted on site. The Builder is responsible for undertaking of the waste management plan. Present receipts to Principal to verify disposal where applicable. Keep separated materials clean and dry.

Waste management plan

A waste management plan is not required but would be beneficial in managing waste, and preparation of one is encouraged. For information on how to prepare a Waste Management Plan, refer to the local *Waste Planning Guide for Development Applications.*

Sorting schedule of 'waste' on site

Surplus and waste materials shall be sorted on site *during* the building process (including demolition and construction periods).

Materials shall be sorted into groups as detailed in the waste management plan and dealt with as detailed or otherwise according to a waste management plan approved by the Principal.

For a list of companies who accept second-hand materials, refer to the local waste planning and management board 're-use, repair and recycle directory'.

Table 1. An example of additions/amendments you might make to your building specifications ensuring all tradespersons working on your site understand your position on re-use and recycling.

Material	Existing location	To be reused as:	New location	To be sent to:	Notes
Bathtub and handbasin	Bathroom		Re-enamel and install in new bathroom		Check for any other house fixtures which can be re-used in new building
Timber studs in demolished walls and roof	Any demolished walls		New framing throughout		Leftover timber sent to second-hand merchant. All scraps mulched (waste centres have facilities)
Brickwork in demolished walls and footings	Any demolished walls	Paving and steps	New patio	Any leftover sent to second-hand merchant	Any leftover unusable bricks can be delivered to crushing facility for roadbase etc
Plasterboard	Any demolished walls			Plasterboard reprocessing facility - can be made into new plasterboard	Keep clean and dry
Metal roofing sheets	Old roof	External wall cladding	New shed		Separate any unusable metal products on site and send to recycling facility
Doors and windows	Throughout	Throughout as indicated in drawing			Re-use good condition items only. Keep clean and dry
Packaging from new materials	As left on site			Send back to supplier for re-use	Recycle any cardboard or paper packaging

Table 2. *Example waste management schedule only

This example schedule describes how materials demolished during the building process may be re-used on site or to what location they shall be sent. A schedule similar to this should be produced prior to demolition. Note, when materials scheduled for demolition are to be re-used on site or elsewhere, they are to be removed carefully during the demolition process.

better price from the supplier.

Building specifications

Final building designs go to the council with a set of *specifications*. These 'specs' instruct all tradespeople working on your project exactly what building procedures and methods shall be used. The specification is a legal contract, giving you the power to instruct a builder to use second-hand materials, for example.

Traditional specifications do not usually mention the use of second-hand materials nor the management of demolition 'waste'. This means you will have to take a close look at the specification you will be using (usually provided by the designer).

Make amendments and additions to it in the areas of materials and waste management, making it a suitable set of instructions to build with second-hand materials.

Some inclusions you could add to your specifications are listed in Table 1.

Demolition 'waste' management

Practically all demolished materials from a building are re-usable or recyclable. Carefully demolishing a building and sorting materials on site into like piles facilitates the re-use process.

A recent push by waste boards throughout Australia means that local councils and waste boards have a wealth of resources and policies to assist you. Ask your council for a copy of their waste minimisation policy, call your state and local waste board or visit their website.

Once again, your builder may have a problem with sorting and recycling. Many of the resources can help you and your builder to prepare and implement a waste management plan.

Use the specification to insist on recycling, by adding an entire section on waste management.

You may need to insist on receipts from recycling depots and refuse to pay any tip fees. (Look out! These fees can be hidden in your contract price with the builder). See Table 2 for an example waste management schedule.

Happy reconstructing! ✲

Further information

Bell, N *Waste Minimisation and Resource Recovery* in BDP Environment Design Guide, RAIA, August 1998.

www.resource.nsw.gov.au/programs.htm

www.ecorecycle.vic.gov.au

www.southernwaste.com.au/materials/demolitionwaste.html

www.ecospecifier.rmit.edu.au

Thankyou to Mim Buchorn.

Carbon and energy markets

Our regular columnist Alan Pears discusses the NSW benchmarks scheme which puts a price on carbon, the current MRET review and where the gas industry fits into the greenhouse debate

From January 2003, electricity retailers selling power in NSW will have to meet greenhouse targets under the NSW state government's Greenhouse Benchmark scheme. For each tonne of CO_2 above their target, they will have to pay around $15, but they can cut their costs by trading NGACs (NSW Greenhouse Abatement Certificates) generated by certified abatement actions including cogeneration, renewable energy, energy efficiency and fuel switching. The recently re-elected Victorian Government, conscious of the strong green vote, promised before the election to look at a similar scheme in Victoria.

There will be some very interesting bargaining over the next few months. With funding of many of the national greenhouse programs ending soon and heavy cutbacks across government agencies to fund the anti-terrorism and asylum seeker programs, combined with the usual effective lobbying from the minority energy-intensive industries, conservatives in the Commonwealth will try to take the opportunity to wind back greenhouse action. On the other hand, State governments are feeling plenty of pressure from the green swing to push hard on greenhouse: and some of them are even finding that greenhouse response can be good for the economy—as we've been trying to explain for decades. At the same time, the Commonwealth will be trying to drive further energy market reform while states will be trying to limit the impact of reform to avoid losing the votes of rural and regional energy consumers and households. No room for idealism here!

The gas industry risks losing its green tinge?

The gas industry has recently taken what seems to be a tactically poor stance, advocating removal of rebates for solar hot water. They propose that rebates should be linked to greenhouse performance—so gas hot water services would gain subsidies comparable with electric-boosted solar in many regions. This stance will certainly reinforce suspicions that the gas industry is using *greenwash* to promote its own interests, instead of being genuinely supportive of a transition to a sustainable energy future.

The obvious strategy the gas industry should adopt is to accept that governments are trying to build a viable solar industry for the long term, and lobby for both greenhouse-related incentives and solar incentives. The combination makes sense, and would make the gas industry much more popular!

I certainly see wider use of natural gas as part of the path towards sustainability—but not *wasteful* use of gas. I don't see any sense in encouraging people to install poorly insulated gas storage water heaters with continuous pilot lights. A five-star storage hot water system wastes more than five gigajoules of gas each year (costing $40 to $70 per year) before delivering any hot water: that's enough gas to heat at least 70 litres of water each day and about twice the heat loss from a 125 litre electric hot water system (adjusted for gas combustion efficiency)! Similarly, although they are more efficient at low daily draw-offs, most continuous gas hot water system units struggle to be compatible with solar boosting and water-efficient showerheads and taps, so they are not a great answer yet—although some manufacturers have just about overcome the problems.

If the gas industry really wants to show that it is part of a transition to a sustainable energy future, apart from supporting complementary emissions trading and ongoing solar rebates, it could adopt approaches such as:

- Ensuring that all new gas hot water units have electronic ignition and very low standby losses (at least as good as the electric Mandatory Energy Performance standards levels), and are compatible with solar pre-heating and water-efficient showerheads and taps.
- Ensuring that all new gas pipes and fittings are hydrogen-compatible.
- Designing new gas burners so they can (preferably automatically) cope with a range of gas quality, so blends of natural gas, biogas, reformed natural gas, and other forms of gas can be used easily as they become available.
- Promoting a *GreenGas* product along the lines of *Green Power* using biogas, landfill gas, solar gas reforming and other renewable gas sources to offset sales under this program.
- Working with governments to ensure that a gas pipe is installed to every new

building during construction so that future occupants will have the option of using fuel cells and other emerging gas technologies: it is much more expensive to install gas pipes after development. This will also help building occupants to negotiate with electricity suppliers, because they will have a fuel choice rather than being hostage to an electricity supplier.

CoAG Energy Market Review final report

The Council of Australian Governments Energy Market Review has published its final report. It acknowledges that there are major problems, and that much more work is needed. The final report is available at www.energymarketreview.org

Unfortunately, the review has focused on band-aids rather than fundamental issues. For example, it advocates more transmission capacity to try to break the market power of large generators: why not make generators responsible for contributing to system reliability and limit the financial rewards for large generators from sales at times of tight supply? And why not divert money from new transmission capacity to energy efficiency, cogeneration and renewables instead? They would break the generators' market power, reduce greenhouse gas emissions and save money. The review completely fails to acknowledge that many of the agents who influence energy demand are not involved in the energy market, and that new strategies are needed to ensure builders, developers, electricians, lighting shops, shop fitters and others promote sustainable energy solutions.

The review does propose some worthwhile changes, such as a mandatory code of practice between distributors and embedded generators, a 'pay as bid' scheme for demand-side bidding into the market (where demand-side bidders can be confident they will be paid what they originally bid for avoided power use, not a lower price that is a result of their bid easing the tight supply-demand situation), and it supports early introduction of greenhouse emissions trading. But the proposal to kill off the Mandatory Renewable Energy Target (MRET) could seriously undermine confidence in renewable energy investment unless promptly rejected by the government. And proposals for locational pricing and replacement of state regulators by a single national one will face serious social and political barriers, even though they have some merit. The review also failed to effectively address many of the issues related to household and small business energy users: as in previous processes, the focus has been mostly on large industrial consumers.

When will a review of energy markets be conducted by a panel with broad expertise including social justice issues, environment, sustainable energy, small business, and ecological economics, as well as conventional energy supply? After all, households and small-to-medium businesses use more than half of the electricity produced, and the low electricity intensity (in terms of emissions per dollar of GDP) commercial and light industrial sectors generate over three-quarters of GDP. And when will such a review actually include a reasonable consultation and participation process, where community groups are provided with sufficient resources to participate in a meaningful way? Such a review also needs to be set in a context of large cuts to greenhouse gas emissions over the next 50 years, something the CoAG panel failed to do. ✲

Fail-safe irrigation

Collyn Rivers describes the irrigation system he designed to meet the specific needs of his food garden—which now thrives in the harsh climate north of Broome, WA

Our all-solar powered home north of Broome (roughly 18 degrees south of the equator) is a few hundred metres from the Indian Ocean. Virtually anything that can withstand heat and the odd cyclone will grow there, but the sandy soil and intensely hot sun year-round necessitates absolutely reliable irrigation.

Our land is still almost virgin bush, with an extraordinary variety of native trees and bushes—including exotics like boab and sandalwood trees. All existing trees have been retained, and about 40 to 50 (specific to this area) have been added.

Broome is still very much a pearling town, with a population that expands fivefold each year during the three to four month tourist season. Only a small quantity of a limited range of fruit and vegetables is grown locally (and is usually sold out by 9am at the Saturday markets).

Most supplies come from Perth or Darwin (over 2000km away), and are priced accordingly. Because of this, we have a couple of largish vegetable gardens that supply our personal needs. These are fenced by dense lemongrass in a semi-successful attempt to keep out wallabies. We have also planted a dozen mango trees, various fruit trees, and also banana plants—again, for our own use.

Keeping this lot watered requires 2500 to 4000 litres per day, readily obtainable from our excellent bore (the water from that is so good that it could be bottled and sold).

Here you can see the 23,800 litre water tank with the two outlets at the 18,000 litre level. Also note the large outlet at the bottom of the tank.

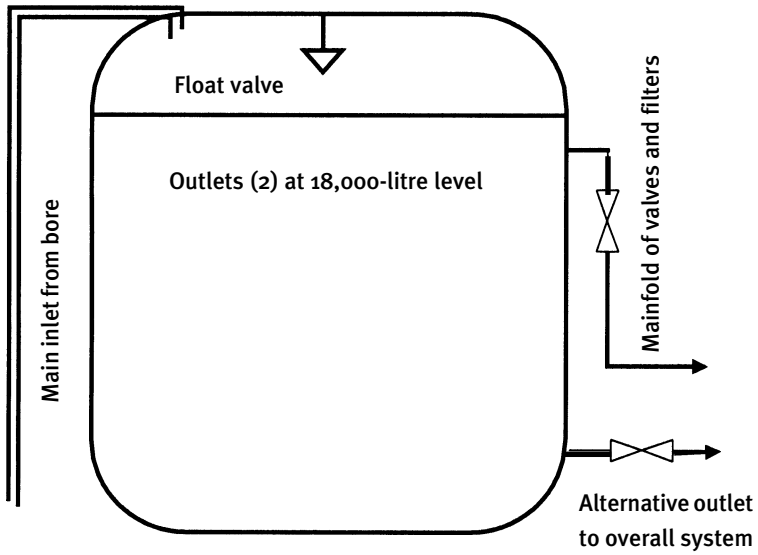
Designing for need

A major need was that, because of the Kimberley's extremely hot sun all year round, the system needed to operate after the sun went down and before it rose in the morning, thus ruling out an online system using a small-capacity pump. We also wanted the system to be simple in operation, with as few moving bits as possible—and, once water was pumped up, to be gravity-operated.

Further, the sun being so hot and the soil so porous, it was essential that the system be able to continue irrigating for several days in the event of virtually any part of it failing.

Conventional methods using timers and control valves were not feasible, nor, in any case, felt to be reliable enough. Most use a constant 12 or 24 volts AC to shut water off (that is, cutting power allows the water to flow). This is hardly energy-efficient anyway—and certainly not to be considered if running from solar. Latching type valves are obtainable, but need a good head of water to operate.

We initially considered simply running the system straight off the bore pump, but the higher pressure caused havoc with the multiplicity of light plastic fittings and vast runs of light piping. The obvious solution of reducing the pressure was not an option, as energy-efficient pumps *must* be used at specific rates of flow. Using a smaller pump was not feasible, as we needed a large flow



There are twin outlets each feeding a manifold of three valves, filters and distribution pipes.

for possible fire fighting. Also not possible (for regulatory reasons) was sinking another bore and using a smaller dedicated pump. Yet a further problem was that direct operation would not provide any reserve operation in the event of pump failure.

Because our land is totally exposed to the full force of cyclones, raising the tank to increase water pressure was also felt not to be a good idea.

The final solution, shown in the main drawing, is almost childishly simple, but is effective and utterly reliable. Curiously, I have yet to meet anyone else who has done the same.

A Grundfoss SQ5 bore pump (which draws about 700 watts to pump 4000 litres per hour) is switched on and off as required by a 240 volt time switch. The water is pumped up to a 23,800 litre tank located at the highest point on the prop-

erty, but still only a couple of metres above most irrigation outlets.

This tank has three main outlets. Two are at the 18,000-litre level, and another large one is at the bottom. The two top 35mm outlets each feed separate manifolds, each supplying three filters and manual valves with 25mm Blue Line piping running underground (to limit heat build up) to the areas around the 10 acre property needing irrigation. From there, normal drip feeds are used in various combinations of number and size as required.

How it works

The tank is initially filled to the 18,000-litre level by manually overriding the time switch. Then, at one or more desired preset times of day (usually 5pm and/or 5am), the time switch starts the bore pump. The level in the tank begins to rise and water immediately begins to flow under gravity into the irrigation manifolds (the system's valves being normally left open).

The water level in the tank continues to rise until either the time switch turns the pump off or the rising water level causes a height-adjustable float valve in the tank to cut off power to the pump. When the pump cuts out (typically after 45 minutes), irrigation continues until the water level falls to the level of the two main outlets (that is, 18,000 litres).

This action has thus allowed the pump to work at its most efficient level, yet allows irrigation to continue automatically for a further couple of hours, always ceasing at the 18,000-litre level.

In the event of the bore pump or inverter failing, a big gate valve at the bottom of the tank enables the remaining 18,000 litres to feed the system for several days while repairs are under way.

Overall pumping can be adjusted by extending the time switch setting and/or float switch level. Substantially extended irrigating causes the pump to cycle a few times as the float valve alternately starts and stops the pump—there is about 500 litres differential.

Individual water quantities are adjusted simply by using varying sized drips and the numbers of drips.

The system has now been in use for about 18 months and has needed no attention at all, except for the addition of a Carefree water treatment unit that almost magically removes all those nasty white deposits and keeps the entire system (including/especially about 1500 drips) squeaky clean. The Carefree system is a non-chemical catalytic converter that neutralises the effect of scale binders. ✲

Energy efficient whitegoods buyers' guide

If you need to buy a new fridge, or maybe a washing machine, and want to get one that uses the least energy and water, then the appliances in this guide could be just what you are looking for

Almost everyone in Australia owns at least one whitegood—usually a fridge and a washing machine, and often a dishwasher. However, buying the wrong machine can mean that you (and the environment) pay a lot more to run the appliance over its lifetime than you should or need to.

Appliances use electricity, and unfortunately, some use a lot more than others to do a similar or even worse job, so it pays to look around and find the most energy-efficient appliances you can.

But where do you find the information that you need to make an informed choice?

Well, this information is available from several sources, including appliance manufacturers, the energy ratings labels on the appliances themselves, and several government websites that list the energy use and star ratings for various appliance types.

However, if you don't have internet access, and we are aware that many of our readers don't, then accessing that information can be a lot more difficult. This is the main reason that we decided to put together this guide—so that there is a readily available resource of information on the top few appliances in the categories of dishwashers, fridges and freezers and washing machines—the most commonly purchased of all the whitegoods.

The information presented here is based largely on the information available on the Energy Ratings website (www.energyrating.gov.au), and we have tried to fill in any holes, such as the recommended retail prices and current availability of each appliance, as price is often a deciding influence when looking for appliances.

The Energy Ratings website has a wealth of information on energy ratings of appliances, how they are derived, and includes an interactive database that can list the appliances in order of lowest energy use. You can even enter the price you pay for electricity and it will include estimates of running costs for each year. If you have internet access, this site is well worth a look.

What we have covered

The information can be seen in the accompanying tables, and covers dishwashers—both large and small, fridges—in four different categories, including fridge/freezers, all-fridge units and chest and upright freezers. Washing machines are divided into top loaders and front loaders. There are almost

no other models of washing machines—in fact, only one twin-tub was listed.

In each category we have listed just the top six appliances. In most categories, the listed appliances will be four-star or better (the maximum an appliance can have is six stars), though in some categories there are very few appliances of this rating, so some with lower star ratings are included.

While we have only looked at appliances that are listed on the energy ratings website, there are some other energy efficient whitegoods available, but most are available only from a limited number of dealers, or are designed primarily for 12 or 24 volt DC systems and may not have energy star ratings yet. An example of this is the new Waeco range of fridge/freezers, which include models up to over 500 litres. They have inbuilt battery chargers and can run from 12, 24 or 240 volts.

Other whitegoods

One common whitegood—clothes dryers—while having energy ratings, have not been looked at as they are not considered 'necessary'. While many people think of them as a nice convenience, even the smallest flat usually has enough space for a clothes line of some sort. Clothes dryers are huge users of electricity. If you really must have a clothes dryer, then expect to be paying a great deal to run it, as they all use at least two kilowatt-hours per load (except the AEG Lavatherm, which is a heat pump unit, but is very expensive to buy), which equates to $0.30 or more, and greenhouse emissions of up to 4.2 kilograms of CO_2 or more each load.

But they're so expensive!

Unfortunately, with many energy-efficient appliances, that is true, for several reasons.

The first seems to be that many of the truly efficient appliances are imported from Europe, where many countries have stricter energy-efficiency requirements than Australia. As the Australian dollar is so weak against other currencies, prices are likely to remain high until the dollar improves, if it ever does.

Another reason is basically the old adage of 'You get what you pay for'. Energy-efficient appliances have generally undergone greater development and testing than less efficient ones. They are generally of a higher quality and more thought has gone into designing and constructing them. Remember also that while they may cost more to purchase initially, a good quality appliance will easily outlast a cheap, inefficient one, so you will actually not only be saving energy and money when buying the more expensive, energy-efficient appliance, but it may easily last you 15 or 20 years, as opposed to, say five or 10 years for the cheap one. So, buying the cheaper, energy wasting machine is false economy in most cases, as it may use two or even three times the energy of a good quality one, and you will be contributing unnecessarilly to the waste cycle.

Some of the more locally made appliances, such as the Fisher & Paykel machines, do cost less than the European models, so many will consider them high on the list when looking for appliances. However, there is a limit to how cheap a well-designed appliance can be made, so they are often out of the reach of low-income earners. Maybe this is a good opportunity for the federal and state governments to provide rebates to low-income earners for such appliances?

The Energy Rating Label

The Energy Rating label enables you to compare the energy efficiency of domestic appliances on a fair and equitable basis. It also provides incentive for manufacturers to improve the energy performance of appliances.

The Energy Rating Label was first introduced in 1986. It is now mandatory in most states and territories for refrigerators, freezers, clothes washers, clothes dryers, dishwashers and air-conditioners (less than 7.5 kilowatts output cooling capacity) to carry the label.

The Energy Rating Label has two main features:

- The star rating, which gives a quick comparative assessment of the model's energy efficiency. The maximum rating an appliance can carry is six stars
- The comparative energy consumption (in kilowatt-hours per year) provides an estimate of the annual energy consumption of the appliance based on the tested energy consumption and information about the typical use of the appliance in the home.

The Star Rating of an appliance is determined from the energy consumption measured under Australian Standards which define test procedures for measuring energy consumption and minimum energy performance criteria. Appliances must meet these criteria before they can be granted an energy rating label.

