SOLAR, WIND AND WATER PUMPING BUYERS' GUIDE

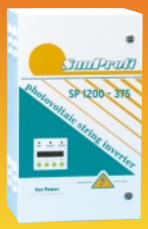
ReNew

Technology for a sustainable future

Loving it up in the trees

We visit a passive-solar designed backyard bungalow—perfect for the tropics

WIN!



A SunProfi SP1200 grid connect inverter

Valued at $3170

See page 5 for details

Conditions apply

Commercial green cleaning

Wind industry overview

A car that runs on air

Environmental benefits of push lawn mowers

This year's range of renewable energy courses

Issue 82 Jan–Mar 2003
AU$7.15 (inc gst) NZ$7.95
ISSN 1327-1938
01
9 771327 193010

Make your own generator from a washing machine motor

WIN! a 6 volt rechargeable lantern battery and charger in our build your own competition. See page 9.

Conditions apply

INVERTERS • INVERTERS • INVERTERS • INVERTERS • INVERTERS • INVERTERS • INVERTERS

Whatever your application, you can be sure Solar Energy Australia will have a Sinewave Inverter just for you.

• SIMPLE • PRACTICAL • RELIABLE

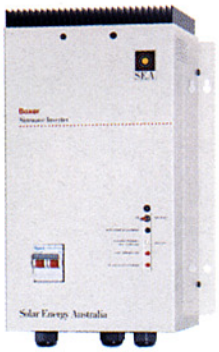
Horizon Inverter/Chargers

Horizon series of inverter chargers integrate a 2200 watt sinewave inverter, 80 amp three stage battery charger and 40 amp load transfer switch, all in one great package. Simplify and improve the performance of your system. Plus our exclusive 2 year + 3 year warranty option.

Gridfeed Inverters

Add value to your home while doing your part for the environment, our grid feeding inverters can operate with solar arrays from as little as 300 watts up to 4000 watts.

Stand Alone Sinewave Inverters



Medium sized stand alone inverters from 800 watts to 3800 watts.
These units are focused on efficiency, reliability and practicality.

For a free colour brochure and your nearest stockist, fill out this form and fax to 03) 9761 7789 or mail to; Solar Energy Australia, Unit 1/15-16 Nicole Close, Bayswater North, VIC 3153.

Name: .....

Address: .....

.....

State: ..... Postcode: ..... Telephone: ( ) .....

SEA/REN7707/01

SYDNEY · 4 BEAUMONT ROAD MOUNT KURING-GAI NSW 2080 TEL 02)9457 2277 FAX 02) 9457 2255
MELBOURNE · 1/15-16 NICOLE CLOSE BAYSWATER NORTH VIC 3153 TEL 03) 9761 5877 FAX 03) 9761 7789
EMAIL SALES@SOLARAUSTRALIA.COM.AU WEB SITE WWW.SOLARAUSTRALIA.COM.AU

Solar Energy Australia

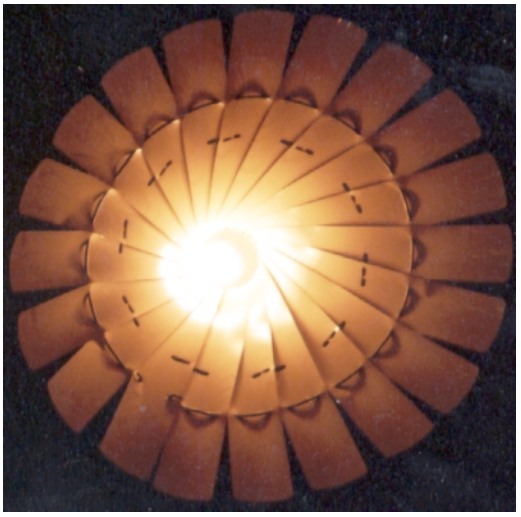
Contents

Issue 82
Jan–Mar 2003

features

Build Up Design architect Simon Scally shows us his Love Shack, a raised bungalow designed to perform well in Darwin's hot, humid climate.
Cover and above photo: Jacinda Brown

Bridget Gardner makes a living as a green cleaner and shares some of her methods. Story page 25.



This lampshade fashioned from venetian blinds is just one ingenious product available from The Bower tip shop. Article page 30.

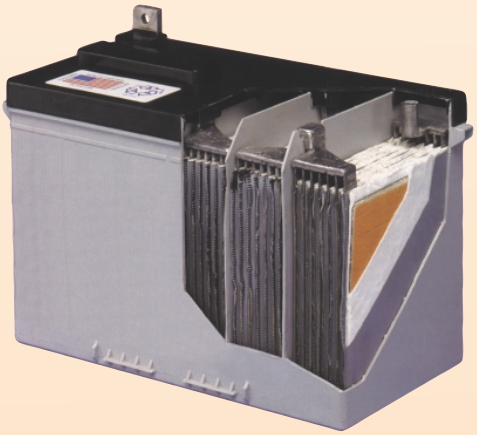
Federal Solar Batteries

The Best Answer in 'Cost to Performance' Ratios

Flooded Cell:
6V: 210AH to 420AH
12V: 36AH to 270AH

Gel Technology:
6V: 198AH
12V: 36AH to 265AH

Introducing Lifeline (AGM) Batteries by Concorde (USA)
6V: 263AH
12V: 38AH to 305AH



FEDERAL
E.P.M. PRODUCTS, BALTIMORE, MD 21226

Ryde Batteries (Wholesale) Pty Ltd
24/51 College Street, GLADESVILLE NSW 2111
Telephone: (02) 9879 5422, (02) 9807 3933
Facsimile: (02) 9807 3700
URL: www.federalbatteries.com.au
Email: contact@federalbatteries.com.au

Also available from selected Solar shops and specialist battery outlets.

Using a push mower for those big jobs is a great way to get exercise while saving on greenhouse gas emissions. Article page 36.

Make power from your dead washing machine. Page 48.

regulars

This glow in the dark material can make dark areas safer and save you money and energy. See this and more in *Products* page 72.

Behind the scenes and thank you

This issue of *ReNew* has been a fantastic one, especially in the magazine production office. We have had a full house of new and long-term supporters helping pull together the myriad aspects of this issue, and conducting original research.

Readers may not be aware that many of *ReNew's* contributors (based inside and outside the office) volunteer their time to produce the high-level editorial, images and ideas we publish, ensuring that each issue of the magazine is fresh and unique. *ReNew* is certainly a collective effort and we thank everyone who has made this issue a great one and those who have supported us over the years. Our regular contributor Noel Jeffrey, of Treasures from Trash fame, and Alan Pears, who keeps us all abreast with the policy world, are especially valued. A regular behind-the-scenes contributor is Danny Dagher, our legend sub-editor, who has been picking out mine and others' errors for more than two and a half years!

In every magazine we include a sustainable technology buyers' guide which is generally compiled by a different person each time, and this issue is no exception. There is an enormous amount of work involved in the table of every one of these guides—with some requiring more than a week of meticulous attention. Most people only ever volunteer to do one of these in their lifetime, no matter how keen they are! (Anyone want to take up this challenge?) Thanks to Amanda Day for her excellent work compiling the three tables for our remote pumping guide (page 54).

There are a few other regular items that are not in this issue due to a serious lack of space. They include our Sustainable Technology Events, Browser, Up to Standard and Book Reviews. These will definitely be back in issue 83, and apologies for any disappointment caused. We have also changed the format of our *Suppliers Directory* (page 78) in an attempt to make it easier for readers to locate products and services in their area.

Our competition winners

Gail Skerry of Doncaster East, Victoria, is the 'absolutely ecstatic' winner of the *ReNew*/Solar Edwards issue 80/81 subscriber prize of a 300 litre solar water heater. Gail joined ATA at the Royal Melbourne Show in 2002. Dave Keenan is the winner of this issues's *ReNew*/M+H Power System build-your-own competition—Len Greaves won last issue's BYO prize. There is still one 6 volt rechargeable lantern left to win in the next issue, so send us you build-your-own articles before the competition cut off date of 10 January 2003.

Finally—have fun over the festive season!

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.

Publisher: ATA
Managing editor: Kulja Coulston
Technical editor: Lance Turner
Advertising: Olivia Neville-Smith
Editorial assistant: John Kelly

Editorial and production assistance:

Special thanks to Danny Dagher, Lisa Mariah, Amanda Day, Andrew Taylor, Ryan Loucks, Rachel Ollivier, Heather Pemberton, Wendy Clark.

Contacts and contributions

Send letters and contributions to:

ReNew
PO Box 2001 Lygon St Nth, Brunswick East VIC 3057 AUSTRALIA
ph:(03)9388 9311, fax:(03)9388 9322
Email: ata@ata.org.au
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: 9 December 2002, copy due 20 December 2002.

Printed by PMP Australia. Produced by Caidex Print Management. Distributed in Aust and New Zealand by Gordon and Gotch.

$7.15 Recommended Retail Price.
Registered for posting by Australia Post: No VBG 4172.

ISSN 1327-1938

Reg. No.: A0017411T ABN: 57 533 056 318

WIN!

A SunProfi SP1200 grid-connect inverter

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

in the ReNew/Advanced Energy Systems subscriber competition

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
For your local AES dealer call 1300 367 765.

Greenhouse

Kyoto—The Australian Government has come under renewed fire for its failure to ratify the Kyoto Protocol after the local industry was closed out of the lucrative European Union carbon-trading market. Recent European Parliament legislation prevents EU countries and companies from trading in carbon credits with countries that have not ratified the Protocol.

The Australian Government had believed the trading restrictions would not apply to companies. The decision denies access to the EU market, recently estimated to be worth 20 to 30 billion euros by 2010, and will potentially cost Australian industry hundreds of millions of dollars.

The news comes as the Howard Government faces increased pressure to sign the Protocol. The government appears more likely to ratify after a growing tide of economists, climate academics, energy distributors and business groups have called for a more responsible position on climate change.

A recent report by the Australia Institute says Australia has the highest greenhouse emissions per person in the industrialised world, emitting an average of 27.9 tonnes per person per annum compared to the global average of 12.8 tonnes. This follows warnings from Pacific Island nation leaders that they are prepared to launch legal action against Australia for refusing to ratify.

Energy distributors Energy Australia and Origin Energy have called on the Federal Government to introduce a scheme similar to the NSW emissions benchmarks under which energy retailers must reduce greenhouse emissions by five per cent on 1990 levels by 2006 to 2007 or be penalised $15 per tonne of CO_2 above that. The companies also called for greater government support for greenhouse gas reduction programs. Origin recently released a report saying, according to current trends, greenhouse gas emissions will increase 63 per cent over 1990 levels by 2010 despite the introduction of a National Greenhouse Strategy to curb emissions. The report also claims gas and renewables offer a greenhouse gas reduction solution without significant price increases, thereby destroying the myth that electricity prices would blow out under the Kyoto Protocol.

Johannesburg Summit

While the World Summit for Sustainable Development in Johannesburg, South Africa, failed to deliver on expectations, it did focus attention on the Kyoto Protocol and renewable energy targets for the next decade. Around 60,000 people were expected at the 10-day summit but only 21,000 turned up. Significantly, China, India and Russia all committed to ratify the Protocol. Two main documents emerged from the Summit—the Plan of Implementation and the Johannesburg Declaration on Sustainable development, which seek to implement commitments made at the 1992 Rio Earth Summit and commit to new renewable energy outcomes. Australia and the US blocked an ambitious European plan for countries to commit to generate 15 per cent of the world's energy from renewable energy sources by 2010.

Water

The New South Wales state government has announced the phasing in of rainwater tanks. The plan is set to cut water usage in some areas by up to 37 per cent. Sydney Water is installing new meters designed to stop backflow from tanks into the mains water supply allowing homes to have dual supply systems. Environmental planning laws will also be amended to double allowable tank sizes to 10,000 litres.

Meanwhile, Melbourne has been placed on level one water restrictions for the first time since 1982. This brings the city in line with other parts of the state and country as Australia faces its worst drought in a decade. Some areas are in the driest period on record. Environment Victoria has called on the government to implement further conservation measures and rebates for consumers who use water-saving devices.

The drought has been linked to government policy on climate change with environmentalists and scientists warning that Australia can expect more extreme weather patterns in years to come.

Schemes to turn Australia's rivers inland have been quashed following concerns raised by scientists and the general public. Sydney broadcaster Alan Jones called for the plan to turn the country's northern rivers inland and redirect their waters thousands of kilometres to drought affected Queensland and western New South Wales. Environmental experts say river redirection is a long discredited idea and not the answer to drought issues, but rather that Australians need to learn to live with the environment we have. Director of the South Australian Museum in Adelaide, Dr Tim Flannery, has formed the Wentworth Group to urge for more practical measures to deal with drought. Australia used 0.8 cubic kilometres of water in 1995 and is projected to use 0.6 by 2025.