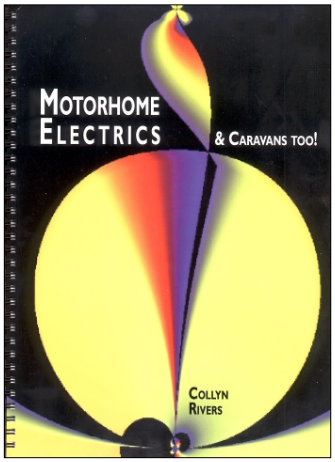
The new Energy Rating Label

Following several years of negotiation between government and industry the familiar red and yellow energy rating label was revised in 2000. Energy efficiency is now measured against a tougher standard. This change should encourage improved technology and more efficient products, which will save consumers money and help reduce greenhouse gas emissions.

Washing machines: top loaders											
Brand (made in)	Model	Load (kg)	Warm wash energy consumption (kWh/365 uses)	Cold wash energy consumption (kWh/uses)	Star rating	Washer type	Program time (minutes)	Hot water used (litres)	Cold water used (litres)	RRP	Comments
Kleenmaid St George (France)	TX768A	5	173	-	4	Drum	115	0	61	$2199	www.kleenmaid.com.au Top loading 'front loader'
	TX728A	5	185	-	3.5	Drum	136	0	60	$1999	www.kleenmaid.com.au Top loading 'front loader'
Fisher & Paykel (Australia or New Zealand)	IW811	8	308	60	3.5	Agitator	60	15	137	$1362	www.fisherpaykel.com.au
	IW711	7	293	57	3.5	Agitator	52	14	116	$1228	
Haier (China)	XQJ50	5	374	82	2	Agitator	84	20.7	107.5	$433	phone 02 9898 3188
Simpson (Australia)	36S605K	6	474	68	2	Agitator	44	23	97	$749	www.simpson.com.au
Washing machines: front loaders											
Brand (made in)	Model	Load (kg)	Warm wash energy consumption (kWh/year)	Cold wash energy consumption (kWh/year)	Star rating	Washer type	Program time (minutes)	Hot water used (litres)	Cold water used (litres)	RRP	Comments
Miele (Germany)	W 310	5.5	144	-	4.5	Drum	121	0	55	$1999	www.miele.com.au
Asko (Sweden)	W6661	6	182	-	4.5	Drum	109	1	59	$2399	Energy consumption and water use figures unavaliable. Models changing in March. www.asko.com.au
	W6551	6	-	-	4.5	Drum	-	-	61	$2049	
	W6221	6	-	-	4	Drum	-	-	61	$1799	
	W6011	6	-	-	4	Drum	-	-	61	$1649	

Single door refrigerators								
Brand (made in)	**Model**	**Total volume**	**Energy consumption (kWh/year)**	**Star rating**	**Fridge volume**	**Freezer volume**	**RRP**	**Comments/website**
Liebherr (Germany)	KSPv4260 and KSPves4260	405	209	6	405	0	$2699	www.andico.com.au
	KSSv4260	405	281	4.5	405	0	$2499	
Fisher & Paykel (Australia)	C373	373	406	4.5	373	0	$1115	www.fisherpaykel.com.au
	C450	451	451	4.5	451	0	$1309	
Westinghouse (Australia)	RP142	135	320	3.5	135	0	$480	www.westinghouse.com.au
	RP342T-R	340	590	3	340	0	$1081	
Two-door fridge-freezers								
Brand (made in)	**Model**	**Total volume**	**Energy consumption (kWh/year)**	**Star rating**	**Fridge volume**	**Freezer volume**	**RRP**	**Comments**
Vestfrost (Denmark)	BSKF 352	293	396	4	175	118	$2035	www.vestfrost.com
	BSKF 375	328	421	4	210	118	$2167	
Samsung (Korea)	SRS614DW	614	634	4	387	227	$2999	Side by side
	SRS20NTD	594	684	3.5	365	229	$2299	
	SRL550DW	560	784	3	372	188	$1999	www.samsung.com.au
Chest freezers								
Brand (made in)	**Model**	**Total volume**	**Energy consumption (kWh/year)**	**Star rating**	**Fridge volume**	**Freezer volume**	**RRP**	**Comments**
Vestfrost (Denmark)	SE255	247	237	5	0	247	$1446.50	www.vestfrost.com
	SE325	323	302	4.5	0	323	$1595	
Fisher & Paykel (New Zealand)	H510	511	549	2.5	0	511	$1184	www.fisherpaykel.com.au
Kelvinator (Australia)	Chest Freezer H500	496	590	2.5	0	496	$1256	www.kelvinator.com.au
Simpson (Australia)	Freezer H500	496	590	2.5	0	496	$1256	www.simpson.com.au
Fisher & Paykel (New Zealand)	H360	358	488	2	0	358	$856	www.fisherpaykel.com.au
Upright freezers								
Brand (made in)	**Model**	**Total volume**	**Energy consumption (kWh/year)**	**Star rating**	**Fridge volume**	**Freezer volume**	**RRP**	**Comments**
Liebherr (Germany)	GSND3316	361	355	5.5	0	361	$2699	www.andico.com.au
	GSN3326	361	355	5.5	0	361		
	GI1923, GEL1923	180	365	4	0	180	$2099 $2999	
Westinghouse (Australia)	FR121S-L	120	380	3	0	120	$560	www.westinghouse.com.au
Kelvinator (Australia)	F140H-L	140	394	3	0	140	$565	www.kelvinator.com.au

Dishwashers: nine place settings or less								
Brand (made in)	**Model**	**Place settings**	**Energy consumption (kWh/year)**	**Star rating**	**Water consumption (litres)**	**Program tested**	**RRP**	**Comments**
Fisher & Paykel (New Zealand)	DS603/DS603I	7	161	3	9	Normal Eco	$992/ $1047	www.fisherpaykel.com.au 'I' model is bench integrated
Miele (Germany)	G 611 SC Plus	9	249	2.5	16	Gentle 45C	$1699	www.miele.com.au
	G 618 SCVi Plus	9	246	2.5	16	Gentle 45C	$2099	
Bosch (Germany)	SRS5302AU	9	247	2.5	17	Glass 40C	$1599	www.bosch.com.au
	SRI43A05AU	9	247	2.5	17	Glass 40	$1799	
Dishwashers: ten place settings or more								
Brand (made in)	**Model**	**Place settings**	**Energy consumption (kWh/year)**	**Star rating**	**Water consumption**	**Program tested**	**RRP**	**Comments**
Miele (Germany)	G 896 SCi Plus	14	229	4	19	Gentle 45C	$2499	www.miele.com.au
	G 898 SCi Plus	14	230	4	19	Gentle 45C	$2999	
Bosch (Germany)	SGU59A05AU	14	242	3.5	20.1	Glasses 40	$2599	www.bosch.com.au
	SGU59A13AU	14	242	3.5	20.1	Glasses 40	$2399	Bench integrated model
Asko	D1896	14	245	3.5	14	Quick was 45C without drying	$1999	
	D1976	14	245	3.5	14		$1899	$1999 for stainless steel finish



Motorhome Electrics & caravans too!

Author:Collyn Rivers
ISBN: 0 9578965 14 RRP is $42.50. Publisher: Caravan & Motorhome Books, Broome WA. Size: A4, 102 pages plus covers. Order from the ATA bookshop online www.ata.org.au or use the order form on page 73 of this issue.

If you own a motorhome or other vehicle or even a home with a 12 or 24 volt electrical system, then this book is bound to have useful information for you.

While it is written with the mobile home owner in mind, a lot of what it contains is relevent to any DC electrical system, and many remote homes have systems with many similar components.

The book starts off outlining basic electrical terms, which is always a good thing to do with such a text, as the writter has no way of knowing the level of knowledge of the reader. Unfortunately, there were one or two small errors here, such as the statement that our 240 volt mains changes direction 50 times each second In fact, it changes direction 100 times each second, as there are two reversals per cycle.

However, the vast majority of the information in the book was accurate and useful, and I even learned a few things about alternators I didn't know before.

There are sections on charging batteries, and the problems involved in getting a good level of charge quickly, alternators and voltage regulators, batteries, their capacities, and types, system monitoring, and of course, sections on solar energy, wind generators, backup generators and inverters.

Also included is discussion on system loads, such as lighting, refrigeration, water pumps and communications equipment. There are even examples of system sizing calculations.

Another useful section was that of extra-low voltage wiring, which dealt with cable and connector types, switches and meters. As you would expect, a lot of this information is aimed at automotive systems, but is still useful for home systems. There is even a section dealing with mains voltage wiring, though it is, of course, illegal to do this wiring yourself unless you are a qualified electrician. Lastly, there is a FAQ section, where common questions are asked and answered.

All in all, a good publication that many readers would find useful. Oh, and I should mention that the book is ring-bound, with plastic protective covers, making it ideal for use in the workshop.

Reviewed by Lance Turner

When the Wild Comes Leaping Up

Edited by David Suzuki. Publisher: Allen & Unwin. RRP $24.95. Paperback, 235 pages. Order from the ATA bookshop online www.ata.org.au or on page 73 of this issue.

When the Wild Comes Leaping Up is a collection of essays and personal accounts of people's interactions with nature. Edited by David Suzuki, the book offers a series of perspectives on the relationship between humans and the natural world. The stories and reflections are by a number of noted international writers which makes for a fascinating journey into the power, beauty and terror of the natural world.

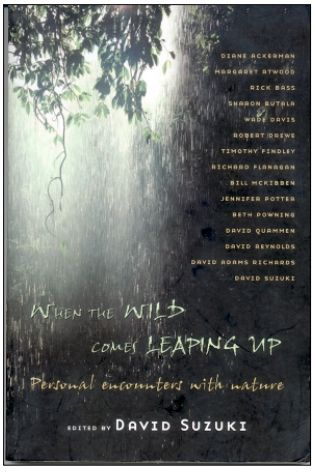
Contributors include novelist Margaret Atwood, Australian science writer Richard Flanagan, internationally respected ethnobotanist Wade Davis and Robert Drewe, who writes a thought-provoking piece on the perils of the Western Australian coast.

The pieces are quite personal, often reflecting on some revelation gained, or a naivety lost, by the author. Many of the stories are remarkably honest and some are deeply touching, without being sanctimonious or falsely mythologising the natural world. As David Suzuki notes in the introduction, we are a species subject to conflicting notions of the world around us. He speaks of children's fascination with living creatures.

When the *Wild Comes Leaping Up* also offers insights into the human condition. While as a species we have moved from an agrarian existence to city-bound individualism, we cannot stop being part of our environment.

This polemic—our need to survive and grow beyond the confines of our natural existence—has driven much of human development. Yet, as these thoughtful essays make clear, it this very thing which we must come to terms with if we wish to live responsibly on the planet.

Reviewed by John Kelly



Browser

www.ghgonline.org

As you might expect from the URL, this site deals with greenhouse gases, such as carbon dioxide and methane, and many of the issues associated with them and the problems they pose for the world now and in the future.

The site contains not only greenhouse gas related news, but also up-to-date links to abstracts of hundreds of greenhouse gas related scientific papers. Additionally, there are detailed discussions of the main types of greenhouse gases, and the global warming issues they are central to. There is a links list, and a news archive covering the past couple of years.

If you want more information on the greenhouse issue, this site is a good place to start.

www.itdg.org

ITDG (Intermediate Technology Development Group) aims to demonstrate and advocate the sustainable use of technology to reduce poverty in developing countries.

It was founded in 1966 by the radical economist Dr EF Schumacher to prove that his philosophy of 'Small is Beautiful' could bring real and sustainable improvements to people's lives.

ITDG works on the philosophy that, regardless of the tools used, simple or sophisticated, to provide long-term, appropriate and practical answers, they must be firmly in the hands of local people—people who shape technology and control it for themselves.

ITDG is a charity registered in the United Kingdom which works directly in four regions of the developing world—Latin America, East Africa, Southern Africa and South Asia, with particular concentration on Peru, Kenya, Sudan, Zimbabwe, Sri Lanka, Bangladesh and Nepal.

In these countries, ITDG works with poor communities to develop appropriate technologies in food production, agroprocessing, energy, transport, small enterprise development, shelter, small-scale mining and disaster mitigation.

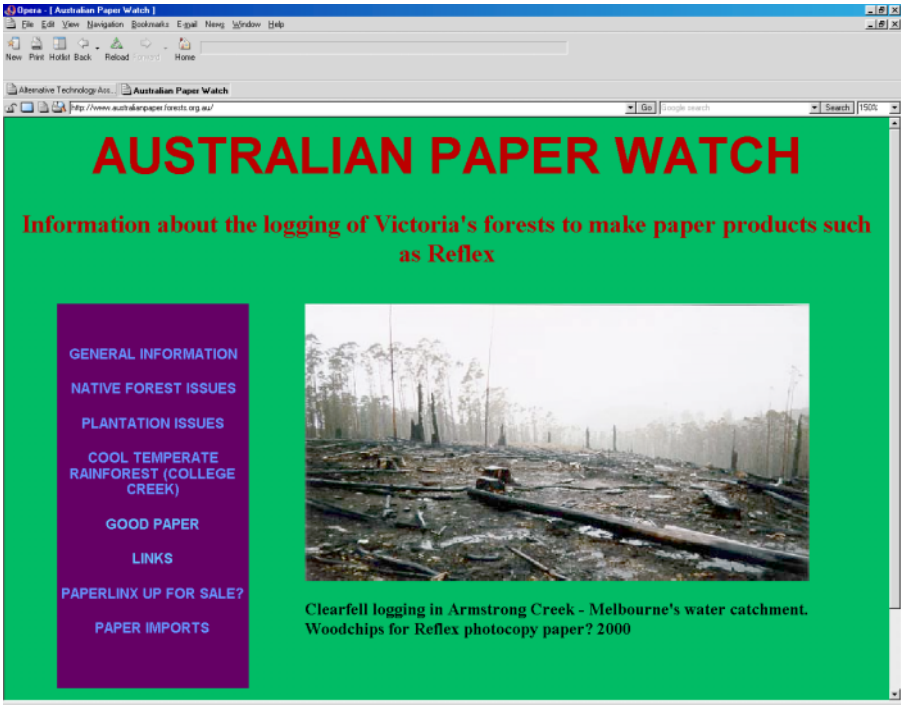
ITDG provides a number of products and services, including a consultancy service, teacher training and resources and advocacy. The website itself has a lot of information on ITDG and what it does and how it can help, downloadable information, a free technical information service and a good sized links list.

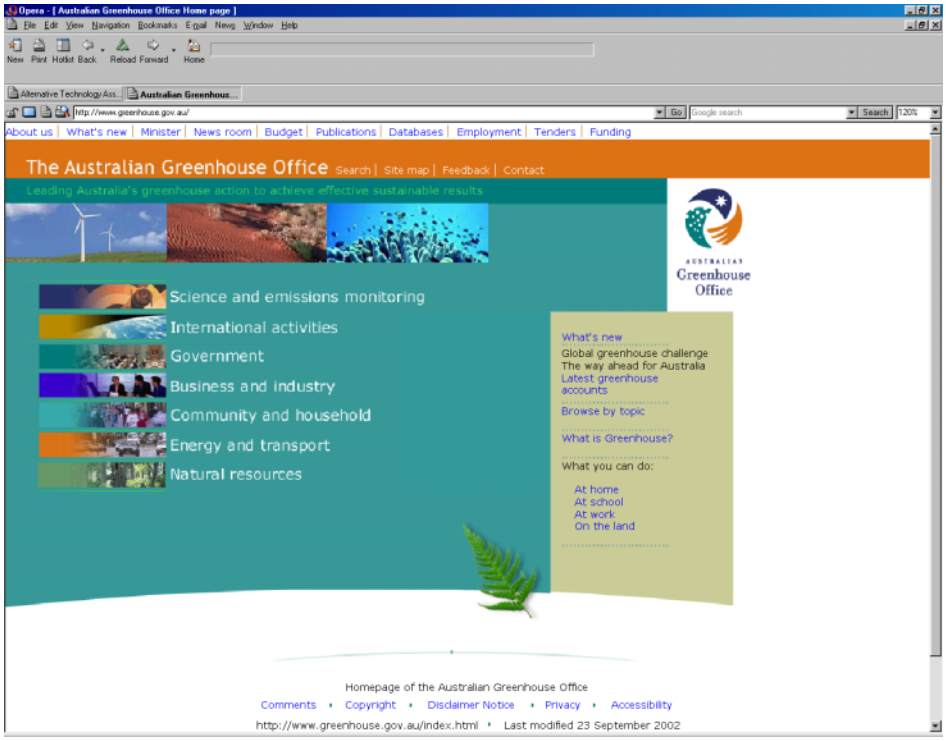
www.australianpaper.forests.org.au/

The aim of this site is to provide information to the public about current mismanagement of forests by both the makers of Australian Paper (Paperlinx), and the Department of Natural Resources and Environment (Victorian Government).

This website has been made by concerned citizens who, four years ago, embarked on a project to determine the source of Australian Paper products. Through the course of this project they came across many people concerned with similar issues.

This website can be used by everyone to make informed decisions about their paper source and to educate themselves on the current situation of Victorian forest management. It includes details on environmentally sound papers, and where to get them.





www.greenhouse.gov.au

This is the main website of the Australian Greenhouse Office. Despite being a government site, it is actually quite useful, with information on the many programs the AGO runs, as well as many other helpful pages, such as the energy ratings page for appliances, where you can select a new appliance based on the amount of energy it uses.

There are sections on biomass, carbon emissions and trading, the cool communities program, electricity generation, education, alternative fuels, the Kyoto Protocol and the Mandatory Renewable Energy Target, rebate programs and a great deal of other information.

While the information has a government hue, there is a lot on this site for anyone interested in environmental issues.

Build a simple water flow indicator

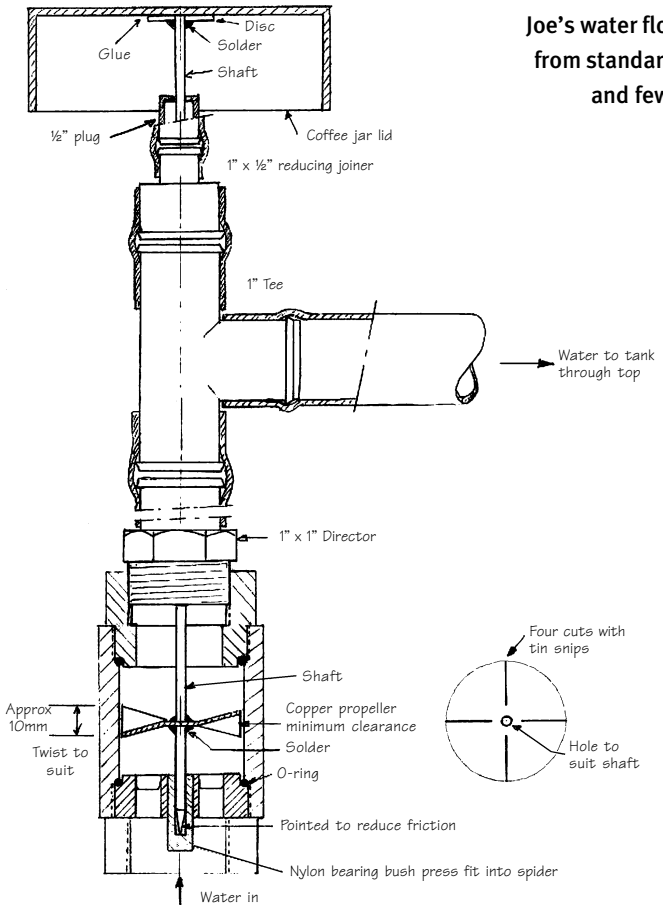
Joe Casteleijn, winner of the build-your-own competition for this issue, describes his simple indicator that tells him his pump is still running

Last year I installed a solar bore pump of the submerged piston type. In our case, the pump is situated 200 metres from and 30 metres lower than the house. With full sun, the pump moves 720 litres per hour while working at a total head of 55 metres from bore water level to tank full level.

Because it was necessary to make a trip to the pump to see if it was working (or not working), I decided to make a waterflow indicator for the water tank, which is close to the house. Now I can see at a glance whether water is flowing or not and also get an idea of the quantity being pumped at the time, while I am going about my daily jobs near the house. In our situation, the solar panels are on a tracker 150 metres from the pump, as the bore hole is sited at an unsuitable place for solar access. Indirectly, the flow indicator also shows me what the sun situation is at the tracker.

Making it

I found an old, clapped out Wingfield check valve in my junk box, the nominal 25mm body of which was just perfect for the job. This body has a three legged spider at one end in which the piston used to move up and down, as required in a check valve. My intention was to use the body in a vertical position, the water flowing upwards, rotating a four-bladed propeller on the way up. The water would then make a right angle turn through a one-inch barbed T and flow into the tank.



Joe's water flow indicator is made from standard plumbing fittings and few other items.

The vertical leg of the tee carries a poly plug which has been drilled to suit the vertical shaft of the propeller. The shaft is a short piece of bronze brazing rod and it carries the propeller and a brown plastic coffee jar lid. This lid becomes the indicator, and it revolves when water flows. Its side has been evenly divided into four white and four brown strips. The white ones contrast nicely with the brown lid and are visible at a considerable distance. I can see from almost 100 metres distance whether the flow has stopped, is going at full speed or any speed in between. Sometimes, when there is very little sun, the pump makes a slow stroke, stops, waits a moment for the maximiser and another stroke happens and the indicator starts, makes a few turns and stops again with such little flows, showing that it is very sensitive. I know at any time what is going on down the bore, at a glance.