A report by the International Food Policy Research Institute and the International Water Management Institute points to an impending water crisis as the world struggles to feed its expected eight billion inhabitants by 2025. Unless sustainability measures are implemented by then, water scarcity will cause annual global losses of 350 million metric tons of food production—slightly more than the entire current US grain crop.

Parramatta Protocol

Parramatta Council in Sydney is setting an example for the rest of the country as it seeks to cut its greenhouse gas emissions. The council has undertaken to cut emissions by 40 per cent by 2010 via measures including solar street lights and hybrid electric-petrol cars. Local industry is also being asked to cut their emissions as the council seeks to halt the annual 2.6 million tonne increase in greenhouse gas emissions. The measures will cost around $100,000 to implement this year.

Victorian election

The Victorian State Election is being fought on environmental issues as the major parties strive to secure the growing Green vote. The Bracks Labor Government recently announced the suspension of logging in some of the most important native forests in the state. Logging in the Otway State Forest in the south, and woodchipping in the Wombat Forest will cease under a $50 million plan to be implemented over the next four to six years. The move comes following the announcement to halt logging in the contentious Goolengook region of East Gippsland.

• Victorian State Liberals stated they would not stop logging but promised to oversee the introduction of hybrid-fuel cars on the roads by 2010.

New Zealand carbon tax

New Zealand announced plans for a carbon tax to help the country achieve its targets under the Kyoto Protocol. The tax of NZ$25 a tonne of CO_2, to be levied after 2007, would push petrol prices up by six per cent, diesel by 12 per cent, gas and electricity prices by eight per cent and coal by 19 per cent. New Zealand is expected to ratify the Kyoto Protocol in late 2002.

Photo: Andy Taylor

Queen Vic Market goes solar

Melbourne's Queen Victoria Market will be home to Australia's largest city solar power project. One third of the market's north-facing roof area will be covered with about 1300 photovoltaic panels. The nearly 200kW system is expected to produce up to 250MWh of electricity per year—enough to power 50 homes. As part of the project the market will undergo energy efficiency reform, expected to reduce the market's energy consumption by up to 40 per cent. The $1 million Melbourne City Council project is due for completion in March 2003 and could eventually extend to the entire 10,000 square metres of roof at the market, making it the biggest PV system of its kind in the world. BP Solar, in conjunction with Origin Energy won the supply and install contracts for the project. The first panels were installed at the beginning of November 2002.

Biodiesel users fined

Drivers in Wales have been fined for using cooking oil in their cars and police have formed a special squad to find others doing the same. The drivers were fined £500 for avoiding fuel excise and warned of possible seven-year jail terms for repeat offences. The drivers had allegedly used a mixture of ethanol and cooking oil to power their vehicles. Meanwhile, there have been reports that some commercial biodiesel producers in Australia are being taxed at a rate high enough to make production unviable. We will investigate this further for future issues of *ReNew.*

Hybrid sports car

Honda have produced a concept hybrid sports car. The four-door Honda Dualnote hybrid powers its rear wheels via a mid-mounted 3.5 litre-VTEC V6 engine and the front wheels via two electric motors. Honda's Motor Assist system makes the whole package work together and results in a 300kW sports car consuming just 5.5 litres per 100km. While the car is not expected to go into production, it is seen as a prelude to the next range of the NSX sports car.

Basslink

The Basslink project has received final approval from the Victorian Government and awaits Federal Government approval to go ahead. The project will link the Tasmanian grid to the mainland to enable Tasmania to join the National Electricity Market. It has been widely condemned by the Greens, environmentalists and Gippsland locals affected by the $500 million project.

Critics say the plan will damage Tasmania's green reputation and increase dependence on fossil fuels. The project is also tipped to have a significant envi-

White lines

Readers who enjoy gazing at blue skies will be familiar with the long white 'contrails' that stretch out in straight lines behind high altitude aircraft. Those who look up a lot may have even noticed these trails on occasion persist long after the plane has passed, before they gradually mingle in with their less straight cloudy friends. A recent article in *New Scientist* details how these contrails are a very serious contributor to global warming, on par with the effects of aviation exhaust CO_2. As atmospheric conditions vary with height, the formation of these trails of water vapour and ice can be largely avoided by flying at lower altitudes. And this is a serious proposal for greenhouse reduction. Unfortunately, flying lower uses more fuel and thus produce about four per cent more CO_2 emissions. Researchers have done their sums and say that overall, burning more fuel in this way actually decreases global warming! It is a trade-off between a short-lived effect (contrails) and a cumulative one (CO_2) and for this reason some are cautious about how the costs and benefits of lower flying will play out in the long term.

ronmental impact. Greens Senator Bob Brown says the project may also damage the Tasmanian Wilderness World Heritage Area. According to the Greens, the monopole cable to be used in the project will create corrosion at its poles and discharge five tonnes of chlorine into Bass Strait annually due to electrolysis. Some fear that electromagnetic fields produced by the cable may also impact on marine life. The review process largely ignored concerns of South Gippsland residents in approving overhead power lines instead of underground cabling.

While state politicians and energy retailers have hailed the project as a chance to develop the Tasmanian renewable energy industry, critics contend it will lead to more coal-fired power generation for the state, leading to greater production of greenhouse gases.

Greens election win

The Australian Greens have become the first minor party to win a seat in the Federal House of Representatives since the Second World War. Michael Organ won the Federal seat of Cunningham in NSW after the retirement of the sitting Labor member forced a by-election. The win follows a Labor Party scare campaign which tried to tie greenhouse gas reductions to massive job losses in the local Wollongong area. Analysts interpreted the win as a rejection of both Labor and Liberal parties and a win for grassroots campaigning.

Carbon sinking

Too much carbon dioxide in the atmosphere? Simple solution—just sink it. The British Geological Survey has found that the greenhouse gas carbon dioxide can be safely stored underwater. The findings could provide another way to alleviate global warming. A 1700-metre-wide, five million tonne bubble of CO_2 has remained below the North Sea since 1996 and has not seeped back into the seabed.