The art of building it yourself

There are all sorts of whizz bang gadgets available for renewable energy systems, but if you are the do-it-yourself type then you might want to try making some of them yourself from a kit. Lance Turner looks at renewable energy equipment kits available in Australia and a few from overseas as well

When we started to look around for kits, it became obvious that there were quite a few that pertained to people living on renewable energy systems. Whether it be a solar regulator, voltmeter display or battery management system, there are kits out there to suit many peoples' needs.

We decided to approach the various kit suppliers here in Australia for samples of their kits so that we could build and test one of each to allow us to rate them comparatively—no small task, as it turns out!

While this review mostly focusses on Australian kits, we also looked at a few from overseas suppliers. This was done to fill holes in the areas that the kits covered. For instance, there was very little in the way of fluorescent lamp inverters for 12 volt systems available from Australian suppliers (at a realistic price, at least), but Cana Kit, a Canadian suppier, does both 20 and 40 watt tube inverters, so we reviewed these as well.

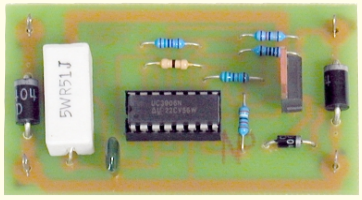
The workings of each kit is briefly described, along with its price, quality and presentation, and an evaluation of how well it performed. Obviously, some of these comments will be subjective, but they are intended to give you an idea of the value of the kit and how useful it may be. For kits that we didn't get to build and test, we have just listed the name, catalogue number and price.

The kits in this article are either a short form kit, which is usually just the circuit board and components, or a full kit, which includes the case and everything else to make a complete device. *

Altronics www.altronics.com.au

Altronics is an Australian company, based in Perth, that has been selling kits for many years. Presentation was generally good, but kits were supplied in a non-recyclable vinyl bag.

6/12 volt gel cell charger K1685 $26.50

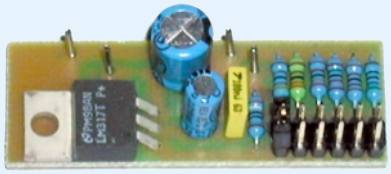


What it does: Charges sealed lead acid batteries. Short form kit.
Quality of instructions: Good quality photocopy.
PCB quality: Good, but some of the holes were too small, and no overlay.
All parts correct: Yes, but no IC socket supplied.
Ease of construction: Simple.
Time to build: 20 minutes.
Performance: Excellent, as it uses a smart multi-stage charger IC.
Comments: Ideal for keeping small (below 20 amp-hour) sealed lead acid batteries charged. Can be built as either a 6 or 12 volt charger.

Battery guardian K4080 $47.95

What it does: Provides audible warning of low battery voltage, as well as disconnecting any loads to prevent battery being flattened completely. Full kit.
Quality of instructions: Average photocopy.
PCB quality: Good, tinned and solder masked, but no overlay.
All parts correct: Yes, but a couple of extra bits supplied.
Ease of construction: Medium to difficult, as you have to wind a simple transformer.
Time to build: 75 minutes.
Performance: Exactly as described.
Comments: Designed for automotive systems, but a helpful add-on for any 12 volt DC system. No voltage indication like the Oatley kit has.

Universal regulator K3220 $6.50



What it does: Provides a regulated DC voltage in the range of 3 to 15 volts, at 1.5 amps, from an unregulated DC source, such as battery banks. Short form kit.
Quality of instructions: Good, but photos were too dark.
PCB quality: Good, tinned and solder masked, but no overlay.
All parts correct: Yes, a few extra PC pins and a spare resistor supplied.
Ease of construction: Simple.
Time to build: 10 minutes.
Performance: Very good, all output voltages were within 100mV of expected.
Comments: Ideal for powering all manner of DC loads, such as for running nine volt smoke detectors from 12 and 24 volt DC systems.

Digital voltmeter K4338 $64.95

What it does: Allows voltage monitoring of 12 or 24 volt DC systems.
Quality of instructions: Good.
PCB quality: Good, but no overlays on PCBs.
All parts correct: Yes.
Ease of construction: Medium to difficult.
Time to build: 1 hour, 40 minutes.
Performance: Exactly as described.
Comments: Has a low voltage hold function, to allow you to see the lowest the system voltage has reached since the meter was last turned on.

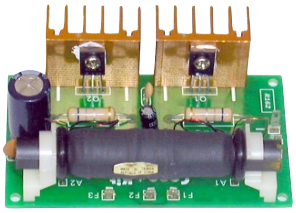
Other kits available from Altronics include:

Battery low-voltage cutout K4328 $24.95
PIC controlled ammeter K4336 $74.95
Mains monitor K6048 $59.95
25 amp ammeter K4335 $26.95
Multipurpose charger K1672 $229.95

Cana Kit www.canakit.com

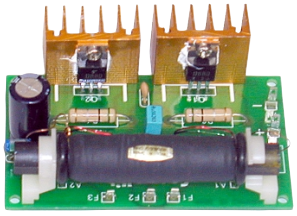
Cana Kit is a Canadian kit supplier with some interesting kits. They send to anywhere in the world. Their kits were supplied in a bubble pack without a recycling code.

20 watt fluoro inverter CK162 US$15.97



What it does: Drives fluoro tubes from 12 volts DC. Short form kit.
Quality of instructions: Excellent. Only two double-sided pages, but including step-by-step instructions.
PCB quality: Excellent. Fibreglass, screen printed, tinned and soldermasked.
All parts correct: Yes.
Ease of construction: Simple.
Time to build: 25 mins, not including fitting into a light fitting.
Performance: Would not consistently fire a cold tube with an input voltage below 14 volts. Would always fire the tube once it was warm, even down to 10 volts. Gave good light output.
Comments: No heatsink washer or transfer compound supplied. Heatsinks only supported by transistor. Finished kit was too big to fit in a single tube fluoro fitting.

40 watt fluoro inverter CK163 US$17.30



What it does: Drives fluoro tubes from 12 volts DC. Short form kit.
Quality of instructions: As per 20 watt kit.
PCB quality: As per 20 watt kit.
All parts correct: Yes.
Ease of construction: Simple.
Time to build: As per 20 watt kit.
Performance: Would always fire a cold tube with an input voltage above 10.5 volts. Seemed to have two stages of power output, depending on supply voltage. Gave reasonable light output but tube was not driven to full brightness.
Comments: As per 20 watt kit.

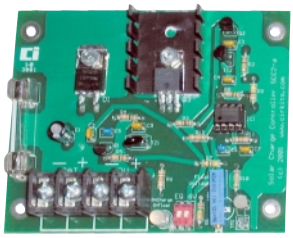
Other kits available from Cana Kit include:

Three digit LED ammeter, 0-5 amp CK147 US$19.30
0-100 volt digital LED voltmeter CK152 US$19.30
Dual display digital LED voltmeter/ammeter with power supply CK203 US$37.30
Universal digital LED panel meter CK221 US$21.96

CirKits www.cirkits.com

CirKits is a small US company selling just two renewable energy kits.

10 amp Universal Solar Charge Controller SCC2 US$45



What it does: Single stage charging control in a solar battery system. Short form kit.
Quality of instructions: Good but brief, yet has step-by-step construction guide.
PCB quality: Excellent, double sided, solder masked and tinned.
All parts correct: Yes, but no IC socket supplied.
Ease of construction: Medium.
Time to build: 40 minutes.
Performance: Exactly as described.
Comments: Simple to set up. The double sided PCB might be a problem for some if you make an error or have to fix a failure.

Other kits available from CirKits include:

Six amp solar regulator/battery warning/disconnect SPC2 US$55

ATA www.ata.org.au

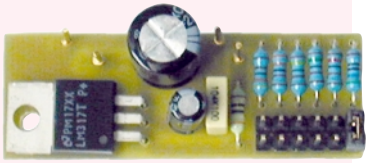
We have left the ATA kits out even though they are readily available, as we could not review them ourselves, of course. We have simply listed the kits available.
Mini maximiser kit: $35.00
Maxi Maximiser kit 12 amp: $80.00
Maxi Maximiser kit 20 amp: $140.00
20 amp speed controller: $45.00
Constant current supply: $8.00
Switchmode current/voltage supply: $27.00
LED halogen replacement: $18.00

Jaycar Electronics www.jaycar.com.au

Jaycar Electronics is an Australian company with outlets all around Australia that has been selling kits for many years.

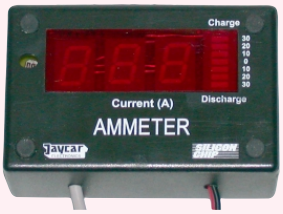
Their kits were supplied in a bubble pack without a recycling code, which means more plastic waste, although packs can be recycled in-store.

Regulated voltage adaptor KA1797 $8.95



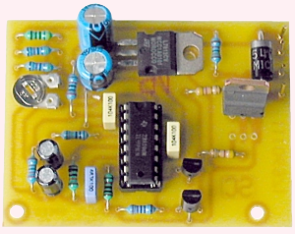
What it does: Provides a regulated DC voltage in the range of 3 to 15 volts, at 1.5 amps, from an unregulated DC source, such as battery banks. Short form kit.
Quality of instructions: Good.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Simple.
Time to build: 10 minutes.
Performance: Very good, all output voltages were within 100mV of expected.
Comments: Ideal for powering all manner of DC loads, as well as for running nine-volt smoke detectors from 12 and 24 volt DC systems.

80 amp ammeter KC5336 $89.95



What it does: Provides up to ±80 amps battery charge/discharge metering.
Presentation: Good. However, it is supplied in a bubble pack without a recycling code, which means more plastic waste. Full kit including pre-punched case.
Quality of instructions: Excellent, very detailed.
PCB quality: Good, but no PCB overlays.
All parts correct: Yes.
Ease of construction: Difficult. PCBs have very small pads and tracks.
Time to build: 2.5 hours
Performance: Worked as described initially, but when put in the case, which is difficult due to the tight fit, something was damaged and the unit would no longer display a valid reading.
Comments: A good idea, but case is too tight. The only kit in this article that experienced a failure.

10 amp motor speed controller KC5225 $23.95



What it does: Controls power flowing to a DC load, such as a motor or lamp. Short form kit.
Quality of instructions: Good, but lots of erratas to watch out for.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Simple to medium.
Time to build: 40 minutes.
Performance: Worked ok, but with trimpot supplied could not get motor to turn off completely. Circuit design has 90% maximum power limitation, so motor can't run at full power.
Comments: Circuit board power tracks were a bit thin for the optional 20 amp rating.

Jaycar continued on page 64

Continued from page 62

Water level indicator KC5330 $33.25

What it does: Provides a remote indication of water level in a tank. Full kit.
Quality of instructions: Good, but lots of erratas to watch for which slows building time.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Medium.
Time to build: 90 minutes, not including water tank sensor.
Performance: As described using a variable resistor in place of the sensor.
Comments: A good idea, especially if the tank is not visible from the house.

12V Battery guardian KC5334 $39.95

What it does: Provides audible warning of low battery voltage, as well as disconnecting any loads to prevent battery being flattened completely. Full kit.
Quality of instructions: Good, but a few erratas to watch for.
PCB quality: Average. No overlay, and some holes were drilled way too big.
All parts correct: Yes.
Ease of construction: Medium.
Time to build: 110 minutes.
Performance: As expected.
Comments: Designed for automotive systems, but a helpful add-on for any 12 volt DC system. No voltage indication like the Oatley kit has.

Multipurpose fast battery charger KC5315 $229.00

What it does: Fast charges Nicad, NMH, Lithium Ion, sealed lead acid and flooded lead acid batteries (maximum current six amps). Full kit.
Quality of instructions: Excellent.
PCB quality: Good, but no overlay on PCB.
All parts correct: Wrong cord grip grommet supplied.
Ease of construction: Difficult. Lots of internal wiring and some mains wiring.
Time to build: 6 hours 50 minutes.
Performance: Exactly as described.
Comments: Kit supplied with very little packaging, just a thin layer of plastic wrap. A great device, but not for the inexperienced builder. Worth the money.

Other kits available from Jaycar Electronics include:

18/36 watt high efficiency fluoro inverter KC5338 $99.00
Digital rain gauge KC5292 $55.00
Solar generator KE4730 $16.75

Futurlec www.futurlec.com

Futurlec sell a small range of kits through their website, mostly into the US market, but available to anyone.

10 amp solar regulator US$39

What it does: Single stage control of battery charging. Full kit.
Quality of instructions: Medium to good. Detailed, but copying quality a bit variable, and a few things needed clarification.
PCB quality: Average. Main PCB had all resistors except one incorrectly marked. LCD PCB was phenolic resin. Pads and tracks very small and fine.
All parts correct: Pins on LCD were bent, one segment didn't work. Power cable supplied too thin for 10 amp rating. PCB mounting hardware not correct.
Ease of construction: Difficult. Tiny PCB pads and tracks.
Time to build: 4 hours, 30 minutes.
Performance: Switching point too low, and hysteresis too large. Very easy modifications fixed both problems.
Comments: This kit is really only for the more experienced builder. Supplier happily accepted feedback and have told us that they will address the problems.

Other kits available from Futurlec include:

Mini-maximiser kit (ATA's kit) $US25.00
3.5 digit general purpose LCD display US$11.50
Kilowatt-hour meter kit (to be released soon)

Dick Smith Electronics www.dse.com.au

Dick Smith Electronics is a general consumer electronics company, with outlets all around Australia, that has been selling kits for many years.

Most kits were supplied in non-recyclable plastic bags. All kits were supplied with a guide to kit construction and quality feedback form.

One amp DC motor controller K3070 $16.69

What it does: Provides power control on small motors and lamps. Short form kit.
Quality of instructions: Excellent.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Simple.
Time to build: 15 minutes.
Performance: Exactly as described.
Comments: A useful kit for controlling small loads.

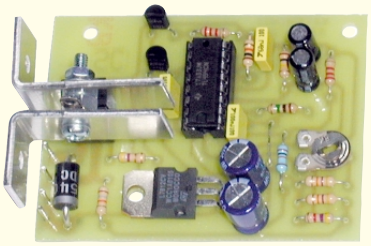
Voltage adaptor K3594 $9.93

What it does: Provides a regulated DC voltage in the range of 3 to 15 volts, at 1.5 amps, from an unregulated DC source, such as battery banks. Short form kit.
Quality of instructions: Excellent.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Simple.
Time to build: 15 minutes.
Performance: All outputs within 150mV except 15 volt—230mV over.
Comments: Ideal for powering all manner of DC loads, as well as for running nine-volt smoke detectors from 12 and 24 volt DC systems.

Low voltage battery cutout K3124 $29.88

What it does: Disconnects loads when battery voltage reaches a pre-set level to prevent battery being flattened completely. Full kit.
Quality of instructions: Excellent.
PCB quality: Good, but no overlay.
All parts correct: Yes.
Ease of construction: Simple to medium.
Time to build: 50 minutes.
Performance: Exactly as described.
Comments: A good addition for a small 12 volt system. Uses a relay for switching. The only kit supplied in recyclable packaging (cardboard box).

20 amp speed controller K3072 $26.50



What it does: Controls power flowing to a DC load, such as a motor or lamp. Short form kit.
Quality of instructions: Excellent.
PCB quality: Good, but no overlay.
All parts correct: Yes, but no IC socket supplied.
Ease of construction: Medium.
Time to build: 30 minutes
Performance: Worked okay, but with trimpot supplied could not get the motor to turn off completely. Circuit design has 90 per cent maximum power limitation, so motor will never run at full power.
Comments: Circuit board power tracks were a bit thin for the optional 20 amp rating.

Digital voltmeter K4209 $73.50

What it does: Allows voltage monitoring of 12 or 24 volt DC systems. Full kit.
Quality of instructions: Very good but some photos were a bit dark.
PCB quality: Good, but no overlay or mask, but were tinned.
All parts correct: The electrolytic capacitors had pre-cut leads, which were too short for two of them to allow them to be mounted flat as required.
Ease of construction: Medium to difficult.
Time to build: 1 hour, 55 minutes
Performance: Exactly as described.
Comments: Has a low voltage hold function, to allow you to see the lowest the system voltage has reached since the meter was last turned on.

Other kits available from Dick Smith Electronics include:

Battery charger regulator K3127 $28.80
Solar generator K3129 $16.85

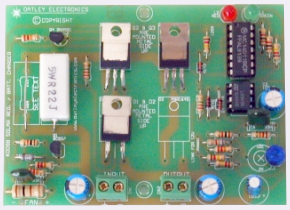
DIY Electronics www.kitsrus.com (available from Ozitronics www.ozitronics.com)

DIY is an Asian kit supplier with resellers in numerous countries. Ozitronics is an Australian reseller. While no kits were supplied for review, DIY sell the following kits that might be of interest:
General purpose LCD panel meter K34 $28.50
General purpose LED panel meter K61 $26.00
Five to 15 volt, 5 amp DC motor speed controller K67 $24.00
General purpose 1.5 amp voltage regulator K68 $17.00

Oatley Electronics
www.oatleyelectronics.com

Oatley Electronics is an Australian electronics surplus company that has been selling kits for many years.

Oatley's kits were supplied in non-recyclable plastic bags.



Solar regulator Koo9B $21.00

What it does: Single stage charging control in a solar battery system. Short form kit.

Quality of instructions: Average. Photocopy of original article that appeared in *Silicon Chip* magazine. Good detail on construction and testing.

PCB quality: Excellent. Fibreglass, screen printed, tinned and soldermasked.

All parts correct: Supplied with two MOSFETs but only one Schottky diode. C3 was not adequately rated—rated for 35 volts, while input can exceed 40 volts in a 24 volt system. 0.22 ohm power resistor supplied in place of 0.33 ohm.

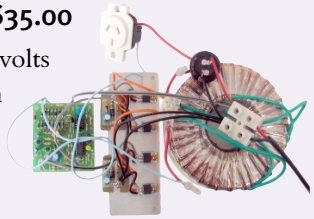
Ease of construction: Medium.

Time to build: 45 minutes.

Performance: As described

Comments: Very simple to set up, a good little kit. Can be used to control output of an unregulated battery charger.

12 to 240 volt inverter K127 $35.00



What it does: Inverts 12 or 24 volts DC to 240 volt AC. Short form kit.

Quality of instructions: Good, with a fair bit of detail.

PCB quality: Excellent. Fibreglass, screen printed, tinned and soldermasked (three PCBs).

All parts correct: Yes. One spare resistor and capacitor.

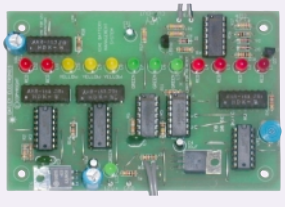
Ease of construction: Medium.

Time to build: 80 minutes, 2.5 hours including wiring of transformer.

Performance: Okay at low loads, but voltage was very load dependent.

Comments: Transformer is extra cost. Would be better if there was a separate PCB for the MOSFETs.

Battery management system K141 $32.00



What it does: Displays relative state of charge of battery. Has low battery voltage warning and optional load cutout output. Short form kit.

Quality of instructions: Printing okay, but very brief and needed more information on the low-voltage warning link points, A to I, on the PCB.

PCB quality: Excellent. Fibreglass, screen printed, tinned and soldermasked.

All parts correct: Yes. An extra 1uF capacitor supplied.

Ease of construction: Medium. Lots of wire links on the board.

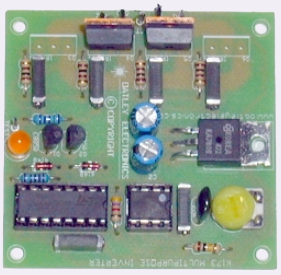
Time to build: 50 minutes.

Performance: Worked very well on both 12 and 24 volt systems.

Comments: Should have more green LEDs and at least one less yellow. A very neat display, and a good addition to simpler systems. The best kit of its type.

Multipurpose inverter K173 $18.00

What it does: Inverts 12 volt DC to 240 volt AC. Short form kit.



Quality of instructions: Good print quality, but no step-by-step instructions.

PCB quality: Good. Fibreglass, screen printed, tinned and soldermasked. Overlay had some incorrectly marked components which were noted in the instructions.

All parts correct: Yes.

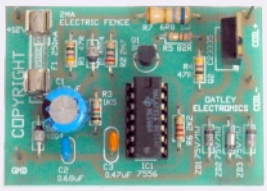
Ease of construction: Medium.

Time to build: 30 minutes, not including connecting the transformer.

Performance: Output with supplied transformer was quite low. Voltage was very load dependent.

Comments: Produces mains voltages, so not for the novice. Power connections were very crowded and too close to the MOSFETs.

Low power electric fence K046 $25.00



What it does: Provides a low power drive for an electric fence for use on farms et cetera. Short form kit.

Quality of instructions: Good.

PCB quality: Excellent. Solder masked, screen printed and tinned.

All parts correct: Yes.

Ease of construction: Simple.

Time to build: 15 minutes.

Performance: Produced a high tension pulse at around one per second, but hard to tell how much kick it had as we didn't touch it!

Comments: Requires an automotive coil to complete the kit.

Other kits available from Oatley Electronics include:

SLA battery booster K091 $27.00
20 amp speed controller K098 $18.00
CFL inverter K111 $25.00

UNIVERSALITY OF THE SUN

PHOTO-VOLTAIC PANELS

These incredible, triple junction, amorphous panels are taking the market by storm, and for good reasons! **Over 20% more actual battery charging amps** than crystalline panels under realistic, high temperature Australian conditions! Shadow tolerant, **unbreakable construction**, (no glass) very low embodied energy and weight. **20 year performance warranty.**

	Amps @ 14V and 50°C	Inc GST
Uni-Solar US-64	4.5A	$ 649
Uni-Solar US-42	3.0A	$ 499
Uni-Solar US-32	2.25A	$ 399

KYOCERA Panels

Ok folks, if you must buy crystalline, at least go for the best, and from one of the planet's leading optical and electronics companies.

Kyocera KC120-1	6.5A	$ 1099
Kyocera KC80-1	4.7A	$ 729

WIND DRIVEN GENERATORS

The first wattage rating is at 20 knots, (realistic) the second figure is peak (rare). Wind power obeys the "cube" law. Double the wind speed = 8 times the power and vise versa. If your average wind speeds are below 8 knots forget it!

Ampair 100	12/24v	60 / 100 watts	$1557
LVM 612/624	12/24v	120 / 360 watts	$2461
Soma 400	12/24v	400 / 530 watts	$3158
Soma 1000	24/48v	1000 / 1200 watts	$4171
Bergey XL.1	**24/48v**	**1000 / 1200 watts**	**$4595**
Westwind 3kW	24/48v	1700 / 2700 watts	$11999
Westwind 5.5kW	48/110v	3500 / 5500 watts	$17399

PLASMATRONIC REGULATORS

Brilliant Aussie built units, with the edge on performance and value. A digital display presents all essential solar system parameters, volts, amps in / out, amp-hrs in / out. With the optional shunt and PLS, the inverter load amps and daily amp-hrs used can be displayed. Inbuilt 30 day data logger.

PL-20	12/24/48 volt 20 amp smart controller	$ 249
PL-60	12/24/48 volt 60 amp smart controller	$ 599

TRUE SINE WAVE INVERTERS

Your country needs you....to support it's electronics industry, and with superb **true sine wave** inverters at these prices why on earth wouldn't you? Come on...get on the phone and do it!! Your blues will be gone without a Trace!

		Inc GST
S.E.A SEAP-12-150	12v 150 / 400 watt	$ 399
Selectronic SE-12 / 12	12v 600 / 1500 watt	$ 1117
Latronic 47-BKZ-12	12v 700 / 2800 watt	$ 1169
Selectronic WM1200-12	12v 1200 / 3600 watt	$ 1767
S.E.A SEAP-12-1K3	12v 1300 / 3900 watt	$ 1999
Latronic 412-BKZ-12	12v 1300 / 4000 watt	$ 1861
Latronic 518-BKZ-12	12v 1800 / 5500 watt	$ 2272
S.E.A SEAP-12-2K0	12v 2000 / 5000 watt	$ 2899
Latronic 48-BKZ-24	24v 800 / 3200 watt	$ 1099
Selectronic WM1000-24	24v 1000 / 3000 watt	$ 1459
Selectronic WM1500-24	24v 1500 / 4500 watt	$ 1851
S.E.A SEAP-24-2K2	24v 2200 / 6000 watt	$ 2571
Selectronic SE-32	24v 2400 / 7000 watt	$ 2899
Latronic 525-BKZ-24	24v 2500 / 7500 watt	$ 2515
Latronic 530-BKZ-24	24v 3000 / 9000 watt	$ 2796
Latronic 535-BKZ-48	48v 3500 / 10500 watt	$ 2899
Selectronic SE-42	48v 3600 / 10000 watt	$ 3553
S.E.A SEAP-48-3K8	48v 3800 / 10500 watt	$ 3637
P.S.A. RAP-5-48	48v 5000 / 10000 watt	$ 8498
Latronic 915-GI-72	72v 1500va Grid feed	$ 2861

ENERGY STORAGE BATTERIES

We've supplied these premium grade home power system batteries for 18 years. They're rated at 4000 cycles, ie, an average life span of 10+ years in a correctly designed plant. 5 yr honest warranty from the world's leading battery company. EXIDE ENERGYSTORE have become the industry standard in the past twenty years for reliability, performance and price. **All sizes available. Free freight to major centres.**

EXIDE 24RP830T	24v 21840 watt-hours	$ 2772
EXIDE 24RP910T	24v 24000 watt-hours	$ 3437
EXIDE 24RP1080T	24v 28320 watt-hours	$ 3882
EXIDE 24RP1350T	24v 34800 watt-hours	$ 4715

Solar Technology Designers Catalogue 2003

Now entering it's 13th year, this compelling 150 page master design manual / catalogue is endorsed by thousands of enthusiasts as their renewable energy bible ! This edition is substantially revised, and written in a clear and innovative style for your renewable enlightenment, by leading solar engineer and pioneer Christopher J Darker. cdarker@unisun.com.au

Estimating your energy requirements; *Power system design; *Solar radiation maps; Solar (PV) panels; * Wind generators; Batteries; Regulators; *Inverters; *Chargers; Energy efficient appliances; Water pumping; Water heating; *Passive solar buildings; *Heat Pumps;

This manual is for consumers, dealers, installers, electricians, educators, administrators, journalists, politicians. From beginners to experts this is undoubtably the first and perhaps the only book to read before designing, purchasing or assembling a renewable energy system. **View table of contents and sample pages at www.unisun.com.au**

UNIVERSALITY OF THE SUN (UNI-SUN)

1/13 Scanlon St, (Box 2009) Solar City, Esperance, WA 6450, Ph: 08 9071 1513, fx: 08 9071 3591, mob: 0418 934 607 www.unisun.com.au email: cdarker@unisun.com.au

Your help is needed now to help stop global warming!

Tackling climate change is as important and urgent as ever. What we do in the next 10 years will make a big difference to the state of the world in 2100. **Your help is needed now** to address climate change as fast as possible.

By becoming a regular *Supporter* of ATA you will help fund activities that achieve **tangible cuts in greenhouse gas emissions**.

In particular, ATA will:

- ✶ Raise the profile of climate change and the practical ways it can be tackled.
- ✶ Advocate innovative, practical changes to government policy.
- ✶ Cut the energy bills of low income households in need.

It is regular donations from *ATA Supporters* that fund these practical activities. *Supporters* are kept up to date with ATA activities every quarter.

ATA's Strategic Plan 2002-2005 outlines other upcoming projects. See www.ata.org.au to download a copy, or contact ATA to have a copy sent to you.

Sign up on page 73

Win a

Multipurpose fast battery charger

From Jaycar Electronics

Valued at around $229

This is a built version of Jaycar's kit KC5315, as featured in our kit review article in this issue. It fast charges nicad, NMH, lithium ion, sealed lead acid and flooded lead acid batteries, with charge currents up to a maximum of six amps.

The charger will be given to the author of the best build-your-own style article. You don't have to be a tech-head, just have a project, simple or complex, electrical or mechanical, that has appeal to do-it-yourselfers and involves renewable energy or appropriate technology in some form. It may be a regulator, pedal-powered generator, a solar cooker or anything useful, really, but it must be a completed working project.

We have a total of 24 built kits to give away over the next few issues of ReNew.

Just send your ideas to: *ReNew*, PO Box 2001 Lygon St North, East Brunswick VIC 3057, email: ata@ata.org.au. Competition closes Friday 11 April 2003.

Like *ReNew*? —join the ATA

ATA is a not-for-profit association that now represents over 3000 members around Australia and New Zealand. It has lead the way in promoting renewable energy, energy efficiency and water conservation since 1980.

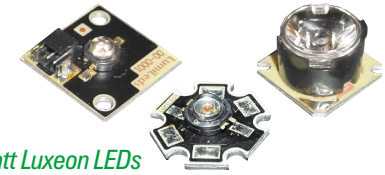
ATA is well known as the publisher of *ReNew* magazine, which reaches more than 40,000 readers, and for its practical, independent information. ATA's 14 branches and members make up the region's largest network of people with these interests.

ATA's practical activities include running demonstration sites, practical energy saving in community buildings, running mobile education displays, open houses and field days. ATA advocates on behalf of householders and ATA members in government and industry forums.

Locations of ATA branches are: Adelaide, Alice Springs, Brisbane, Cairns, Canberra, Coffs Harbour, Gold Coast, Melbourne, Perth, Sunshine Coast, Sydney, Tasmania, New Zealand and Wimmera (Western Victoria). Contact the ATA national office for further details.

ATA shop by mail

Maximiser kits and other amazing things



1 watt Luxeon LEDs

We now have stocks of these impressive LEDs. Each single Luxeon LED is equivalent to a dozen or more high-brightness 5mm LEDs in light output. For more information, prices and to order, go to the ATA's website at www.ata.org.au or call Lance on (03)9380 3411.

Cold cathode fluoro tubes

Cold cathode fluoro tubes, available in white, red, blue, green, and UV (blacklight). There are also 12 volt DC inverters to suit, which makes these lights ideal for small lighting systems, such as solar garden lights, accent lights, stairwell safety lighting or miriad other uses. Please note that one inverter is required for each tube.

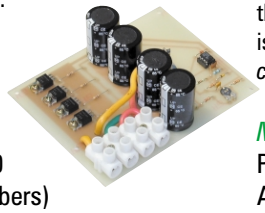
For more information, prices and to order, go to the ATA's website at www.ata.org.au or call Lance on (03)9380 3411.

Cold cathode fluoro tube sets

These tube and inverter sets are prewired ready to go. The tube is mounted in a protective fitting, as is the inverter, and the two are joined by around 500mm of cable. Connection to the inverter is by a 750mm pair of leads. These devices run on 12 volt DC and are ideal for small lighting systems. 100mm and 300mm tube lengths available.

New

Maxi-maximiser kit



Price: 12 amp: $80 ($75 for ATA members), 20 amp: $140 ($130 for ATA members)

A larger version of the mini-maximiser which is available in 12 and 20 amp versions. The kit allows you to build the unit for use on either 12 or 24 volts. You must specify current rating when ordering.

Item code: MAXIMAX

5 watt Luxeon LEDs

If you thought the 1 watt LEDs were bright, you should see these! With over twice the current draw and twice the voltage of a 1 watt LED, each single 5 watt LED is equivalent to up to 50 or more high-brightness 5mm LEDs in light output. Available in blue, green, cyan and white. For more information, prices and to order, go to the ATA's website at www.ata.org.au or call Lance on (03)9380 3411.

Constant current circuit kit

This short form kit allows you to build a simple constant current circuit for driving LEDs from almost any DC voltage. It is available in three sizes, 20mA, 300mA (for the 1 watt Luxeon LEDs) and 650mA (for the 5 watt Luxeon LEDs). These kits could also be used to charge nicad and NMH batteries at a fixed current. Please specify which current rating you need when ordering.

RRP: $8 plus $4 postage inside Australia

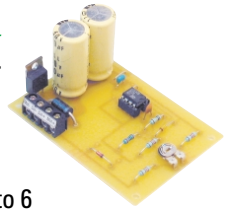
Item code: CCBOARDxxx where xxx is the current rating in mA (020, 300 or 650).

Digital power meter

The SparOmeter is an electronic meter that will measure the amount of energy used by any appliance or group of appliances plugged into it, up to 2400 watts. It can display the energy used in kWh, or read out the actual cost of using the appliance, either in accumulated cost or estimated cost per year. It also records the minimum and maximum power drawn by the appliance in the recording period, which is user selectable. $260 plus postage. *Item code: SPAROMETER.*

New

Mini-maximiser kit



Price: $35 ($30 for ATA members)

Our popular mini-maximiser kit will handle pumps up to 6 amps. The kit allows you to build the unit for use on either 12 or 24 volts.

Item code: MINIMAX

Luxeon optical collimator and reflector

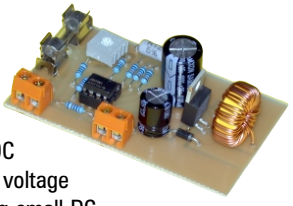
The luxeon optic is the same as in the LEDs with optics, just without the black plastic holder. Fit this to a 5 watt LED for a great torch or directional floodlight. $6.50 each.

The reflector is not designed for the Luxeon LEDs, but fits nicely over them to give a semi-directional output. $0.50 each.

Note that there is no postage on these items when ordered with LEDs.

New

Switchmode LED driver kit

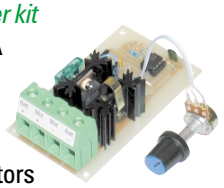


This kit allows you to build a simple switchmode DC to DC converter with either voltage limiting (for powering small DC appliances from up to 30 volts DC) or current limiting (for driving LEDs directly from up to 30 volts DC). The voltage or current is fully adjustable, allowing the one design to be used for a huge number of appliances or LED types, including the 1 watt and 5 watt Luxeon LEDs. Efficiency is typically over 70% on most input voltages.

Kit includes circuit board, all components and instructions, and fuses in the following ratings: 50mA, 315mA, 500mA and 800mA. No case is provided. *Item code: SWITCHMODE.*

New

20 amp speed controller kit



Price: $40 ($35 for ATA members)

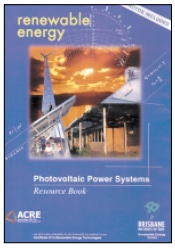
This controller allows you to vary the speed of 12 or 24 volt DC motors from 0 to 100%. It is also ideal for controlling loads such as incandescent/halogen lamps and heating elements. It is ideal for use on small electric vehicle projects, such as electrically assisted bikes and go-carts. While it is rated at 20 amps, this is very conservative, as we have tested it to over 30 amps without problems.

Item code: SPEEDCON

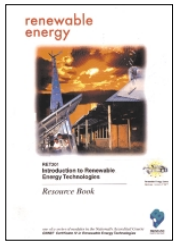
Order on page 73

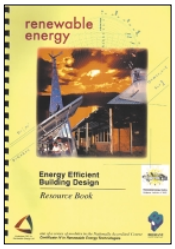
Renewable energy and energy efficiency in detail

Photovoltaic Power Systems Resource Book
Brisbane Institute of TAFE
Price $92.00, Paperback.
Covers photovoltaic device physics and manufacturing, module operating characteristics, system configurations, batteries and other components, water pumping systems, stand-alone PV system design, installation, maintenance and fault finding.
Item code: PVPSRB

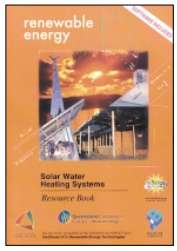


Introduction to Renewable Energy Technologies
Brisbane Institute of TAFE
Price: $73.70 Paperback, approx 300pp
This book contains a wealth of information on renewable energy systems, their sizing and design.
Item code: IRET





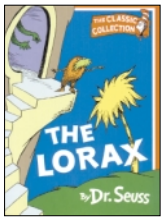
Energy Efficient Building Design Resource Book
Brisbane Institute of TAFE
Price $73.70, Paperback, approx 300pp
Covers basic principles of passive solar and energy efficient building design with sections on thermal mass, insulation, building orientation, landscaping and much more. *Item code: EEBD*



Solar Water Heating Systems Resource Book
Brisbane Institute of TAFE
Price $92.00, Paperback.
A thorough and comprehensive guide to solar water heating. Covers domestic and commercial solar water heaters and solar pool heating.
Item code: SWHSRB

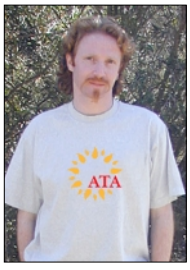
Just for kids

The Lorax
Price: $7.95
This Dr Seuss classic is a great story teaching about the need to care for the environment.
Item code: LORAX



Eco-fun
Price: $18.95
A fun-filled activity collection from David Suzuki and Kathy Vanderlinden. Activities include measuring pollution, creating a forest ecosystem, making recycled paper, building a worm composter, and many others. *Item code: ECOFUN*

Be a fashion guru!



ATA T-shirts
Price: $25.00 plus $5 postage
Sizes: S, M, L, XL
Show your support for the ATA with one of these great Aussie-made T-shirts.
Item code: TSHIRT
Note: You must state size when ordering!

Save water this summer

Greywater Diverter
Price: $33.00 plus $8 postage
Don't send that water down the drain, use it to water your garden! Fits standard 50mm pipes, or other sizes with appropriate adaptors.
Item code: DIVERTER

Renewables on CD ROM

SoftROM
Price: $33.00
Our CD ROM of the first 40 *Soft Technology* back issues is a great searchable resource. Just $33 plus $4 postage inside Australia.
Item code: SOFTROM

ReNewROM
Price: $65 ($55 for ATA members) plus $4 postage
Our long-awaited second CD ROM of the issues 41 to 70 of *Soft Technology* and *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 30 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM*

Remember to keep checking ATA's online webshop for new products including books, electronic kits and items, and other exciting things!

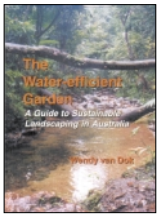
The Water-efficient Garden

Author: Wendy van Dok

Price: $25, As reviewed in *ReNew* issue 81

Practical and detailed information on planning and design of a water-efficient garden, including use of greywater on the garden.

Item code: WEG

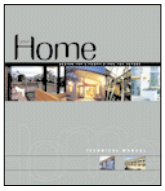


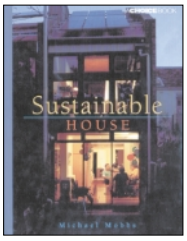
Your Home Technical Manual

Price: $49.50

Gives you the information you need to design and build a more comfortable home that is less expensive to run while being more environmentally friendly. Contains over 60 fact sheets on sustainable solutions for designing and building your home.

Item code: YHTM





Sustainable House

Author: Michael Mobbs

Price: $38.50, Paperback, 188pp

The sustainable house in Sydney provides all of its own power and waste water recycling on-site. Contains many great ideas on how to make your house less of a burden on the planet.

Item code: SHB

When the wild comes leaping up

Author: Various. Editor: David Suzuki

Price: $24.95, Paperback, 235pp

A collection of short pieces reflecting on people's interactions with nature, this is a thought provoking look at the magic and beauty of the natural world and its power in our lives.

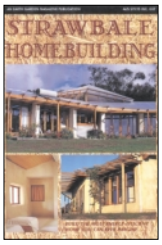
Item code: WHENWILD

Strawbale Homebuilding

Price: $19.95, Paperback, 156 pp.

This book details practical strawbale building practices you can use to build anything from a small cabin in the bush to a mansion in the city. A great book that details many homes that have been built around Australia.

Item Code: SBH

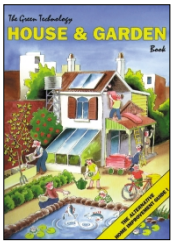


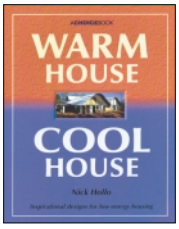
The Green Technology House and Garden Book

Price: $11.00, Paperback

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



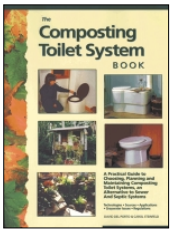


Warm House, Cool House

Author: Nick Hollo

Price: $33.00, Paperback, 172pp

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. *Item code: WHCH*



The Composting Toilet System Book

Authors: David Del Porto & Carol Steinfeld

Price: $43.90, Paperback, 234pp

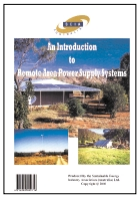
Covers many different composting toilet systems, including those available in Australia, and thorough general information about composting toilets. Includes a chapter on greywater. *Item code: CTSB*

For remote properties

Remote Area Power Supply Systems: An Introduction

Price: $33.00

New edition! Enables the average person to gain a good grasp of what RAPS systems are all about. Covers individual system components, correct sizing, safe installation and maintenance. *Item code: RAPSS*



Windpower Workshop

Author: Hugh Piggott

Price $30.80, Paperback, 160pp

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*

Solar hot water

ATA Booklets series: Solar Hot Water

Price $6.90 each (inc postage)

Solar hot water is possibly the best way to get started with renewable energy. This booklet outlines all of the different available system types and which one will best suit your needs.

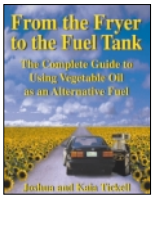
Solar electricity

ATA Booklets series: Solar Electricity

Price $6.90 each (inc postage)

Covers all the basics you need to know when designing a solar power system.