New plastics recycling

Italian scientists have developed a new way to recycle plastics that means plastics don't have to be separated into compatible types before recycling. Normally, when an assortment of different plastics is melted together, the different polymer components don't mix. When the mass solidifies it forms an unstable and weak material containing the various plastic types. The new process, developed by researchers at the Italian National Agency for new Technology, Energy and the Environment (ENEA) found a way to smash up the molecules of waste polymers allowing them to combine and reform to produce hybrid molecules that can be melted down to make new plastics.

Air quality linked to energy efficient houses

Unhealthy indoor air in homes hospitals and schools causes health problems costing $12 billion each year, according to a report from the Clean Air Society of Australia and New Zealand. The President of CASANZ, Len Ferrari, says the problem is exacerbated by the push for energy efficiency in building design which can leave buildings poorly ventilated.

Another acronym to learn: BCSE

Those with a distaste for acronyms can take comfort that at least three have been reduced to just one with the formation of the Australian Business Council for Sustainable Energy (BSCE). Formed in September 2002, the BCSE is an amalgamation of the Australian EcoGeneration Association (AEA) and the Sustainable Energy Industry Association (SEIA), with a bit of the Renewable Energy Action Agenda's (REAA) CEO group thrown in. The new group will surely simplify industry representation from an outside perspective. The BCSE will represent the interests of the Australian sustainable energy industry, including renewables, cogeneration, gas-fired generation, waste-to-energy and energy efficiency.

The new organisation will form part of an international network consisting of the US BCSE, the UK BCSE and the European Business Council for a Sustainable Energy Future. The BSCE has also taken over such things as industry accreditation of courses. The challenge will be in truly serving all member interests in an organisation that spans such a huge range of scales and activities. The BSCE will move into Melbourne's 60L environmental office building.

Its website is www.bsce.org.au

Win one of four Sonnenschein

Rechargeable 6 volt lantern battery and charger packs

From M + H Power Systems

Valued at around $100

For the next issue of *ReNew* we have one battery/charger pack to give away for 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.

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

Competition closes Friday 10 January 2003.

Solar House Day success

Sunny 8 September 2002 saw the launch of what is to become an important annual event that will help shift peoples' perceptions about how best to build or renovate their homes—Solar House Day

With nearly 90 great passive solar houses open to the public for inspection and tours on Solar House Day 2002, the event provided a quality opportunity to experience the benefits of good residential design first-hand. Homes were selected from all over Australia and New Zealand and attracted more than 5500 visitors on the day—making it one of the biggest open house events ever staged in the two countries.

The day was funded by the Australian Greenhouse Office and run by ANZSES (Australian and New Zealand Solar Energy Society), with help from the ATA. Its aim was to raise awareness of the principles of good building design and give people the opportunity of visiting homes in their local area that have incorporated such principles.

Owners of participating passive solar homes opened them to the pub-

Pictured are two of the 87 inspiring homes that were open for Solar House Day 2002.

lic on the day and ran home tours, gave out show bags and answered any number of questions about their home design and the choices they made. ATA and ANZSES members volunteered on the day—with representatives helping out at almost every one of the homes. The event required an enormous mobilisation of resources, including volunteers, promotional materials, example homes and information. The day's success was due to the tireless efforts of all participants.

Householders and volunteers who were involved with the event said they enjoyed watching peoples faces as they experienced passive solar design for the first time. In warm, sunlit lounge rooms visitors looked around for a non-existent heater and in cool tropical homes they felt the comfort of natural ventilation.

ANZSES Chairman, Dr Keith Lovegrove, said attendances were above expectations at most locations, with the most visited house being in the Melbourne suburb of Surrey Hills where a great example of a passive solar designed house (designed by Andreas Sederof of Sunpower Design) attracted more than 500 visitors on the day.

'Most visitors to a solar house received a comprehensive information kit included in the cost of the entry ticket. One of the positive features of the day was the ability for the public to meet and discuss passive solar design principles, and the opportunities provided by active solar measures, with both homeowners and, in many cases, the architect of the house', he said.

Passive solar

The basic idea behind Solar House Day was to show people that good passive solar design can be incorporated into a home, whether it is a new residence or a renovated existing one. In many instances, the Solar House Day homes showed that good design doesn't necessarily mean expensive design.

A large number of visitors to Solar House Day were planning renovations or a new home, and were interested in passive and active solar design and sustainable living. The day helped raise awareness of the resources available such as the Australian Greenhouse Office's *Your Home* website at www.yourhome.gov.au which can also be accessed via the Solar House Day website at www.solarhouseday.com

Other major sponsors for the event included EcoPink Insulation Solutions, BP Solar and the Queensland EPA.

Solar House Day 2003

Please watch www.solarhouseday.com as we look forward to an even bigger and brighter Solar House Day in 2003. If you have a home that you would like to open for the day, please contact Rachel Ollivier at the ATA office on ph:(03)9388 9311 or email: rachel@ata.org.au to express your interest.

[Letters]

Bad system design

Whilst reading previous editions of your magazine, I was prompted to write about the situation I have been left in whilst trying to organise power for our 'mud' home on the south coast. I arranged this to be done through the Australian Greenhouse Office Photovoltaic Rebate Program. I wish to warn your readers that even though the designer I used was accredited with the program my system has not worked from day one. It has taken a local court hearing and two futile Fair Trading Tribunals in 18 months to get it heard. All the while, my $5500 is in his bank and I have no product.

The company involved has now been through the Fair Trading Tribunal for selling dodgy batteries and inefficient systems and misleading information—and no, I didn't get my money back. It is really just a token gesture.

My system designed by them has all but collapsed, needing daily boosting with a charger. My neighbours' system, also designed by the same company, has collapsed. We both have had to replace the regulator, twice. Both systems are less than two years old. Both had eight to 10 year guarantees (worth diddly-squat).

Seeing how the designer/retailer is an accredited member of Sustainable Energy Industries Association and that the association supported my case, it is frustrating to see the company hide behind their banner and still be advertising the same thing they sold me. The company's involvement in the solar rebate side of the industry should be reviewed by SEIA and the AGO before more people are ripped off. I have not mentioned the company's name for fear of litigation. If anyone wishes to know more details, please feel free to contact me, email: bigem@ozemail.com.au

M.Leslie

Another Fisher & Paykel fan

After reading about the low-speed generator in issue 80 I thought I would let you know that I also have had a Fisher & Paykel wind generator in use for the past two years.

The maximum output of mine is about 100 watts in gale force winds, normally one to two amps.

You can get complete Fisher & Paykel washing machines from white goods recyclers for $20 or maybe even free.