Vegetable oil for fuel



From the Fryer to the Fuel Tank

Author: Joshua Tickell

Price: $34.95, Paperback, 160pp

A great book that shows the reader how to make a clean-burning renewable fuel from waste vegetable oil. Includes detailed instructions on making and using the fuel in a standard diesel vehicle. *Item code: FFTFT*

Order on page 73

Join ATA and *WIN* a grid-interactive inverter

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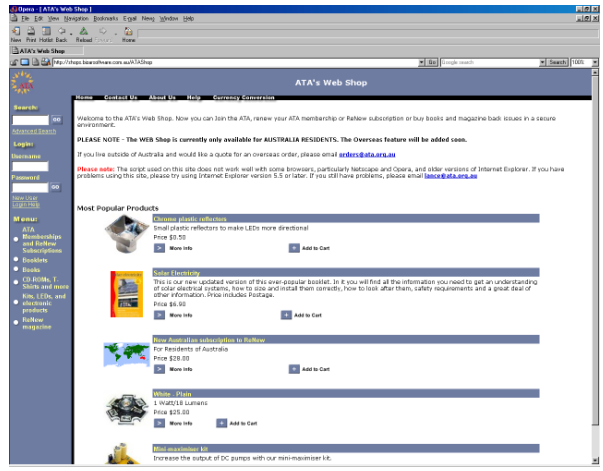

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83/03

Re-use of compact fluoros

In his efforts to reduce toxic waste and make efficient use of electric power, Jozef Steenhout has re-used quite a few compact fluoro lamps (CFLs). Below he explains how this can be done by anybody with some basic electrical knowledge and a soldering iron

Compact fluoros sometimes die early, and the failure may be either in the the electronic ballast or the tube. Both parts of these lamps can be put to good use elsewhere, and I would like to show you how you can make use of 'dead' CFLs.

Firstly, I would like to start by looking at the pros and cons of using electronically ballasted compact fluoros versus coil regulated (ferro-magnetic ballasted) fluorescent lamps.

The electronic ballast (inverter) guarantees a good power factor, meaning the current drawn is as low as possible. Coil regulated fluoros have a bad to very bad power factor. They put a high current load on the electric circuits without drawing much power.

The electronic inverter is highly efficient. I estimate the power loss at about three watts for an 18 watt lamp, versus a seven watt loss for a coil regulated lamp. One can find an even worse rip-off in this regard here in Indonesia, where 10 watt lamp sets are sold with a resistor regulator instead of a coil. This makes for a very cheap combination, but 20 watts gets lost in that resistor.

There is no flicker in electronic lamps due to the high frequency at which they operate.

They are very light and, of course, compact.

Coil regulated fluoros are less prone to electrical failure than the electronic types, where many electronic components are crammed together on a small printed circuit board. Most of these components carry a high voltage. Moisture or small insects can cause a breakdown easily.

CFLs are normally not serviceable, whereas coil types allow for the lamp and starter to be replaced easily. CFLs have no starter.

CFLs may cause radio interference, particularly the very cheap types without filtering. I will describe ways to reduce interference later.

CFLs do not like heat. I experience frequent inverter breakdowns when the lamps are mounted so that the inverter is on top of the glass tube. Heat from that tube seems to damage the electronics after a while. This happens less with low power CFLs.

Re-use of CFLs

CFLs which have died can be given a new lease on life. The inverter can be re-used by attaching a new lamp or the inverter can be built into a standard tube lamp fitting. In case the failure was in the inverter, the lamp can still be re-used. Repairing a damaged inverter is usually not worth it.

Most CFLs can be opened by removing the top cover with a screwdriver. That cover is sometimes sealed to the lamp body which means cutting with a hacksaw.

Make sure the lamp has been de-energised for a few minutes before opening to prevent receiving an electric shock from the electrolytic capacitor inside. When fully charged, it carries more than 300 volt DC, which is a very dangerous voltage.

Two wires run from the lamp fitting to the inverter board, and four wires connect the lamp to that same board. Each end of the glass lamp tube contains a filament electrode which is connected with two wires, each to the inverter board. The electrode ends are normally soldered directly to the inverter board.

Re-using CFL tubes

Worn out lamps can be replaced by a lamp of roughly the same wattage, retrieved from a unit where the inverter has died. Solder the replacement tube to the inverter board and fix with silicone rubber. It is as simple as that.

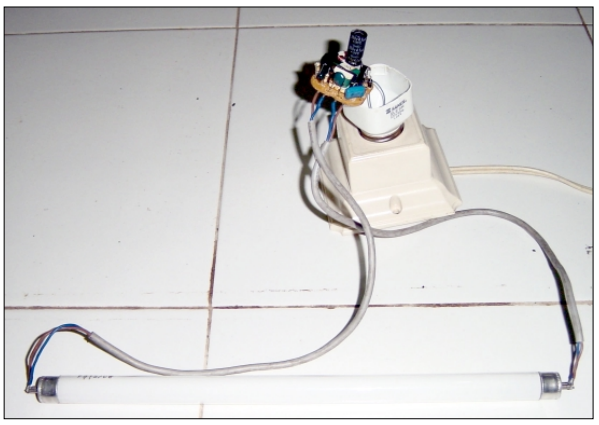

Photo 1. The setup used for checking a defective CFL and testing a CFL inverter-lamp combination. A nine watt inverter is shown connected to an eight watt lamp.

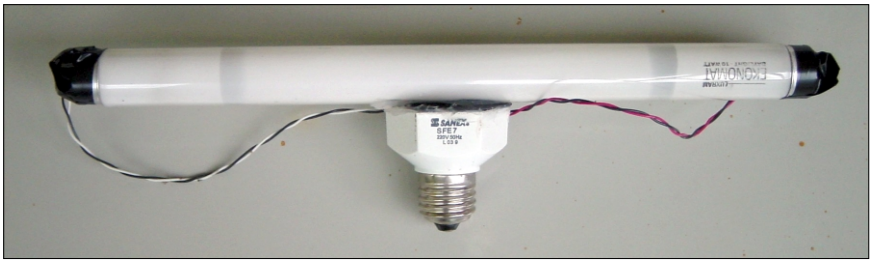

Photo 2: Reusing a still working CFL ballast to run a straight fluoro tube.

Re-using a CFL inverter

Sometimes the lamp has died and the inverter is still working. In this case, a standard straight tube can be used. Once again, the wattage of the CFL and the tube have to match somehow. I found that it is better that the CFL has a slightly higher wattage rating than the tube to be attached. Otherwise significantly less light is produced.

Solder two twin flexible wires to the lamp ends and solder these to the inverter board for testing. I use a lamp socket with power lead and plug to hold the inverter in place while testing (see Photo 1).

When I have a good working combination, I proceed by attaching the tube on top of the inverter body. I start by cutting a piece of hard plastic computer diskette to cover the inverter. Once attached with silicone rubber and settled, the lamp is glued on top. I normally keep the wires soldered to the lamp, which means that soldering is required when replacing that lamp later. Alternatively, wire terminals can be used. To finish off, the lamp ends are covered with PVC tape. This arrangement can be seen in Photo 2. This light can be fitted in places where the aesthetic appeal is not very important, like corridors, sheds and toilets.

Alternatively, the inverter can be built into a standard fluoro fitting, thereby replacing the coil regulator and starter.

After testing the inverter/lamp combination, the inverter can be built into

Warning

This project requires that you have a good understanding of the safety procedures associated with working on electrical power systems. If you are inexperienced or have any doubts as to your ability to complete this project safely, we suggest that you get help from a suitably experienced person. The publishers of *ReNew* take no responsibility for injury or damage caused by anyone attempting this project.

the lamp fitting. Mount the inverter board on a piece of diskette with silicone after soldering new and sufficiently long power and lamp leads. I usually spray the inverter board a couple of times with clear varnish to give it some degree of protection.

Subsequently, I glue the board in the fitting with silicone rubber and solder the lamp wires straight to both sockets, bypassing the starter. In case the unused starter place leaves a hole, I cover that with plastic as well. This combination can be fitted as a normal fluoro light where the lamp can be replaced easily (see Photo 3). The example shown has a 10 watt lamp, line filter with built-in fuse and a VDR (voltage dependent resistor) added.

Due to the large unused space in a standard fluoro fitting, a few extras can be added. See Figure 1 for the complete schematics. Most of the better CFLs

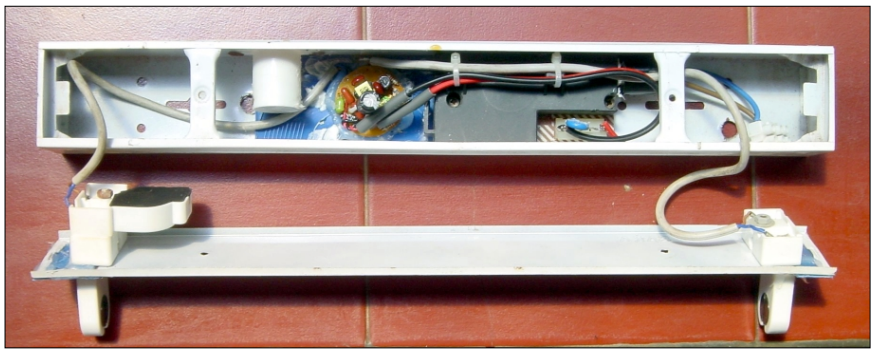

Photo 3. An inverter mounted in a standard fluoro fitting, which uses a 10 watt lamp. The fitting also has a line filter, fuse and VDR.

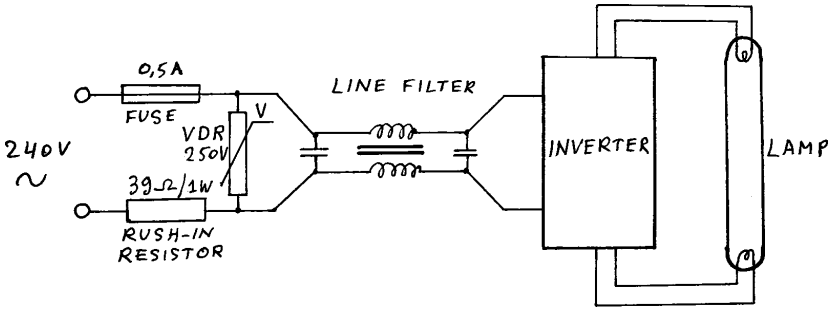

Figure 1. Schematics of a complete setup with fuse, VDR, rush-in resistor, inverter and of course, lamp.

have some of these features built in, like line filtering, a fuse and rush-in resistor. I have never seen a built-in VDR though.

Rush-in resistor

When the lamp to be used equals or exceeds 15 watt, it makes sense to mount a rush-in resistor in the power lead to the inverter. Something like 39 ohm, 1 watt will do. This resistor greatly reduces the rush-in current of the inverter and thereby protects the rectifier diodes and capacitor.

VDR overvoltage protection

A small 250 volt VDR can be soldered across the 240 volt input but after the fuse (if used). This VDR reduces voltage spikes in the supply and hence protects the inverter electronics in case of a thunderstorm. A low-power 250 volt type will do the job. They can be bought in electronic component shops.

Fuse

A small 250 volt compatible fuse in the order of 500mA (0.5A) in the power line to the inverter will provide protection against a short circuit. It is a good idea to mount a fuse in all re-used lamps. Electronic and sometimes automotive shops sell small, fully insulated fuse holders with wire terminals.

Line filtering

Some cheap CFLs create a lot of electric noise, which usually affects radio and, to a lesser extent, TV reception. Most of that noise travels through the power lines. Adding line filtering as close as possible to the lamp inverter will eliminate most of that noise. Many moons ago I bought some line filter/fuse assemblies from a ham radio flea market. They consist of a dual wound coil with a capacitor on both sides. No ground connection is required. Suitable line filters can be retrieved from discarded switchmode power supplies as well, but they are not insulated.

A very simple way of filtering out high frequency noise is the use of clamp-on ferrite filter blocks, as they are very commonly used with computer equipment. Such filter blocks can be bought in some computer stores. They simply snap on the power leads. This way of filtering should be considered first, due to its simplicity. A small model can be clamped on the power wires. The bigger model allows for the power wires to make a couple of turns through the hole, thereby improving the filtering. ✲

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What's a watt?

Dr John Mills takes a look at some basic electrical terms, and how they apply to energy systems

Electrical quantities and their units are not directly experienced like, say, distance or weight, and so can be confusing. Newspaper reports frequently get them wrong, adding to the confusion. This article gives simple explanations of the more important of them. Its purpose is to help the reader wanting information about renewable energy systems and remote power systems to understand catalogues, talk sensibly to sales people, and understand how these systems work.

Units and prefixes

The units and prefixes used in this article are summarised here. First the units:

Quantity	Symbol
Energy	joule (J)
Power	watt (W)
Voltage	volt (V)
Current	ampere (A)
Resistance	ohm (W)
Length	metre (m)
Weight	gram (g)

The same set of prefixes are used for all units. The prefixes used here are:

milli (m)	one thousandth
kilo (k)	one thousand
Mega (M)	one million
Giga (G)	one billion

These symbols are not abbreviations but fixed symbols just like the degree symbol (°). The case (small letters or capitals) is important; don't confuse 'm' (milli) with 'M' (Mega)! They do not take 's' in the plural, so 5km, not 5kms or 5KM.

Energy

Energy is not specifically an electrical quantity. Energy can be neither created nor destroyed, but it can be converted between many different forms, including electrical, motion, pressure, chemical and gravitational.

Energy is measured in joules (symbol J) or commonly in its multiples kilojoules (kJ) and megajoules (MJ).

One kilojoule will raise the temperature of one litre of water about a quarter of a degree. So to bring one litre of water at 20°C to the boil needs about 320kJ. A typical car battery, fully charged, holds 2.5MJ. A litre of petrol, when burnt, releases 34MJ. The energy of motion (kinetic energy) of a one tonne motor car travelling at 60km/hr is 139kJ. Travelling at 80km/hr, the energy is 247kJ—nearly twice as much.

Comparison of the energy stored in a battery and in petrol shows the reason for the major problems with electric vehicles; battery weight and limited range.

Power

Power is the rate of conversion or transfer of energy. Power is measured in watts, symbol W, or its multiples kilowatts (kW) and megawatts (MW). Like energy, it is not specifically electrical. A watt is one joule per second. Here are examples of the power used or produced by some typical devices: Electric torch, 3W; Fluorescent tube, 38W; Light bulb, 60W; Electric drill, 500W; Electric bar radiator, 1kW; Electric kettle, 2.4kW; Wind turbine, 2.5kW; Car engine, 100kW (maximum output); Power station, 500MW.

In electricity supply, it is often convenient to use a different unit for energy, the kilowatt-hour, instead of the joule. One kilowatt-hour is the energy transferred when one kilowatt flows for one hour. It equals 3.6MJ, and costs about 14 cents from the electricity supply authority.

Voltage

Voltage is the electrical driving force, rather like the pressure in waterpipes. It is measured in volts, symbol V. It exists between two points in an electric circuit, for example between the two terminals of a battery.

Current

Electric current is like the flow of water in a pipe. It is measured in amperes, symbol A. One ampere is a specific—very large—number of electrons per second. Unlike water in a pipe, electric current must flow around a complete circuit back to the starting point. The voltage of a battery, or of the supply mains, is nearly, but not quite constant—provided that the current drawn is within the capability of the supply. The electric current depends on the supply voltage and the load connected to it.

Electric power

Electric power, in watts, is equal to the

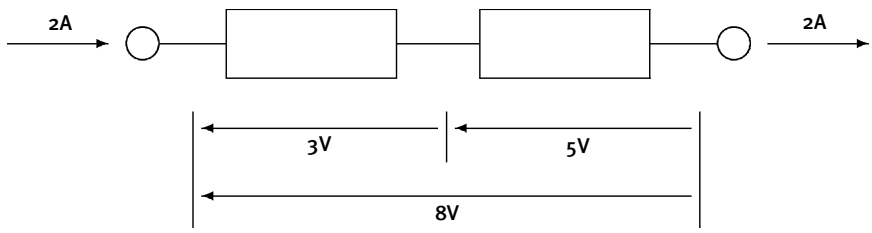


Figure 1. Elements in series: Voltages add together but current is the same.

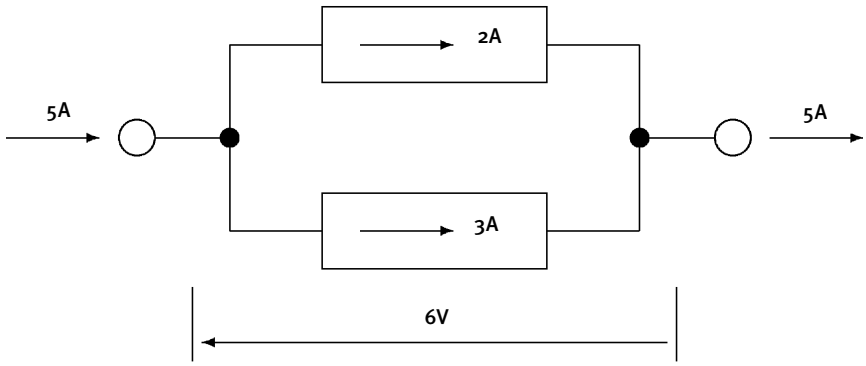


Figure 2. Elements in parallel. Currents add, voltage doesn't change.

voltage multiplied by the current. An example may clarify some of these points. Suppose that a 12V battery is supplying 2A to a load, through connecting wires. Then the power from the battery is 2A times 12V = 24W. Now suppose that it takes one volt to drive the 2A through the connecting wires, then the voltage at the load will be only 11V, and the power delivered to the load will be only 2A times 11V = 22W and the power lost in the connecting wires will be 2A times 1V = 2W.

Another example: suppose that two globes, one 12W and one 36W are connected to a 12V battery. The 12W globe will draw 1A and the 36W globe will draw 3A from the battery, a total of 4A. The power drawn from the battery will be 48W.

Circuits

The circuits here will illustrate the relations between voltage, current and power. Voltages add in a series circuit (Figure 1), and currents add in a parallel circuit (Figure 2) because a voltage exists between two points, and a current exists at a point in a circuit.

When a voltage across a component and the current through the component are in the same direction, the component is delivering electrical power to the circuit. When voltage and current are in opposite directions the component is absorbing power from the circuit.

Resistance

In many circuit components the ratio of voltage to current is constant—that is, doubling the voltage will double the current (this is Ohm's law.) The ratio of voltage to current is known as the resistance, symbol R. It is measured in ohms, symbol Ω.

Resistance = Voltage/Current.

Voltage = Resistance x Current.

Current = Voltage/Resistance

Since the resistance of most devices on a power system varies with temperature, it is usual to specify power or current ratings, rather than resistance. One place where resistance calculations are useful is in calculating the voltage drop in connecting wires. The resistance per metre of wires can be found in wire tables.

Suppose that a load of 15A is supplied from a power source 20 metres away, using 2.5mm² wire, which has a resistance of 0.00344 Ω per metre (this size wire is commonly used for power wiring). Since the total length of wire is 40 metres, the wire resistance is 40 x 0.00344 = 0.1376 Ω and the voltage drop is 0.1376 x 15 = 2.06V.

If the power source were a 24V battery, then this would be a drop of about nine per cent, and a power loss of about nine per cent also, from a total 360W (24 x 15). If the source were 240V then the same power (360W) would require a current of only 1.5A, and the voltage drop would be 0.206V, less than one-tenth of one per cent, with a power loss less than one tenth of one percent also. This example shows that lower voltage systems need very heavy wiring.

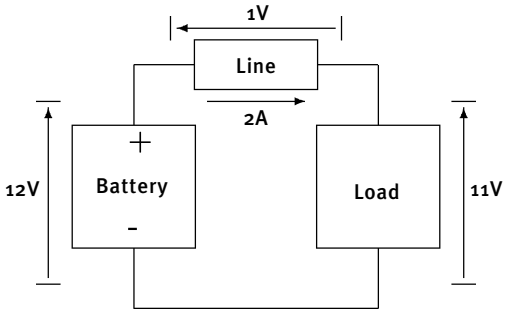


Figure 3. Battery with load.

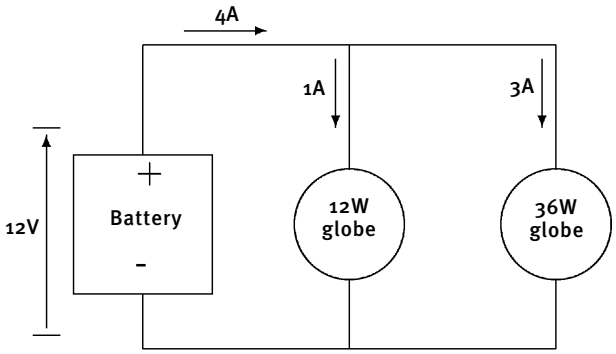


Figure 4. Battery with two loads.

Alternating Current

A battery is a source of direct current; the current flows in one direction and is constant. The supply from the power mains is alternating current; the current starts from zero, rises to a maximum, drops to zero, rises to a maximum in the other direction, and drops to zero. The sequence is then repeated. The wave shape is a curve known as a sinewave, the same as the oscillations of a pendulum, or the shape of ripples on a pool, or many other natural oscillations, (Figure 5a). In Australia, and in most countries in the world, the public supply goes through this cycle 50 times a second. The unit of frequency is the hertz, symbol Hz, so our supply is 50Hz.

Alternating current has a number of advantages:

• AC motors and generators are simpler, more robust, more reliable and cheaper than DC motors and generators. Small AC generators (alternators) have benefitted greatly from modern permanent magnet materials.

• Because AC current goes through zero twice a cycle, it is easier to interrupt, so switches and circuit breakers are smaller, lighter and cheaper than the DC equivalent. If a circuit breaker is rated for both AC and DC, the DC rating will be lower.

• Using transformers, it is easy to change the voltage of an AC supply. Power can be transmitted over long distances at high voltage, which means low current, and transformed to a lower voltage and higher current for distribution to houses. Since the transmission wires carry lower currents at higher voltages, they can be thinner for the same power transmission than those for low voltage.

AC power

The power relationships for AC are similar to those for DC, with two conditions:

• The 'effective' (or RMS) value of voltages and currents must be used. The RMS value of a sinewave is 0.707 of the peak value, so a 240V supply has a peak value of 339V. AC meters are calibrated in RMS values, and they are the values normally given in specifications.

• If the voltage and current waveforms are not in step ('in phase'), AC power is less than voltage x current. For heating elements, voltage and current are in phase, but for electric motors the current usually lags the voltage. For AC, the product of voltage and current is known as voltamperes, symbol VA. The power factor is the ratio of power to voltamperes, W/VA. It cannot be greater than one. For AC motors a typical value is 0.8.

Power conversion

Batteries are DC devices. Solar cells produce extra-low-voltage DC. Wind turbines produce AC, but at varying frequency and voltage. The most suitable supply for domestic use is the same as the public supply, 240V AC 50Hz, and this is essential for connection to supply authorities' supply mains. Devices are therefore needed to convert AC to DC and DC to AC, and to control current flow.

Rectifiers

Conversion from AC to DC needs a rectifier. The simplest of these just reverses the connections for the negative half of the sinewave, but most rectifiers have some built-in control functions. A good battery charger controls the current going into the battery, and turns off when the battery is fully charged.

Inverters

Conversion from DC to AC needs an inverter. The simplest inverter connects the DC source in one direction for half a cycle, then in the other direction for half a cycle, so producing a squarewave (Figure 5b). However, while some devices will accept square waves, others—some AC motors for example—will not, and need sinewave power, or something very close to it.

Supply authorities require that inverters sending power into their mains must have close to a sine wave output, and insist that the inverters must comply with the appropriate standards.

Some inverters for renewable energy systems and remote area power supplies do much more than just invert. They are the main controllers for the system, and can rectify as well as invert. They can take power from the battery and convert it to AC at the correct voltage and frequency for the local loads. They can synchronise their frequency and phase with the mains supply, and export power to the mains. They can also draw power from the mains to charge the battery when necessary, and control the charge in a battery to the level for longest battery life.

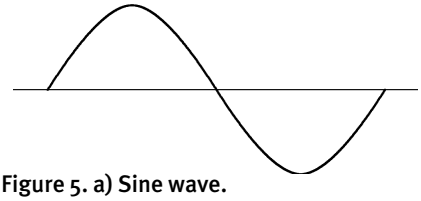
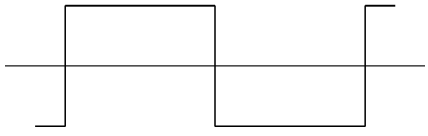


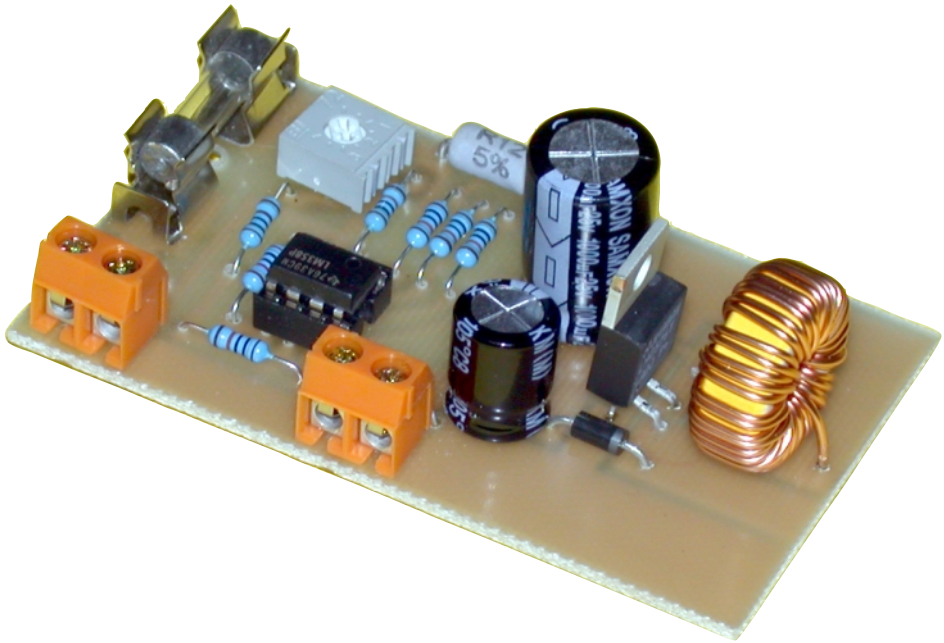
Figure 5. a) Sine wave.



b) Square wave.

A simple universal power supply

Want to run the big Luxeon LEDs from 12 or 24 volt solar power systems, or maybe a 6 volt radio from a 12 volt battery? This power supply lets you do that more efficiently than most linear supplies. By Lance Turner



Here at the ATA we have been selling a lot of the Luxeon LEDs, along with the linear constant current source kits to drive them. When driving three of these LEDs in series from 12 volts, this system works fine, however, for people wanting to run a single LED from 12 or 24 volts, this is not the way to do it, as most of the energy is lost in the constant current driver, making the whole setup very inefficient.

A much better method is to use a switchmode constant current driver rather than a linear driver. This means that the driver circuit takes the 12 volts DC and switches it down to a suitable voltage for the LED, stepping up the current in the process. This means that the circuit makes the process of driving a single LED more efficient, and less power is wasted in the circuit. In fact, if you were to run a single LED from 12 volts with a linear driver, you would waste about 75 per cent of the energy taken from the battery. With a switchmode driver, this is more like 25 per cent or less.

The circuit

The main requirement for this design was that it was simple, relaible and used readily available parts. With this in mind, I looked at a few different semiconductor manufacturer's web sites, and decided on the Simple Switchers range from National Semiconductor.

These devices require as few as six components plus the switchmode IC, which is about as simple as it gets with this sort of circuit. Looking around on their site, I ordered samples of an IC that can provide up to one amp of output and had an efficiency of over 90 per cent. However, a bit more searching made me realise that this IC was not that commonly available in Australia, at least not at a good price. So, I searched the sites of some of our local suppliers, and found another of the Simple Switchers ICs, the LM2576 for a realistic price, so decided on that device for our design. The disadvantage with this chip is that is less efficient than the other IC (only around 75 per cent on average—see Table 1) but it had the advantage that its circuit was simpler (see Figure 1a) and it could deliver up to two amps.

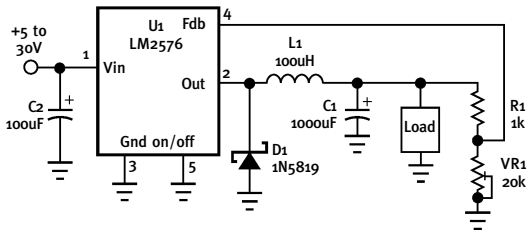
Constant current

Now, these chips are designed to provide a constant voltage for powering voltage sensitive devices, not a constant current, so a way had to be found that would allow the current to be measured and that measurement be used to control the ICs output via its feedback pin, which is normally used to measure the output voltage.

Another quick search on the internet found a circuit that did exactly this, and it even used the same switchmode IC that I was planning to use, but the opamp IC they used was one not common in Australia, so I decided to change it to use the one we use in some of our other kits—the LM358.

The final design can be seen in Figure 1b. Note that the circuit can be built as either a constant current source or a constant voltage source, so that the same kit can be built so that it can either be used to drive LEDs or to supply appliances like radios et cetera. Also, as this circuit can handle voltages up to 30 volts, it should be ideal for providing a 12 volt power source from a 24 volt system.

Figure 1a. The circuit diagram of the switchmode converter when used in constant voltage mode to drive DC appliances. Note how much simpler the circuit is compared to the constant current version below.



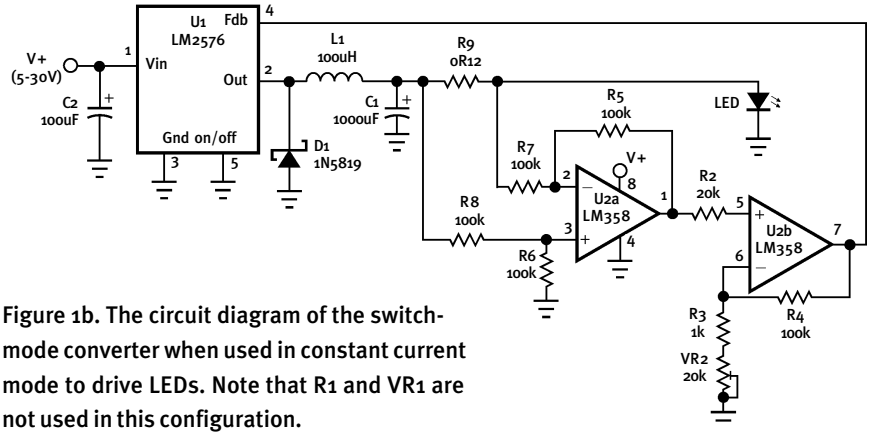


Figure 1b. The circuit diagram of the switchmode converter when used in constant current mode to drive LEDs. Note that R1 and VR1 are not used in this configuration.

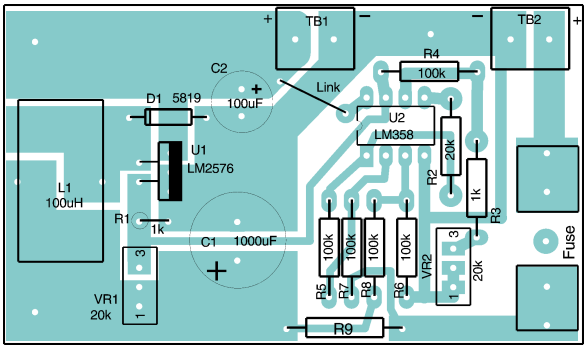
Building it

There is not much to building this device, you just put the appropriate components in their places on the circuit board and solder them in place. You must take care with the polarised components, such as the capacitors, the diode and the ICs.

Note that you will have to bend pins 2 and 4 of the LM2576 forward and down so they they fit in the board.

If you are building the circuit to drive LEDs, then you must leave out resistor R1 and trimpot VR1. These components are used as R3 and VR2 instead. All of the other components must be fitted. Also, don't forget the wire link that provides power to the LM358.

If building the device to power appliances, then leave out the LM358 and all of its associated resistors (R2 to R8 and VR2) and replace R9 with a wire link.



The circuit board overlay showing where the various components go. Note that this shows all components for both versions. You will leave some the components out, depending on which version you build.

Testing your handywork

If you have built the kit as a constant current source for LEDs, then test it in the following way:

Connect the output of the board to a suitable small load, such as a 5 watt, 12 volt lightbulb. Now connect the input to a 12 volt source such as a power supply or a 12 volt battery with a 3 amp fuse in line. The bulb should now be glowing weakly.

Now connect your multimeter in line with the bulb and measure the current flow through it. You should now be able to see the current (and the bulb brightness) change as you adjust VR2. If using 1 watt LEDs, set this current for 300 milliamps. You can wind it up a bit closer to the 350mA maximum of the LEDs if you wish, but remember that the LED has to be able to dissipate heat well, so should either be mounted on a small heatsink, or have good convective airflow access.

Lastly, measure the input current to the circuit. It should be well under 300mA, and in fact will be closer to 100mA. This shows the advantage of using the switchmode circuit over a linear circuit.

Note that if you use a multimeter to measure the various voltages on the LM358, you will notice that as you touch certain pins, you will cause the current flow to change. This happens as the impedence of the multimeter, even a good digital one, can affect the LM358 and change its amplification. The multimeter leads will often pick up stray voltages from magnetic fields, such as house wiring, and will introduce these voltages into the LM358, causing these changes.

If you are building the circuit for a fixed output voltage, test as follows:

Connect the output to a small load,

Parts list

Part	Value/description
R1 (R3)	1k, 1/4 watt resistor
R2	20k, 1/4 watt resistor
R4-R8	100k, 1/4 watt resistor
R9	0R12, 2 watt resistor
VR1 (VR2)	20k multiturn trimpot
D1	1N5819 1 amp diode
U1	LM2576 switchmode IC
U2	LM358 op-amp IC
C1	100uF 63V electrolytic
C2	1000uF 25V electrolytic
L1	100uH toroid inductor
SOC1	8 pin IC socket
TB1, TB2	2 way terminal block
F1, F2	Fuse clip
Fuse	M205 fuse
PCB	Circuit board

Table 1. Input power and efficiency for an output of 3.5 volts at 300mA (1.05 watts).

Input voltage	Input current (mA)	Input power	Efficiency
6	225	1.35	78
12	120	1.44	73
25	70	1.75	60

such as the aforementioned 12 volt bulb. Now, connect the input to 12 volts, and while measuring the voltage across the bulb (or even better, across the output terminals), adjust the output voltage using VR1 until you reach your desired voltage. Now, add another load and make sure that the voltage stays the same. There should be very little change in voltage providing you stay withing the circuit's current rating. Also, if you want to draw more than half an amp from the output, the switchmode IC might need to have a heatsink attached to it. A small piece of aluminium should do, just check the temperature of the IC to make sure it is not getting too hot. It can be quite hot, but should not burn you.

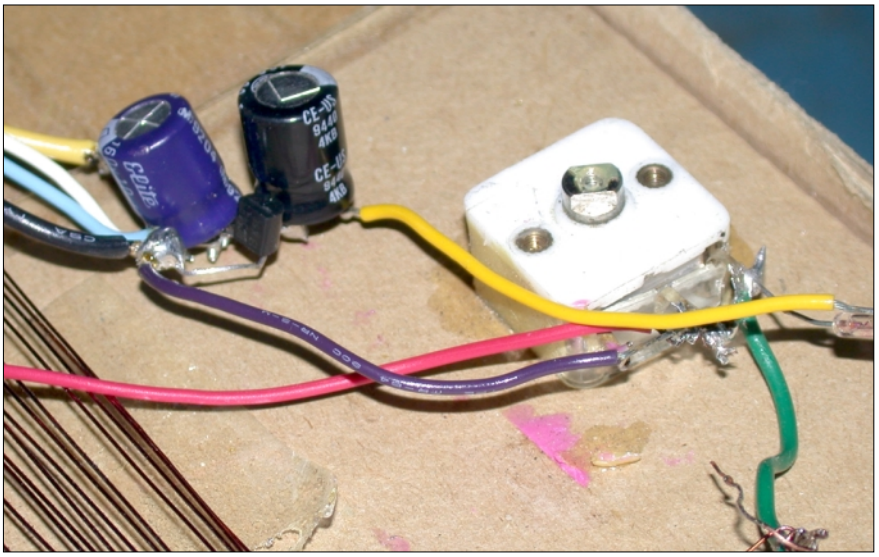
If all is well, then you are ready to go, but make sure you give the circuit a bit of a soak test first (that is, run it for an hour or two with a suitable load) before you hook your expensive LEDs or whatever to it. Make sure you put it inside a suitable plastic enclosure to protect it from dust and moisture, and always use the correct fuse for your LEDs—a 315mA (or a 500mA maximum) for a 1 watt LED and an 800mA for a 5 watt device.

This kit is available from the ATA, price is $27 (or $22 for ATA members).

Noel's Treasures from Trash

To make your own Audio amplifier you will need:

- A transistor BC548 or equivalent NPN
- 330,000 ohm resistor (330k, marked orange, orange, yellow, gold)
- 1,500 ohm resistor (1k5, marked brown, green, red, gold)
- 22uF electrolytic
- 10uF electrolytics
- Two 1.5volt batteries
- Solder and soldering iron, connecting wire, pliers and side cutters.



As I promised in *ReNew* issue 81, here is a simple amplifier to make the sound louder in the crystal set described in that issue. This is not an easy project and because it involves a hot soldering iron it needs adult assistance and thick coverings on surfaces that may be damaged.

A transistor consists small pieces of germanium or silicon with a very small amount of arsenic to make it short of electrons, called P type, or with phosporus to make an excess of electrons, called N type. These are sandwiched together to make NPN or PNP transistors. The middle slice is called the base and the voltage connected to it controls how much current flows from the collector to the emitter, the other two connections.

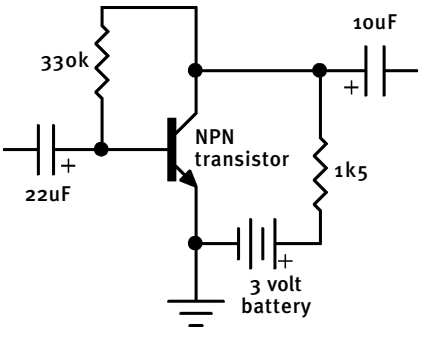
If we connect the tiny current of the crystal set to the base it controls the larger current of the battery flowing from the collector to the emitter. This larger current continues through the 1k5 resistor giving a voltage across the earpiece. Because we are taking power from the battery we get a louder sound in the earpiece. The two capacitors are to allow sound past but block DC from the battery. The 330k resistor is used to give a slightly different voltage or bias between the collector and the base, saving having to use an extra battery.

Construction

Twist the 330k resistor and the base (middle wire) of the transistor together and solder them to the positive of the 22uF capacitor (the negative is always marked). Twist the other end of the 330k resistor, one end of the1k5 resistor and the positive of the 10uF capacitor together and solder to the collector (Look at the bottom of the transistor with the flat side upwards, the collector is the left wire).

Unsolder the earpiece from the original crystal set and solder to the negative of the 10uF capacitor. Now to make the battery. Tape the two batteries together side-by-side, with the positive of one next to the negative of the other. Now solder a wire to the positive of one battery and the negative of the other. Solder the other battery positive to the free end of the 1k5 resistor. Join the free end of the earpiece, the negative of the battery, the emitter of the transistor (right wire of the transistor looking from below with the flat side upwards) and a short piece of wire together and connect this wire to where you disconnected the earpiece on the radio. Connect the negative of the 22uF capacitor to the other place from which you disconnected the ear plug on the radio and after a bit of tuning by moving along the coil, you should hear the stations much stronger than the simple crystal set.

Try to use a short burst of soldering on the transistors. If you find too hard to soldering parts together use wire to join them, the amplifier can be wrapped in insulating tape and made quite small. Good luck.



The circuit diagram of the simple amplifier. If this looks too confusing, just follow the instructions in the text.

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*, PO Box 2001, Lygon St North, East Brunswick VIC 3057**
Ph:(03) 9388 9311
Fax:(03) 9388 9322
Email: lance@ata.org.au
www.ata.org.au

Heatflow through windows

In reference to the article *Enhanch your summer comfort* in issue 82 of *ReNew* is the poor performance rating for double glazing in summer taken with direct sun on the window or in shade?

Why is it so much worse performance than for winter?

Nigel Barnard,
ndbarnard@bigpond.com

Nigel, the double glazed performance is indeed in full sun. Under these conditions, most of the solar radiation still passes through the double glazing, and that is the dominant aspect of the heat flow.

Your question is a good one—if the glass is shaded, then the main form of (much reduced) heat flow is conduction so under those conditions the double glazing makes a big difference. But the total heat flow is much less, so the reduction in heat flow (in terms of watts per square metre) due to the double glazing is about the same whether it is in the sun or shaded. I hope this makes sense.

***Alan Pears**, Sustainable Solutions*

Washing machines and inverters

I seem to remember quite a few issues ago there were articles on what inverters would run what washing machines. I did not take on board the information as I did not have an inverter and I owned an old washer that was power hungry.

I have since decided to shift to my Tenterden country retreat and have purchased a Latronics 518BKZ 12 volt inverter rated at 1800 watts continuous and 5000 watt surge. The washing machine I currently own is a Whirlpool AWM 5080 front loader, only some months old. I contacted Whirlpool to see if I could run this washer from the inverter as I did not know the current draw of the machine motor—the only information on the specification sheet is to provide the washer with a 2300 watt outlet (a 10 amp GPO).

Whirlpool emailed me back stating that they do not recommend any of their products be run from solar power or inverters—their reason is that the washer could damage the inverter. So it looks like I have to buy a washer now that will suit the inverter I purchased or wash by hand. Was there a washer in any of past articles in *ReNew* that would run on the inverter that I purchased? I have no intention of using the washer's heater at all.

Chris Harris,
ctharris@wa1.quik.com.au

Chris, the problem here seems to be that many whitegoods manufacturers don't understand the quality of modern inverters, and the fact that they can put out sinewave power, and plenty of it when needed, and can handle loads of any power factor (at least the good, Aussie made inverters can).

I suggest that you first contact Latronics and ask them if the machine will run on their inverter, then, if they confirm that it will, then go for it and see how well it runs. I expect there will be no problems. Even though front loaders often draw large surge currents, a 5000 watt surge inverter should handle it, though you may have to make sure no other large loads are running while the machine is. Selling the washer for a new one is a last resort, really.

Lance Turner

Downlights

Does a low-voltage downlight with a transformer use less power than a 240 volt downlight, or does it depend on the wattage of the globes? Can both 240 volt and 12 volt downlights use lower wattage globes? Also, when you dim downlights, are you using less power?