I used the hub and bearings and put the bearing block in a piece of rectangular hollow section (RHS) about 100 mm long. I used the hub and blades you had described in your Products section in an earlier issue.

The hub has good bearings and stainless steel shaft, which is good out in the weather. I just ground the nylon away until it was a tight fit in the RHS, then put two self tapping screws into the nylon so it would not move and filled all gaps with silicone sealant.

I used three diodes from an alternator. Positive from the diode plate and negative from the three start windings plate that is already linked at the start of windings.

Keep up the good work at *ReNew*.

Graeme Lock, Port Lincoln SA

PS: I would like to give a big rap for the boys from DCFX and Lindsay Hart from Solar Energy Australia for all their help in the past.

Unfortunately, there are still some less than scrupulous people in the industry. For more information on choosing a reliable installer, see our article on the subject in issue 81 of ReNew.

Lance Turner

Green energy too expensive

I have become aware of Energy Australia's intent to increase the prices of all their electricity rates. We are currently on a three-year contract for 'Pure Energy'. This was done because of the cost for us to go renewable by ourselves. The price at the time was 13.68 cents per kilowatt-hour, but this has now increased to 17.90 cents per kilowatt-hour (a 31 per cent increase), whereas the normal tariff has only gone up to 10.68 cents from 10.32 cents (3.4 per cent). I could justify the 30 per cent premium over fossil power but not 67 per cent. The normal rate is using inefficient fossil fuels and is not a sustainable resource compared to the almost limitless supply of wind and solar energy.

It may be said that renewables are more expensive to set up. This is true per kilowatt-hour produced but I cannot see it being at a 67 per cent premium to the fossil fuel rate.

On its website and advertising, Energy Australia portrays itself as an environmental leader. I fail to see how, with this massive gap between fossil and green energy discouraging people from signing up.

It will and has stopped people from joining or staying with the 'Pure Energy' program. I have since stopped our commitment to 'Pure Energy' because of their disregard for the common sense applied to their pricing policy. It seems to me that Energy Australia is discouraging people from getting environmentally aware. Most people connected to the grid cannot justify going renewable. Pricing out our only viable alternative is not the way of the future.

Glenn Lawson,
Ashtonfield NSW

Almost right!

I wish to draw attention to what I consider to be a terrible clanger in issue 81.

On page 61 under the ironic heading of 'Climate facts' you state that 'CSIRO has found that climate change is increasing the severity of El Ninio events.'

What on Earth is El Ninio? Do you by any chance mean El Niño? I will say no more. If your wordprocessor does not permit you to insert symbols into your text, then you will need to get a new one.

Geoff Watson, Cooper Creek QLD

Geoff, thanks for the feedback. Interestingly, the error was actually on page 65!

Lance Turner

Soil permeability

I would like to give you some feedback on some of your articles in the last issue of *ReNew*.

1. Choosing Laundry Detergents—thanks for the accurate referencing of my research. I have had a couple of enquiries for more information from that article. I would appreciate that the spelling of 'phosphorus' be used correctly. (Phosphorous is the reduced form of the element but phosphorus is the only spelling of the element.)

2. Water Efficiency in the Landscape by Wendy van Dok (page 43, end of third paragraph) 'Regrettably the Standard does not make actual permeability tests compulsory'. The very reason for that is well supported by research around the world and particularly some statistical work I did for my PhD. The so-called permeability test (water disappearing down a test hole) was developed by Ryon in USA in 1920s and has never been able to be replicated since. To soil scientists, it is a meaningless test. Sure it gives you a number, but so does counting the fairies in the garden. The field texture method of assigning long term permeability rates as indicated by AS/NZS 1547:2000 is more robust and is extremely easy for anyone to learn to do.

3. Method of determining the absorptive capacity of your soil by Dr Ross Mars. The method to which Dr Mars refers has been abandoned by almost every scientist as useless. From a statistical analysis it cannot be replicated with any certainty without a very large number of replicates. The quality of the water is extremely important, and if the readers think that tap water or rainwater is the correct liquid, why would you test with water when septic tank effluent is to be discharged. The 'percolation test' has been discredited for long enough that to suggest its reinvention is seriously flawed and misleading.

There is a significant difference between irrigating with water from rainfall or reticulated supplies compared with either greywater, blackwater or combined wastewater from an all-waste system.

I would be happy to pass on any information with regards to the above subjects and in the interim refer the reader to some of the papers I have published on the effects of effluent chemistry on soil permeability. Readers can check out this information by going to: www.lanfaxlabs.com.au/publications.htm

The On-site '03 Conference—specifically about on-site wastewater management—will be held in Armidale NSW from 29 September to 3 October 2003. All the details and call for papers can be found on the website at: www.lanfaxlabs.com.au/onsite03

Bob Patterson,
Lanfax Labs, Armidale Australia

Water issues

I heard a great discussion last Thursday evening on Radio 774 with an ATA person regarding greywater and plumbers et cetera. At the moment we are trying to set up a greywater recycling system at our house in the country outside Bendigo, especially in regard to using bath water et cetera on the garden. It is difficult. The plumber is sympathetic but does not want to do it himself. I have since contacted the Plumbers Control Board, who said much of the information given on 774 regarding this subject (particularly in relation to storage of greywater for 24 hours) was 'rubbish' and that they had no policies at all on the subject which they could send me.

Where do I go from here? How do I get the real facts?

Philip Tyndall,
philipgtyndall@yahoo.com

We did our best to cover these issues in issue 81 of ReNew. If you haven't already seen this issue, you can buy a back issue from the ATA.
Ed.

High living, shack style

Helen Sellar visits Darwin architect Simon Scally's *Love Shack*—a simple, passive-solar designed bungalow which can be installed in just three days!

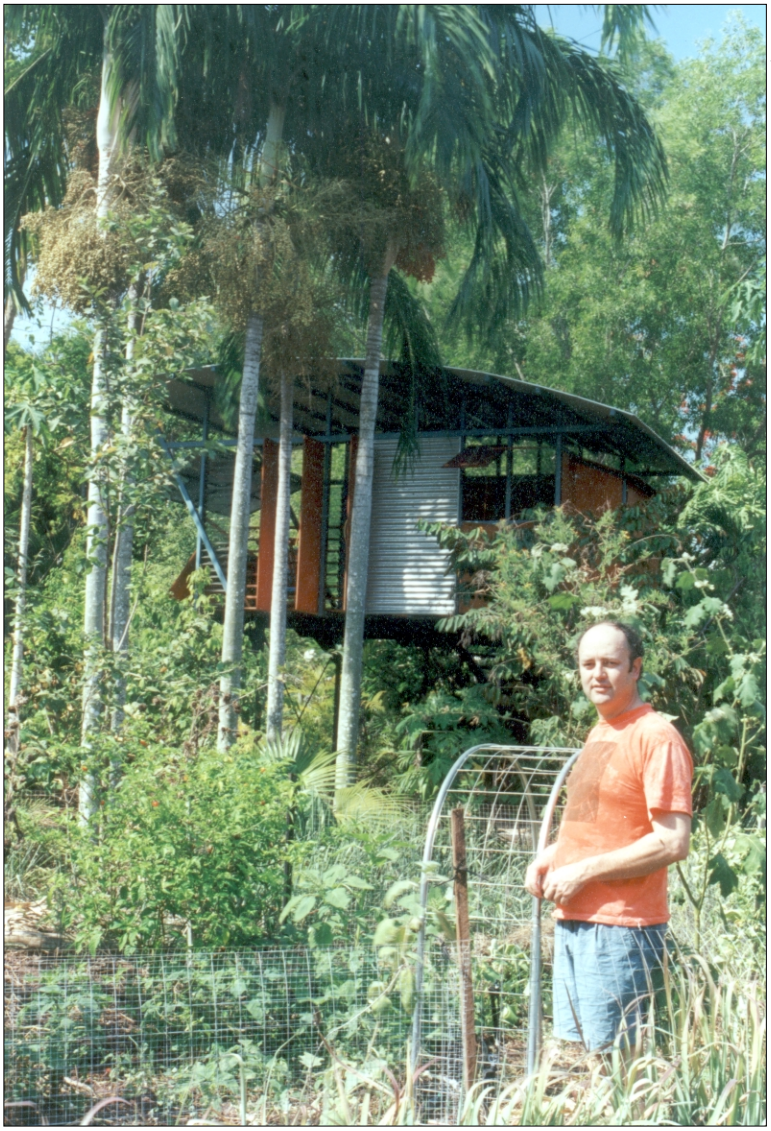


Photo: Jacinda Brown

Built among the trees at the back of Simon Scally's Darwin garden, the Love Shack acts both as refuge and spare room for those guests from out of town.

The Love Shack gives the feel of a luxury hideaway, yet architect Simon Scally's philosophy on design is one of simplicity. He built his Love Shack along with his partner, Angela, in their Darwin garden two years ago, and is now offering to sell the plans to others who may wish to build one.

The strong vertical structure nestles in amongst the tall palms, the tropical paw paw and syzygium trees, while the ducks scratch among the veggie garden below. A tidal creek runs along the rear of the block, adding to the tranquillity of the Love Shack experience. Simon describes his project as a 'prototype for the top end backyard bungalow, a low cost spare room for sleeping, writing and relaxing'. He has drawn from principles of cost and time effectiveness, environmental efficiency, and traditional understandings of climate to create his design.

Design

The Love Shack's design is in response to the extreme climate of the Northern Territory and has come largely from Simon asking the question: 'how did the traditional people here deal with it? The intense heat, the humidity, the long wet season and the mosquitoes?'

Simon drew inspiration from the traditional knowledge of the north and he describes his style as being 'not dissimilar from the sleeping platforms in Arnhem Land'. These platforms were built from bush poles and had a stringy bark roof curving almost to the floor. The raised platform provided extra shelter at ground level, allowed for greater air movement and a fire was lit underneath during the wet season to ward off mosquitoes. Simon's own recommendation against the mosquitoes, however, is a large net surrounding the bed.

He acknowledges the very fine line within architecture between cultural appropriation and giving adequate recognition to traditional ways and people. However, listening to him speak of his time spent working alongside Aboriginal communities in Arnhem Land, he pays great respect to these people and their sophisticated designs. He sees within his role as an architect the logic in 'exploring the existing building traditions as a way of understanding the place, its climate and resulting lifestyle'. He marries these traditional ways with his own designs, again, because they make sense. 'These buildings are still being built out bush. They work.'

It is easy to understand the climatic

sense that the Love Shack makes while standing there, up amongst the trees on a hot and steamy Darwin afternoon. It uses passive design principles, good cross ventilation, a high, well ventilated roof and open planning. 'To survive in this climate you need to flow with it,' says Simon. The combination of fixed panels, louvres, awnings and both vertical and horizontal shutters gives the flexibility for working within different climatic conditions. The walls are comprised of vertical shutters which can be used as fins to either channel breezes inside or to deflect them away, and of horizontal shutters which allow for natural light as well as shelter from a heavy downpour of rain. He describes the process as 'tuning them up like a sailing boat'.

The fixed panels are necessary to cross brace the structure, and the use of low-level walls are emphasised within the design so as to not disturb natural airflows. The shack is designed so that a solid end can be positioned to the east as protection from the early morning sun, and each other side of the building can be shut down completely against the weather or left wide open for air low. 'The Love Shack is designed for the tropics,' says Simon. 'It's sophisticated camping. An attempt to respectfully interpret the spirit and ideas behind the Arnhem Land platforms with contemporary materials and construction systems'. However, modifications can be made to his plans so as to work with more temperate climates.

Materials

It appears that almost every aspect of the Love Shack's design fits with concepts of minimal impact and minimal waste. The shack's size is based on material standards so as to easily avoid the work and waste associated with measuring and cutting to different dimensions. The floor plan measures 3.0 metres by 4.8m with a pop out section at the end, making use of full sheets of plywood, without cuts. The selection of materials has focused on sourcing those which are most appropriate for the application—predominately timber, steel and concrete. The choice of steel frames means no poisons are required to protect against white ants, that the lifespan of the construction will be long, and, if the shack does outlive its occupancy, the various materials are easily unscrewed for recycling. The shape of the roof simply imitates the natural curve of the corrugated iron, fitting the rafters without mechanical bending. Simon sees that the elegant structures of the Love Shack display a good understanding of how materials can work.

Photo: Jacinda Brown

Sit back and enjoy! While the raised, passive solar designed Love Shack is perfect for enjoying the tropics, it can also be modified to suit more temperate climates.