Jeremy Spencer,
cjluspencer@yahoo.co.uk

A downlight with a transformer will use more power than one without for bulbs with the same wattage rating. With the 240 volt bulb, the only energy used is in the bulb, whereas with the 12 volt downlights that use transformers, you also have the energy lost in the transformer (no energy conversion devices are 100 per cent efficient). So, downlights with transformers use 10 per cent or so more energy that 240 volt units, depending on the quality of the transformer, and whether it is an electronic or ferro-magnetic type.

Downlight bulbs are available in wattages from 10 watts to 50 watts or more, so downsizing is easy with most fittings.

When you dim any lamp, you are using less power, but as a lamp is dimmed, the light output does not decrease proportionally with the decrease in power, it drops off faster. This is because, as the filament temperature drops, it becomes less efficient at producing light, until it reaches a point where it may be running at 600 degrees or so and using power to do so, but is producing no light at all.

Lance Turner

Notes and errata: ReNew 82

In the Pumping buyers' guide we omitted the details of major solar pump distributors Eric R Bates. Their contact details are: 25-29 Heygarth St, Echuca VIC 3564, ph:(03)5480 6411. Eric R Bates provided information which assisted in compiling the guide in the last issue. See their classified advertisment in the Water Pumping section for more details.

The contact details in the Products section for Advanced Energy Systems were incorrect. The correct details are: PO Box 1149, Bentley WA 6983, ph:(08) 9470 4633, fax:(08) 9470 4504.

We stated that the Nine-mile beach windfarm was being planned, when in fact it is being constructed. See www.westernpower.com.au/html/9mile_news.html for more information.

The All New *AIR-X*

A breakthrough in small wind turbine

AIR-X:

ROTOR DIAMETER: 46 inches (1.15m)
WEIGHT: 13 lbs (5,85kgs)
MOUNT: 1.5" schedule 40 pipe (1.9" OD, 48 mm)
START-UP WIND SPEED: 7 mph (3.13 m/s)
VOLTAGE: 12 and 24 VDC (36 and 48 VDC available soon)
RATED POWER: 400 watts at 28 mph (12.5m/s)
TURBINE CONTROLLER: Microprocessor-based smart Internal regulator with peak power tracking
BLADES (THREE): Carbon fiber composite
BODY: Cast aluminum (AIR-X Marine is powder coated for corrosion protection)
KILOWATT-HOURS PER MONTH: 38 kWh/mo@12 mph (5.4m/s)
WARRANTY: 3 Year limited warranty
SURVIVAL WIND SPEED: 110 mph (49.2 m/s)
OVER-SPEED PROTECTION: Electronic torque control

Southwest Windpower is pleased to introduce the latest evolution in small wind turbines, the **NEW *AIR-X***. The ***AIR-X*** combines what has made AIR the world's number one selling small wind turbine with new technology previously found only in today's state-of-the-art mega-watt-class wind turbines.

All of these features are primarily found within the body of the turbine. The new microprocessor based speed control results in increased performance, improved battery charging capability and the **elimination** of "flutter" noise from the machine. The controller allows for peak-power tracking of the wind by optimizing the alternators output on all points of the cubic curve and then efficiently delivers the energy to the battery. The turbine's smart controller allows it to actually control blade rotation speed thus **eliminating** the buzzing noise commonly found with the AIR 403 and 303 in high winds. Furthermore, a new series of carbon-reinforced blades with a modified pitch angle further increases power production.

The new electronics are a considerable improvement over the previous AIR-403 controller that consisted of diode-rectification and a simple on/off voltage switch.

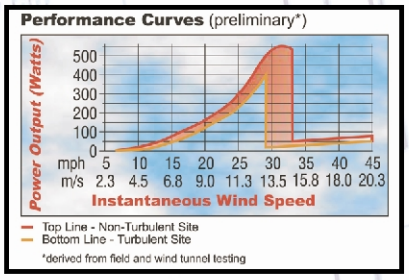
To the customer this means:

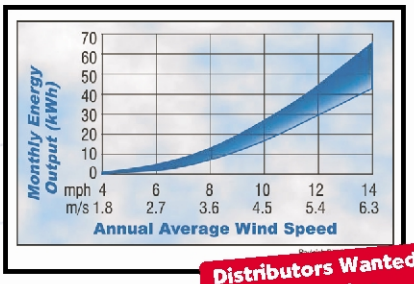
1) Much Lower Noise: Previous AIR wind modules relied on their aero-elastic blade design for protection in high winds, causing loud flutter noise in winds above 35 mph (16 m/s). AIR X's circuit monitors the wind speed and slows the blades as it reaches its rated output **preventing** it from ever going into flutter. The result is a much quieter wind turbine. In high winds, the ***AIR-X*** will continue to produce power at a reduced level until the wind decreases, at which point maximum output will resume. Additionally, when the battery has reached its charged state, the ***AIR-X*** will slow to an almost complete stop. Only when the battery has dropped below its voltage set point will it startup and resume charging.

2) Improved battery charging: Previous AIR designs required 300-400 amp hour battery banks so the trickle charge of the wind turbine could be adequately absorbed. The AIR X's charge controller periodically stops charging, reads the battery voltage, compares it to the voltage setting and if the battery is charged, it completely shuts off all current going to the battery. This function is performed within a few milliseconds. The closer the battery is reaching its full state of charge, the more often the AIR X's circuit repeats this action. This means any size battery from 25 to 25,000 a/h or higher can be charged safely.

3) Lower stress design: ***AIR-X*** limits power on the input side of the electronics by controlling the torque from the blades. The power no longer has to be dissipated by the electronics resulting in lower stress on the circuit, bearings and other materials. Furthermore, stress on wind turbines occurs primarily in high winds. Under these conditions, the electronic stall design reduces the speed to 600 rpm, thereby significantly reducing turbine and tower loading.

The ***AIR-X*** is our most expensive venture to date. Thousands of hours of research and testing have gone into the design. We are confident you will love the improvements the ***AIR-X*** has to offer.





Distributors Wanted In All States

Air Marine Australia 43 St Heilier Street Heidelberg Heights 3081
Phone: (03) 9459-2888 Fax: (03) 9459-4327 Email: airaus@hotkey.net.au Web: www.airaus.com

Giving tea growers a fair deal

Tea is one of the most popular drinks on Earth, yet most people who drink it have no idea that the tea they are drinking most likely comes from exploiting those who grow it. In fact, less than 15 per cent of the retail price ever gets back to the growers. The rest is skimmed off by the big multi-nationals that buy it on the world markets and then sell it to you.

People for Fair Trade (PFFT) are a voluntary network of people in Australia who are committed to fair trade with producers of goods, through the support of education and alternative trade. Under Fair Trade, growers are encouraged and helped to set up co-operatives which oversee the process of blending and packing the tea within their local community, or at least within their own country. In this way, there is more money kept in the country to help in local programs. The tea is then shipped and sold to a partner organisation (such as People for Fair Trade). The selling price includes a Fair Trade Premium, an extra payment to producers over and above market prices, to ensure that producers are being paid a fair price.

PFFT products include tea and coffee, including the following: Trade Winds Teas, in 100 and 1000 bag packs, leaf tea, in 250g and 3kg packs, Earl Grey tea in 50 bag packs and 125g leaf tea packs, Garaina organic tea in 25 bag packs and 125g and 3kg leaf tea packs, organic herbal leaf teas and tea bags, Tradewinds coffee, available as roasted beans or ground, in 250g and 1kg packs, El Campesino coffee in instant or ground, as well as other products such as jute and string bags from Bangladesh, Indian friendship bands, tea infusers, jumpers, and educational resources.

For more information, prices and to order, contact People For Fair Trade, GPO Box 4636TT, Melbourne VIC 3001, ph:(03) 9650 9912, fax:(03) 9650 3084, email: orders@fairtrade.asn.au, fairtrade.asn.au. Trade Winds Tea and Coffee Pty Ltd, PO Box 63, Revesby North NSW 2212, ph:(02) 9792 1094, fax: (02) 9792 1086, www.tradewinds.org.au

3500 watt sinewave inverter

Latronics have recently upgraded its 3000 watt, 48 volt sinewave inverter to a more powerful 3500 watt rating. The new unit has an increased surge capacity of 10500 watts along with improved half hour and 40°C ratings.

All features and modes of operation are the same as its predecessor along with the three-year warranty.

Full specifications are available from the Latronics website.

rrp: $3399 including GST

Manufactured by Latronics, PO Box 73, Moffat Beach QLD 4551, ph:1300 550 204, email: info@latronics.com, www.latronics.com

Well travelled inverter

Solar Energy Australia have just released their all new range of *Voyager* stand alone sinewave inverters. Available as a 1300 watt 12 volt, 1700 watt 24 volt and 1700 watt 48 volt models (on request), the Voyager series is the most efficient inverter (particularly at low loads) that the company has produced.

According to SEA, performance has been prioritised over price. SEA believes it has come up with a package which will appeal to all buyers looking for a quality pure sinewave inverter. The inverters feature AC and DC filters to ensure low levels of EMI, autostart, improved DC input voltage range, optional remote switch, low distortion levels, improved surge performance, optional remote display, alarm outputs and the ability to mount an AC circuit breaker or RCD on the front of the unit.

For further details contact Solar Energy Australia direct, 1/15-16 Nicole Cls, Bayswater North VIC 3153, ph:(03) 9761 5877, email: sales@solaraustralia.com.au, www.solaraustralia.com.au

Stunning sound, and DC powered too!

Most people would not expect to see audio products here in *ReNew*, but these radios are of such impressive quality that we though that readers would like to know about them.

There are a lot of low-cost stereos on the market, some of which can be powered directly from DC sources, but they are usually mass-produced, 'cheap and nasty' units that last only a few years if you are lucky. Where are the truly good quality devices, like they used to make in the middle of last century?

Well, the Kloss range of radios from Tivoli Audio are just such devices. Designed by the late audio guru Henry Kloss, the Model One (photo at left) and the PAL are high quality AM/FM radios that produce exceptional sound for their size. They are designed to be simple, rugged and robust, and to last a great many years, which means you will have a reliable radio that picks up the weakest of stations and looks great too.

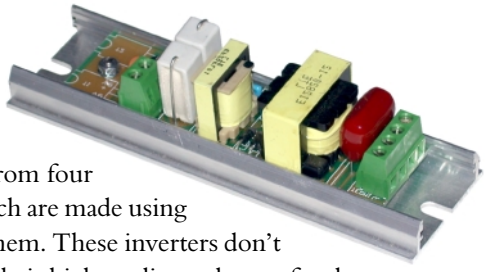
The Model one features a wood cabinet (we are not sure if this is sustainably harvested though) available in five different colour schemes, and will run from either 240 volt AC or any suitable 12 volt DC power source. The unit features built-in AM and FM antennas, a rear 75-ohm jack for connection of an external FM antenna in difficult reception areas, a headphone jack, auxiliary input to connect a portable CD player or other device, and a record output for recording or to use the Model One as a high-quality outboard tuner. Dimensions of the model one are: 114mm high x 213mm wide x 133mm deep and weight is 2.25kg.

The PAL (Personal Audio Laboratory) has the same tuner electronics as the model one, with the addition of an in-built 7.2 volt, 1200mAh nickel-metal hydride battery pack (which is replaceable) and charging circuitry, allowing the radio to be completely portable. It features a rubberised plastic housing, which makes it weatherproof, and uses any 12 volt, 500mA DC source to recharge the battery pack. Dimensions are: 94mm wide x 156mm high x 98mm deep and weight is 0.91kg.

rrp: $299 for the Model One, $349 for the PAL.

Available from Tivoli HiFi, 155-157 Camberwell Rd, Hawthorn East VIC 3123, ph:(03) 9813 3533, email: sales@tivolihifi.com.au, www.tivolihifi.com.au or check out the manufacturer's site in the US at www.tivoliaudio.com

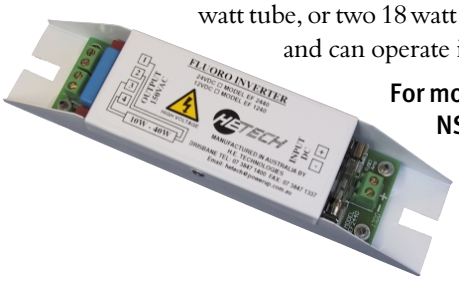
High quality DC fluoro inverters



There are a lot of cheap Asian DC fluoro inverters on the market, but many seem to have a bad habit of going bang after a year or less (we hear this regularly from readers). However, several Australian companies make good quality DC fluoro inverters designed for the renewable energy and high-end automotive markets.

GSL Electronics makes a range of inverters (shown at right) that will power tubes from four watts right through to 58 watts. There are both 12 and 24 volt DC models available, which are made using high quality components, with transistors that are given proper heatsinking to protect them. These inverters don't drive a fluoro tube to full brightness compared to a 240 volt-powered tube, but we feel their high quality makes up for that. The inverters come with a two-year warranty.

Hetech are another manufacturer of fluoro inverters (shown at left), and they have three models that power one 10 to 40 watt tube, or two 18 watt tubes, on 12 or 24 volts. These inverters are also designed for the automotive market, and can operate in high temperatures and extreme environments.



For more information, contact: GSL Electronics, Unit 2, 1 St James Place, Seven Hills NSW 2147, ph:(02) 9620 9988, fax(02) 9620 9899, email: info@gsl.com.au, www.gsl.com.au. Available from Rainbow Power Company, www.rpc.com.au.

Hetech inverters are available from Hetech, PO Box 1432, Coorparoo QLD 4151, ph:(07) 3847 1400, fax:(07) 3847 1337, email: sales@hetech.com.au, www.hetech.com.au

Don't throw them out—refill them!

Many of us have grand plans about what needs to be done to live more sustainably. An Australian company has started with a small item, something that businesses and schools use everyday of the year and probably without a second thought.

ATA has been trialing reusable whiteboard markers for a couple of months now. AusPen, the manufacturers, claim that the pens are more reliable, cut costs by 75 per cent and can be reused over and over again. In their own words this is 'penfill not landfill'. The testing we have done so far has born out these claims.

The whiteboard markers are refillable and sell at a comparable upfront price to their throwaway cousins. The colour and text is strong and clear (better than many other markers we have used), the points are precise and in general we were very impressed. Refilling is simple. It has also proved to be cleaner to do than we had anticipated. We didn't end up with ink everywhere but the ink bottle does drip, and a trick for new players is to be careful not to squeeze when you are removing the cap.

There are a couple of other differences from a standard whiteboard marker. These pens last even if you accidentally leave the lid off. Also, frayed nibs can be trimmed to a new point. Many of AusPen's major customers are schools, mainly because of the cost savings. We've been trialling the pens for only a month now, but they show no signs of fading (AusPen claim a 72 hour 'cap-off' life compared with eight minutes for an average marker).

The pens come in a recyclable HDPE (polyethylene) case (incorrectly called polypropylene in the instructions!), and the pens are made from aluminium, which is also recyclable, though whether they actually get recycled if you put them out with the cans and jars is another matter.

There are some changes we would like to see in the next design. Firstly and importantly, the cap does not fit onto the back of the pen when it is in use. Finding a new bottle design that does not drip would also be great—refilling would then require no tissues and no mess.

These are good pens and hopefully will help make a dent in the 40 million whiteboard markers that are currently thrown away every year by Australian teachers. A present of one of these pens will get you higher marks than an apple any day.

rrp: $38.25 for the set of six pens and six bottles of ink in the carry case. Pens and ink are also available separately.

Available from Auspen, PO Box 1080, Elwood VIC 3184, ph:(03) 9596 1677, fax:(03) 9596 1833, www.auspen2.com

Upgrade your water heater to clean energy

If you have thought about installing a solar water heater but the cost of a complete system has been out of reach, then a solar conversion kit may be the answer.

The Sunplus conversion kit, from Sunplussolar (and developed originally by the late Ross Horman of Heliosolutions), consists of solar collector panels, pump, controller and fittings to allow a standard storage tank water heater to be converted to solar without having to buy a new tank. The kits can be fitted to many mains pressure or gravity feed (open vented) tanks, and are available in sizes to suit tanks from 135 up to 400 litres or more.

The kits have been approved for the Victorian solar hot water rebate scheme (except for the smallest kit, the 17RP) so the cost of converting to a clean fuel is even less. Warranties range from six to seven years on the panels, and one year on the pump and controller.

rrp range from $1220 to $3494 before the Victorian rebate.

Available from Sunplussolar, 69 Racecourse Rd, Riddells Creek VIC 3431, ph:1300 130 315, email: dunnydivers@hotkey.net.au

Reduce your lighting load

In the last issue of *ReNew*, we looked at two different lighting load controllers. These devices reduce the energy used by fluorescent and similar lamps by reducing the voltage to the lamp once they have fired.

The Enersave unit is another similar device, which is made here in Australia. According to the manufacturers, it can save up to 30 per cent of energy use of fluoro lamps. It is designed as a modular 10kVA unit. It has internal protection and monitoring, and if something in the unit should fail, it by-passes itself so that lighting is maintained.

The Enersave units can be rented or leased for less than the savings, so as to give users of these devices a positive cashflow. At the end of the rental period the units can be purchased for a small sum, re-rented, or simply returned.

rrp: $2500 for the 10kVA unit.

Manufactured by Enersave Environmental Services Pty Ltd, 200 Dendy St, Brighton VIC 3186, ph:(03) 9867 6328, fax:(03) 9592 6735, email: info@enersaveunit.com, www.enersaveunit.com

Extra-low voltage twilight switch

There are many applications where it may be necessary to turn appliances on or off by sensing the onset of night and the commencement of day. One of the most common uses would be to provide lighting during the hours of darkness.

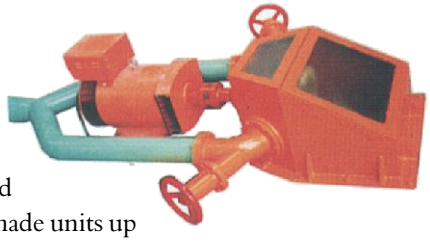
The Twilight Switch, from Arrid, will activate appliances when the light input falls below 10 lux. It can be used to turn on lights, electric motors, security systems or other loads up to a maximum of 250 watts at 12 volt DC, or where a 24 volt unit is used, up to 500 watt. For high loads, it should be mounted to a metal sheet surface for heat dissipation.

The unit has an IP68 rating, meaning it is totally weatherproof, and it is small enough to fit in most places, measuring just 46mm in diameter and 47mm high. Mounting is by a single threaded 6mm x 32mm long stud from the bottom of the unit.

rrp: $75 including GST.

For further information contact ARRID on freecall: 1300 663 563, ph:(08) 9258 9299, email: info@arrid.com.au, www.arrid.com.au

PowerPal micro and mini hydro turbines



PowerPal have expanded their range of Micro and Mini Hydroelectric generators. The range includes propeller, Turgo, semi-Kaplan and cross-flow turbines suitable for sites with heads ranging from 1.5m to 100m.

In the standard range, the smallest unit is a propeller turbine that produces 200 watts and operates at a head of 1.5 metres, while the largest unit is a 16kW turgo turbine. Custom-made units up to 1MW can also be supplied.

The output on the standard models is 240 volt, single phase AC, which is regulated using an electronic load controller supplied with the turbines.

The hydroelectric output can be used to supply power directly to AC appliances or it can be integrated into a remote area power supply or grid-connect system using an interactive inverter.

rrp: 200 watt unit: $1199.00; 500 watt unit: $1922.00; 1000 watt unit: $3281.00. Prices include GST.

Contact: Planetary Power for the address of your local supplier, PO Box 765, Atherton QLD 4883, ph:(07) 4096 2420, fax:(07) 4096 2558, email: info@planetarypower.com.au, www.planetarypower.com.au

Continued from page 14

actually using to supply your stream of beautiful solar heated water? I would hazard a guess that there may be many systems on roofs that are little more efficient that the old fossil fuel units they replaced.

In January 2002 we installed a Solahart 222KN system—two panels, 200 litre tank, bottled gas booster but with a handy on/off switch so that I could control the boosting. Early on I was suspicious that the system was not functioning correctly, but how do you prove it or have action taken? With two stingy adult users, the water would be luke warm after a day or two of inclement weather, or the booster would operate when one would expect the tank to be hot.

I recently monitored the temperature of the dissipater, as I believed it was malfunctioning. The dissipater is a partially evacuated tube containing a small quantity of water. On a very hot day, the water would boil in the end of the tube inside the tank at 75 to 80°C, as determined by the tube's residual pressure, and release the heat by condensing in the finned outside end. By some quirk of manufacture, physics or chemistry, my dissipater starts dumping heat from the tank at a much lower temperature—even lower than the 65°C at which the booster shuts off. Monitoring a different position suggests this temperature may be as low as 58 degrees.

At the date of *ReNew's* deadline, a new dissipater has been fitted and is being monitored.

If you have doubts about your system's performance or a story to tell, particularly about Solahart systems and the company's response, please write to me at 23 Lesley Close, Nyora VIC 3987.

Robert Vickers,
waowombo@tpg.com.au

Thank you for the opportunity to assist with the issues raised by Mr Vickers regarding the performance characteristics of his Solahart 222Kn gas boosted solar water heater.

As with all solar water heaters, Solahart systems are reliant on two energy sources to maintain the stored water temperature at a minimum of 60°C. These being solar energy and some form of auxiliary boosting, in this case gas. Naturally enough, the more solar energy there is available, the smaller the amount of auxiliary energy required and vice versa. Reliance on solar energy only, particularly on cooler days and days of inclement weather, can see the stored water temperature fall below the 60°C minimum.

In instances where a tempering valve is installed, as is the case here, there is a requirement to maintain the temperature of the stored water at a minimum of 60°C. This enables cold water to mix with the incoming hot water to provide a maximum safe water temperature of around 50°C. If the stored water is not maintained at 60°C, the cold water mixing with the incoming hot water will lead to cooler temperatures at the taps. In instances where booster usage is manually controlled, it is common for consumers to limit the amount of auxiliary energy usage too much. Under these circumstances, after a couple of days of inclement or cooler weather, and the consequential issues associated with usage and temperature stabilisation within the storage tank, the stored water temperature can drop below the 60°C minimum, with the subsequent loss of hot water at the taps due to the cold water mixing with cooler hot water at the tempering valve.

This can then lead to an incorrect assumption that something is amiss with the system. In this particular case, there is a perception that the heat dissipation device is malfunctioning. The reality however, is that the water within the dissipation device can only attain boiling point with the associated vaporisation at temperatures above 75°C.

As such, the temperature readings from the dissipation device taken by Mr Vickers would in fact reflect nothing more than residual heat generated through the copper piping employed on the device. This would occur on any exposed fitting, such as the hot water outlet, or the pressure temperature relief valve. As the piping for the dissipation device is located in the bottom half of the storage tank where the cooler water is, it would generally indicate the temperature of the water located in this section of the tank.

To ensure an adequate hot water supply on demand, we would always recommend that consumers operate their Solahart system in line with the directions supplied in their owners manual. In this instance, our aim is to ensure that Mr Vickers' concerns are fully addressed to his satisfaction. To this end, this organisation is more than happy to spend as much time as is required to resolve any matters associated with the performance of the system.

At the time of writing, a senior technician has been despatched to undertake a detailed investigation of the concerns as outlined by Mr Vickers. His findings once again confirm that the system is operating as per its design specification. Indeed, on the day in question the stored water temperature was hovering around the 80°C mark. Anyone who may have questions regarding the performance characteristics of their solar water heating system, should contact their local Solahart Dealership on freecall 1300 669 876. Those people interested in the technology utilised with the heat dissipation device, can access a fact file on the Solahart website located at www.solahart.com.au

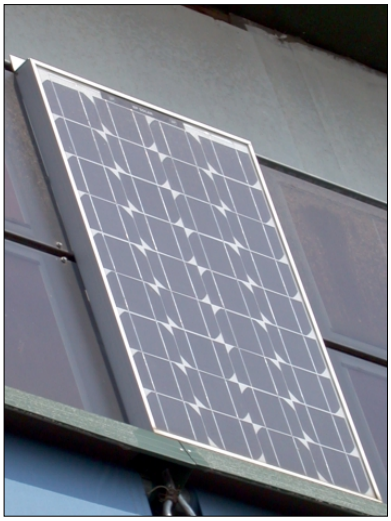
***Jamie Clark**,*
State Manager—Victoria/Tasmania

Write to us!

We welcome letters on any subject, whether it be something you have read in ReNew, a problem you have experienced, or a great idea you have had. No matter what it is, if you think readers would find it interesting, drop us a line!
Send letters to: ReNew, PO Box 2001 Lygon St North, East Brunswick VIC 3057, email: ata@ata.org.au

PV system and battery sizing

Ray Prowse explains the Australian Standards for photovoltaic array output and battery bank sizing



In this edition of *Up to Standard* the new design standard for stand-alone power supply systems is examined and some of its clauses explained.

The title of the standard is AS 4509.2 Stand-alone power systems Part 2: System design guidelines. Note that it is a document of system design guidelines and contains much information about industry best practice.

A few clauses explained

The output power of the module must be de-rated due to the effect of operating temperate, manufacturing tolerances and coverage by dirt (see Formula 1). The power temperature coefficient is typically 0.5 per cent per degree Celsius. The manufacturing tolerance is typically ±5 per cent, which means that the manufacturers will only guarantee the output to within 95 per cent or 105 per cent of the specified output. From a design point of view we must assume the worst case scenario. That is that the output is only 95 per cent of that which is specified. Coverage by dirt has never been included in system sizing calculations in the past, but, depending on location, it can be quite significant. A safe figure to allow in most circumstances is five per cent loss due to dirt coverage.

Tilt angle can be obtained from solar radiation data for the selected site or from local knowledge if radiation data is unavailable. Note that the irradiation is specified at the appropriate angles of inclination and orientation for a fixed or tracking array. For a fixed array it is relatively easy to take information from the Australian Solar Radiation Data Handbook (available through ANZSES) if the site matches the sites in the handbook. The handbook includes data for different orientation and inclination angles. The effectiveness of a tracker in increasing the peak sun hours needs careful analysis. The increase varies at different times of the year, depending on the length of day. In summer the increase may be as much as 60 per cent in some circumstances, but in winter there may not be much increase at all. Specialist advice needs to be sought when determining the peak sun hours when a tracker is used.

Remember that Formula 1 will give the energy output at the array. It is not the amount of energy available at the load. To determine what load could be run from this out you will need to account for losses in the cable (voltage drop leads to heating of the cable and consequent energy loss from the system—allow an efficiency of 95 per cent), losses in the battery (coulombic efficiency of the battery is typically about 90 per cent)—losses in the inverter (typically 85 to 90 per cent efficient) and further cable losses between the battery bank and the inverter (95 per cent efficient). The overall system efficiency is then 0.95 x 0.9 x 0.85 x 0.95 = 0.69 (69 per cent). This means that you will have 31 per cent less energy available at the load compared with at the output of the array.

Battery sizing

Note that industry accepted figures for battery storage are five days of autonomy and 70 per cent maximum depth of discharge (DOD). If the days of autonomy are increased the battery bank will be larger and the average daily DOD will be smaller. This will increase the cycle life of the battery bank. If the days of autonomy are decreased the battery bank will be smaller and the back up generator will need to run for longer to meet the load requirements. A smaller battery bank also implies a greater dependency on the system control equipment to make sure that the back up generator starts up at the pre-set level of battery discharge and protects the battery bank against excessive discharge.

The maximum DOD is that which the battery manufacturers recommend, and should not be exceeded. By only allowing the batteries to go down to the maximum DOD we are effectively reducing the capacity of the battery bank. For example, if a 1000Ah battery bank has a maximum DOD of 70 per cent, in reality, we only have 700Ah in which to provide the energy requirement for the specified number of days of autonomy. The last 300Ah should never be used. Note, however, that the last 30 per cent will be used if there is no protection to cut off the load at low battery state of charge or if the back-up generator fails to turn on. Given that the battery bank is the heart and soul of the system and is the one item that will need replacing at some stage, great care should be taken to make sure that the last 30 per cent is never used. ✲

Classifieds/For Sale

For Sale: RAPS system: 10KVA Simmons Sunshine Inverter / BP Solar Remote Area Power control unit & auto change over switch/ Arthur & Scarf Battery charger *ph:(08)8927 3993.*

For Sale: Bank of 8 x 700AH 6volt Century Enersun deep cycle batteries, excellent condition. Trace C40 12-48v programmable mP controlled Regulator. PC. All 5 yrs old. *ph:(07)3425 1495 ilsesan@iprimus.com.au*

For Sale: Exide Faure X - 2V 730 Ah (C10) batteries. 12 in a 24V bank. May sell as 2 x 12V banks. Ex Telstra, purchased 1 mth ago, oversized for requirements. 2 month warranty. All good S.G, voltage & sediment history. Singleton NSW. Help with local/ Sydney delivery. $1000. *ph:(02)6571 1995.*

For Sale: Wind generators, Aero-watt 12V 60W, Dunlite 48V 1kW, 110V 2kW & 5kW, Beasley solar panels,WEA 24V 80A Battery charger, Wilcox ram pump, Micro Minibore central heating, 15m, 18m Southern Cross towers *ph:(02)6335 6210, handh@ix.net.au*

Architects/builders

BP Architects: An award winning architectural design consultancy specialising in the design of sustainable buildings; designed to a minimum of 5-star energy efficiency, non-toxic building materials specified. *Studio 14-149 Fitzroy St, St Kilda 3182, ph:(03)9525 3780 bparchitects@bigpond.com* ♦

Earthbound Design & Construct: Eco-sustainable, Energy-efficient, Naturally healthy designs. Quality construction & Owner-Builder assistance. ROTA-LOO Composting toilets & Greywater systems. *Gavin Scott Lic No 26508c PO Box 22 Pacific Palms NSW 2430 ph:(02)6552 9165 mob:0427 592 093 gavsearthbound@yahoo.com*

Living Spaces Design Group: Architects & designers spec-ialising in ecological & holistic designs, Feng Shui, Vaastu, Local Spaces Astrology & Sacred Geometry. Eco-Materials and Eco-Technologies. Residential & Commercial. *David Baggs & Mary-Lou Kelly PO Box 586 Balgowlah NSW 2059, ph:1800 306 090 fax:(02)9907 6995 livingspaces@tpg.com.au www.livingspaces.com.au*

Sunpower Design: Solar efficient & environmentally sustainable house design. Andreas Sederof M.I.E. (Aust) *25 Lanark St East Brunswick 3057, ph:(03)9386 3700 fax:(03)9386 3043 sunpower@ozemail.com.au www.sunpowerdesign.com.au*

Education/Courses

ATA Seminars: How to save on Power Bills & Water. These two hour seminars held at CERES & Building Display Centre in Melbourne offer practical tips on reducing the amount of energy and water your household uses (and accociated costs). *To book contact BDC ph:(03)9419 7488 seminars@buildingdisplaydcentre.com.au, www.buildingdisplaycentre.com.au*

One Day Water Self-Sufficiency Course: With Water Engineer Scott McFarlane. Topics; rainwater tanks, water conservation, greywater reuse, compost toilets. At CERES, 8 Lee St Brunswick East 10am-5pm, 2 March, 6 April, 4 May, 1 June *ph:(03)5175 0895 mcfarlanes@netspace.net.au*

Swinburne University of Technology: Renewable technology courses *ph:(03)9214 8504.*

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Australian Ethical Investment: Specialising in environmentally & socially responsible investment. Offers four public trusts & superannuation strategies. Actively supports enterprises in sustainable energy & waste management. *Canberra Business Centre Bradfield St Downer ACT 2602, Freecall:1800 021 227 www.austethical.com.au*

EcoProperty: Permaculture Lifestyles & Organic Farms For Sale & Wanted. Eco Home Stay. Eco Directory. *PO Box 33 Oyster Bay NSW 2225, ph:(02)9528 8614. VIC ph:(03)5348 1546 pk@eco.com.au www.eco.com.au*

Home exterior/interior

Non Toxic Paints: Made from natural and non-toxic ingredients! Wall Paint, Enamel Paint, Varnishes, Oils, Waxes and Thinners. *Bio Products Australia P/L 25 Aldgate Tce Bridgewater SA 5155, Free Information Call 1800 809 448 www.bioproducts.com.au*

Non Toxic Paints: Introducing our range of non-toxic, natural paint! Casein Marble Powder plus a variety of colour pigments combine with water to give just the hue you're after! Add Safflower oil for a washable finish. *ph:(02) 6584 5699 fax:(02)6584 5799 www.natural-paint.com* ♦

Paarhammer windows: Energy Efficient, Double glazed window and door systems. Variety of timbers available. Tilt/Turn-Sliding-By-fold-French doors. Custom made to shape and size. Paarhammer Pty Ltd. *Freecall:1800 676 797 mail@paarhammer.com.au www.paarhammer.com.au*

Ral Homes: Pre-fab Housing delivered Australia & O/S. *ph:(03)5352 2352 Ararat Vic www.ralhomes.com.au*

Winter Windows: Keep your cool with the transparent insulation system for all windows. Simple to apply. Affordable DIY kits - clearly a cool move! *ph:(02)6161 3570 www.winterwindows.com* ♦

Greywater/composting toilets

A & A Worm Farm Waste Systems: Single chamber system that takes all wastes from toilet, kitchen, bathroom & laundry inc. organic garbage/garden waste. Safe, ideal for difficult sites. We deal direct with councils in Vic & NSW, *ph:(03)5979 1887 www.wormfarm.com.au*

Environment Equipment: Rota-Loo compost toilets, Mobile Rota-Loos, Greywater systems, Waterless urinals, Soltran buildings and Wormfarm toilets *ph:(03)9587 2447 www.rotaloo.com* ♦

Gough Plastics: The hybrid toilet system. Microflush or waterless toilet systems. *Freecall:1800 308 302 www.hybridtoiletsystem.com*

Playne & Simple Plumbing: Specialising in on-site water treatment & disinfection, greywater diversion, wet composting systems, rainwater tank installation, pressure pumps & water saving products. PIC Lic. No. 35168, Master Plumbers Assoc. 4001. *ph/fax:(03)9822 7662, mob:0439 398 909* ♦

RE equipm't/components

Batteries

Bargain Batteries: Quality at bargain prices. Gel from $50; 45AH to 7920AH, 2V Gel to 72V Sealed cell. Inverters from 400W to 1300W, portable, self-regulating electronics - all-in-one units. Warranty & free delivery. *Call for more info 0402 621 188 (Sunshine Coast).* ♦

Federal Solar Batteries: Deep cycle flooded cell & Gel batteries for all solar applications. *Ryde Batteries P/L 24/51 College St Gladesville NSW 2111, ph:(02)9879 5422 fax:(02)9807 3700, contact@federalbatteries.com.au*♦

Watts Batteries: Specialise in government quality second hand solar batteries (Ex-backup for large inner city buildings & only used in an emergency.) All with warranty. Capacity from 130 to 3200AH. Transport can be arranged. *38 Woodfield Blvd Caringbah. Mob:0416 262 752.*

Inverters

Advanced Energy Systems: Manufacturer of bi-directional inverters (Stand Alone & Grid Interactive UPS 5kW to 250kW) & grid-connect inverters (Wind and Solar Series 15kW to 125kW). Australian supplier of Solar Roof & Shell solar products. *For further information, ph:1300 367 765 www.aesltd.com.au*

Latronics: Australian Made True Sinewave & Grid Interactive Inverters. *ph:1300 550 204 fax:(07)5491 6792 sales@latronics.com www.latronics.com*

PSA: Sine Wave Inverters providing solutions for all your power needs. RAPS inverter chargers. Solar grid interactive. Range from 3kW single phase to 50kW 3 phase. *Power Solutions Australia. ph:(03)9762 0757 fax:(03)9762 0715 psasales@powersolution.com.au www.powersolution.com.au*

Selectronic Australia: Still setting the standard with the flexible and innovative

Selectronic range of True Sine Wave Inverters. All proudly designed & made in Australia, with distributors and service available across Aust. & NZ. *ph:(03)9762 4822 fax:(03)9762 9646 sales@selectronic.com.au www.selectronic.com.au*

Solar Energy Australia: Manufacturers and distributors of stand alone True Sine Wave DC-AC Power inverters 150w-3800w, inverter/chargers and grid feed inverters. *ph:(03)9761 5877 fax:(03)9761 7789 sales@solaraustralia.com.au www.solaraustralia.com.au* ♦

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Platypus Power: Manufacturers of home & commercial sized turbines from 50 watts to 50kW. Assistance in preliminary site evaluation & equipment selection. Accurate performance curves available. Trade enquiries welcome. *PO Box 538 Smithfield 4878 ph:(07)4055 8057 fax:(07) 4055 8492 plapower@netc.net.au www.netc.net.au/platypus/*

Water pumping

B/W Solar: ETADRIVE® (brushless motor 90% efficient) used with Helical Rotor & Centrifugal Pumps. 5 Star Trakers™, DIY Tracker kits, Inc. drawings for frame. Power Maxi™ with remote control. *ph/fax:(08)9341 8790 http://bwsolar.tripod.com* ♦

Eric R Bates P/L: Stock/domestic & small irrigation solutions using solar water pumping systems. Heads to 120m. From under $1000. Agents Mono & Johnson pumps. *Contact David Bates (PEng Grad IE Aust) ph:(03)5480 6411 fax:(03)5482 1959 david@ericrbates.com.au www.ericrbates.com.au*

Mono Pumps: Solar water pumping systems. *338-348 Lower Dandenong Rd Mordialloc VIC 3195 ph:(03)9580 5211.*

Oasis Windmills: Affordable windpower. Simply installed. Able to pump to 80m (250') head. No expensive rebuilds. Low maintenance. Capable of pumping up to 18 l/min (4 gal/min). 3m (10') or 4.5m (15') towers available. *30 Baldock St Dookie VIC 3646, ph:(03)5828 6452 mob:0418 340 717*

Sun Mill solar pumps: The Sun Mill combines the proven principles of a windmill with the latest in solar technology. It comes in bore and transfer models and requires minimal maintenance. *Freecall:1800 454 161 or visit www.sesltd.com.au*

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Air Marine Australia: Factory authorized importer & service agent for Air, AirX, AirX Marine & Whisper wind turbines. Manufacturer of battery charging generators. We stock a complete range of solar & renewable energy equipment, including grid interactive wind & solar systems. *www.airaus.com airaus@hotkey.net.au ph:+61 39459 2888 fax:+61 39459 4327* ♦

Westwind: Wind Turbines for remote area power supply 3kW, 5.5kW, 10kW or 20kW GP & GF Hill P/L (Manufacturer) *29 Owen Rd Kelmscott WA 6111, ph:(08)9399 5265 fax:(08)9497 1335 venwest@iinet.net.au www.westwind.com.au*

Solar/general

NATIONAL:

AFE Alternative Fuels and Energy: Manufacturers of the Sun Lizard Solar Air Heater. Heat and cool your home using the sun with no running costs. Information on Biodiesel and passive solar home design. *ph:(03)9737 1566 www.alternativefuels.com.au* ♦

Biodiesel Fuel Equipment: Make your own Biodiesel fuel from new or used cooking oil. Reduces air pollution. Can be used in all diesel engines without modification. Tiamat Global *ph/fax: (03) 9583 0751 tiamatglobal@bigpond.com http://www.alternativefuels.com.au/Biodiesel/biodiesel.htm*

Choice Electric Co: Major distributor for SHARP Solar Panels. Stockist of BP Solar Panels, SHURflo Solar Pumps, Bore Pumps, Pressure Systems, Fronius Grid Feed Inverters, SEA Sinewave Inverters/Chargers. Enersun Solar Batteries. Choice DC Lighting & Electronic Ballasts. *Freecall:1800 074 007 sales@choiceelectric.com.au*

EcoWatch: Australian agent for Davis Instruments, Weather Stations. Wind, Rain, Humidity, Temperature, Barometer, Optional UV, Solar Radiation & PC Link. Evapotranspiration & Soil Moisture option. *Free Catalogue & Price List ph:(03)9761 7040 fax:(03)9761 7050 davis@ecowatch.com.au*

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Global Solar Energy Systems: Suppliers of Renewable Energy Systems & Back-Up/Portable Power Suppliers. Low Voltage Refrigeration, 12V TV & Entertainment Systems. BCSE (SEIA) Accredited Designer/Installer *ph:(02) 9450 0709, fax: (02) 9450 0749 www.solarenergysystems.com.au*

Jaycar Electronics: Supplies of solar panels, inverters, batteries, meters, cable, plugs, sockets, etc. We have 19 stores around Australia & over 100 resellers. *1800 022 888 Also on the net at www.jaycar.com.au*

Lateral Technology: Est. 1987. Design, manufacture, sales & BCSE accredited installation of Renewable energy systems. Solar, Wind, Hydro & Solar hot water. Manufacturer of SENSTART II Generator remote/autostart device. Authorised BP Solar sales & service. *ph/fax:(03)9772 9019 mob:0428 278 707 conTAC1@c032.aone.net.au*

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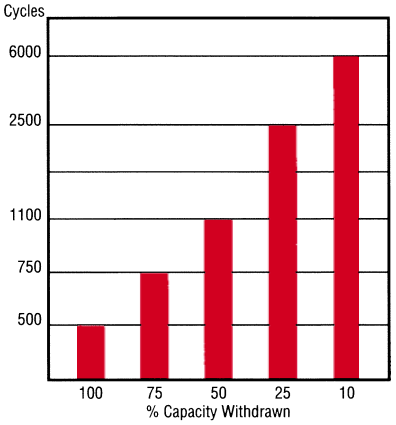

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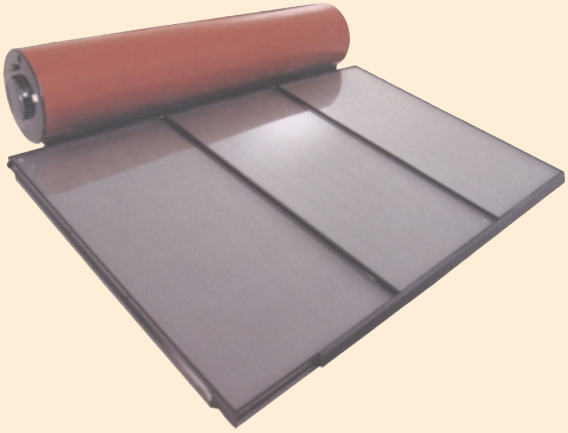

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