Prefabrication option

The entire structure is designed to be totally prefabricated, meaning factory construction greatly reduces cost, energy and time associated with coordinating tradespeople and tools along the stages and sites of building. Installation can be carried out in just three days. Provided site access allows for such prefabrication, there is minimal site disturbance, so the Love Shack can fit within an already established garden or bush block and doesn't leave the footprint of destruction which a building site often does. Simon suggests that the design simply makes sense. 'If you don't need to do something; when there is no need to produce waste, then why do it?'

The structure would work well with recycled materials as the dimensions are easily modified to suit the dimensions of sourced materials. Simon and Angela built their Love Shack on site with a lot of help from tradespeople, and feel this might appeal to those who wish to be owner builders. Their costs were around $15,000, and Simon would expect between $25,000 and $30,000 if a builder was employed to construct it. Recycled or own-sourced materials would greatly reduce this cost.

He has solar panels which he aims to install within the next few months and predicts that two small panels will be sufficient to supply the day-to-day use of lighting and a fan within the shack.

Sets of the drawings for the Love Shack are available for purchase for around $990 which allow for one use. While the original Love Shack does not include a kitchen, bathroom or toilet, Simon is available to discuss other projects. He can be contacted on email: bud@octa4.net.au

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.

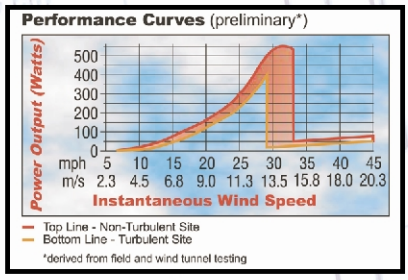
The new electronics are a considerable improvement over the previous AIR-403 controller that consisted of diode-rectification and a simple on/off voltage switch.
To the customer this means:

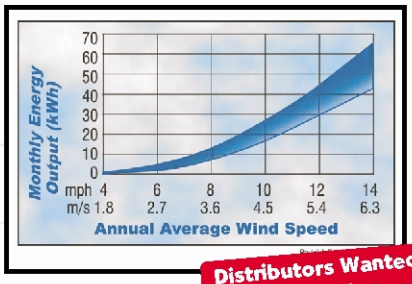
1) Much Lower Noise: Previous AIR wind modules relied on their aero-elastic blade design for protection in high winds, causing loud flutter noise in winds above 35 mph (16 m/s). AIR X's circuit monitors the wind speed and slows the blades as it reaches its rated output **preventing** it from ever going 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 Hellier Street Heidelberg Heights 3081
Phone: (03) 9459-2888 Fax: (03) 9459-4327 Email: airaus@hotkey.net.au Web: www.airaus.com

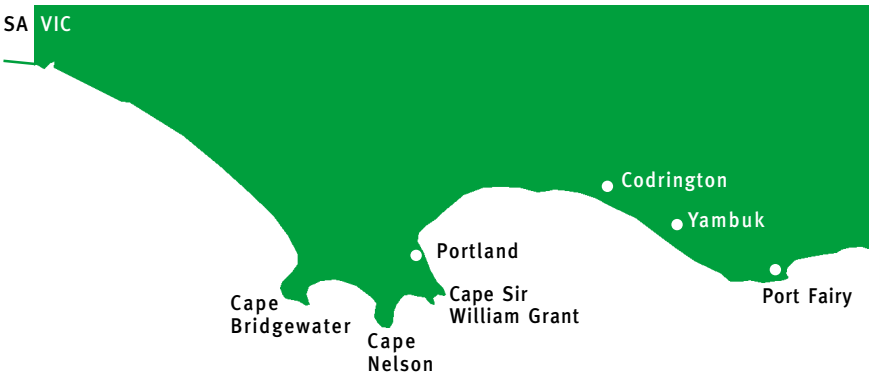
What's news in wind?

Kulja Coulston provides a quick overview of major Australian wind industry developments and issues

Victoria will soon be home to one of the world's largest wind farms—Pacific Hydro's 180MW Portland Wind Energy Project (PWEP) in the state's south west. After almost three years in development, the project received Victorian State Government approval in August 2002, and then final Federal Government sign-off on 18 October 2002. Construction of the 120-turbine project is scheduled to begin in April 2003.

The PWEP is the most significant wind project ever undertaken in Australia. Not only will it single-handedly almost double Australia's current installed wind capacity of just over 100MW, but the project is sufficiently large to stimulate a local wind turbine manufacturing industry. It is expected to create 400 direct and 1600 indirect jobs and inject $100 million into the Victorian and $300 million into the Australian economy.

Danish manufacturing giant NEG Micon clinched the $300 million deal to supply Pacific Hydro with turbines for the PWEP and other projects, and is expected to establish a multi-million dollar manufacturing facility in the Portland region. The facility marks the beginning of what may be a major new industry for Australia which could open up export opportunities to South Asia worth $100 million each year. As an aside, another Danish manufacturer Vestas Australian Wind Technology is investigating the establishment of a turbine assembly plant in Tasmania after being awarded Hydro Tasmania's lucrative $154 million turbine supply deal.



The $270 million 180MW Portland Wind Energy Project spans four sites in Victoria's south west—Cape Bridgewater, Cape Nelson, Cape Sir William Grant and Yambuk. Construction is scheduled to begin around April 2003.

PWEP significance

Approval of the Portland project is a watershed for the wind industry on a number of fronts—the most notable being Pacific Hydro's success in forcing the Victorian and Federal government's hand on wind. By pursuing a project of international significance, Pacific Hydro put wind firmly on the political agenda—pitting the benefits of large-scale wind development, including new employment opportunities, economic growth and the greenhouse benefits of pollution-free electricity generation, against the visual amenity impacts inherent with such projects. Pacific Hydro successfully argued in government, industry and community forums that the PWEP's benefits far outweigh its impacts.

By undertaking such an ambitious project, Pacific Hydro put a lot on the line—especially as it took an 'all or nothing' approach to having the PWEP approved. The company made clear that if approval was not gained for the location of all 120 turbines, the critical mass of turbines required to stimulate a manufacturing industry in Australia would not be reached, thereby making the PWEP and its other projects economically unviable. It showed that without local manufacture, the company would not be able to achieve the economies of scale required to develop projects in lower-wind-speed areas, such as its 52.5MW Challicum Hills wind farm located near Ararat in Central Victoria, which was only to be developed if the PWEP was approved. The 35-turbine Challicum Hills project entered the construction phase immediately following approval of the PWEP.

And, while there are notable groups such as the National Trust and some local landowners and visitors to the areas affected by the PWEP which remain firmly opposed to it (due mainly to the visual intrusion of the turbines on coastal viewscapes and the threat large structures pose to native bird species) the state and federal ministers ultimately responsible for deciding on the project's future decided in favour of it, with some conditions.

When announcing that the Bracks Government had cleared the way for the project to proceed, Deputy Premier John Thwaites said: 'The Portland Project is the biggest renewable energy project pro-

posal Australia has ever seen, and will bring enormous environmental and economic benefits to Victoria.' Planning Minister Mary Delahunty added that the project 'will produce enough clean energy to meet the electricity needs of 113,000 Victorian households—saving some 800,000 tonnes of CO_2 each year that would otherwise be produced through non-renewable generation.'

The Chief Executive of Victoria's Sustainable Energy Authority, David Young, who also oversaw the creation of Victoria's Policy and Planning guidelines for the development of wind facilities, has even released a statement saying that: 'in a nutshell, there will be more wind farms, there will be some visual impacts, but wind energy will help secure Victoria's unique landscape biodiversity for the future.'

So, simply, the approval of the PWEP sends strong signals to the wind industry and to the community about what is considered an appropriate wind development, and that large wind projects can be compatible with other coastal values—if, on balance, a project's benefits outweigh its impacts.

Post-PWEP is a new chapter in the evolution of the wind industry in Australia.

PWEP specifications

The PWEP project will see 120 wind turbines 1.5MW in size located over four sites in Victoria's south west. Pacific Hydro planned for 40 turbines to be located on Cape Bridgewater, 39 at Cape Nelson, 21 at Cape Sir William Grant and 20 turbines sited at Yambuk, near Pacific Hydro's already commissioned 18MW Codrington wind farm (see map). However, due to the state planning minister's requirements, the seven highest yield turbines proposed for the tip of Cape Bridgewater will be relocated to less significant visual zones. Pacific Hydro is currently devising new turbine layouts for the 100 planned for the three Cape locations to satisfy the minister's requirements. These layouts will need to be approved by the state planning minister before construction can begin.

It was only the 20-turbine Yambuk site, an area known to be frequented by migratory and endangered bird species, that needed to gain approval under the Federal Environment Protection and Biodiversity Conservation Act. When Minister for Environment David Kemp approved the location of turbines at Yambuk, he cited the findings of the independent company, Uniquest, which modelled the risk posed to the critically endangered Orange-bellied Parrot. 'The model suggests that, at worst, the wind farm would increase the extinction risk over 20 years by less than one per cent in absolute terms.'

Wind boom?

So is this the beginning of a wind boom in Australia? Well, not necessarily, but it is certainly a major step for the wind industry, and for clean electricity genera-

Existing wind farms (over 0.5MW)

Developer	Project	Location	Size (MW)
Eraring Energy	Blayney	NSW	12
Eraring Energy	Crookwell	NSW	4.8
Hickory Hill Wind Energy	Hampton	NSW	1.3
Hydro Tasmania	Huxley Hill	King Island	0.75
Hydro Tasmania	Woolnorth (phase 1)	TAS	10.5
Pacific Hydro	Codrington	VIC	18
Stanwell Corp	Toora	VIC	22
Stanwell Corp	Windy Hill	Raveshoe, QLD	12
Western Power	Albany	WA	21.6
Western Power	Denham	WA	0.7
Western Power	Ten Mile Lagoon	Esperence, WA	2

Wind farms under construction

Developer	Project	Location	Size (MW)
Australian Antarctic Div.	Mawson Base	Antarctica	0.9
Hydro Tasmania	Woolnorth phase 2	Bluff Point, TAS	54
Pacific Hydro	Challicum Hills	VIC (near Ararat)	52.5
Tarong Energy	Starfish Hill	Cape Jervis, SA	34.5

Some of the many planned projects

Developer	Project	Location	Size (MW)
Ausker Energy	Tungketta Hill (phase 1 and 2)	SA	50/60
Babcock & Brown	Lake Bonney (phase 1 and 2)	SA	80.5/140
Hydro Tasmania	Heemskirk	TAS (west coast)	20–80
Hydro Tasmania	Mussleroe	TAS (north-east)	10–50
Hydro Tasmania	Woolnorth (final stages)	TAS	65.5
Pacific Hydro	Portland Wind Energy Project	Victoria (see map)	180
Pacific Hydro	Robbin's Island	TAS	>100
Stanwell Corp	Kongarong	SA (near Mt Gambier)	30
Stanwell Corp	Nirranda	VIC	50
TrustPower	Myoponga	SA	~35
Western Power	Nine Mile Beach	Esperence, WA	3.6
Wind Energy Corp	Geraldton	WA	30
Wind Power Pty Ltd	Bald Hills	VIC (near Wonthaggi)	100
Wind Power Pty Ltd	Wonthaggi	VIC	10
Wind Prospect	Woakwine Range	SA	50
Wind Prospect/Novera	Green Point	SA	25
Wind Prospect/Novera	Yabmana	SA	35

tion in Victoria. As it stands, community acceptance and regulatory support of wind development and the wind industry is still not guaranteed—and is still largely dependent on site-specific factors and legislative support. Wind remains an emerging industry in Australia, and will require increased government incentive for its continued growth.

The main drivers for the industry are the Mandatory Renewable Energy Target (MRET) and the customer-driven green power program. The MRET came into force in April 2001 and requires that resellers and wholesalers of electricity collectively purchase a legislated amount of renewable generation each year. The MRET is stepped up each year from 300GWh in 2001 until it reaches 9500 gigawatt-hours in 2010, and annually thereafter to 2020. If they do not meet their proportion of the MRET they face a shortfall charge. By mid 2002, consumer demand for green power had reached 403GWh.

Together, these programs have stimulated a demand for wind and other renewables that was previously non-existent, and reflect the Australian community's support for action on greenhouse. To a lesser degree, the New South Wales Government's greenhouse benchmarks legislation, to be enacted from 1 January 2003 and which requires that electricity retailers in the state reduce the greenhouse gas emissions associated with supplying NSW customers with electricity, will also benefit wind generation.

The MRET is considered by many supporters of wind energy and of reducing Australia's reliance on coal-fired electricity to be so small as to be almost insignificant—especially as Australia's energy demand is still growing, and there is still a strong market and political bias towards continued utilisation of fossil fuels. The low target has also restricted wind developers to sites with the highest wind speeds (often coastal locations) in a bid to keep electricity costs at competitive rates. If the MRET is increased, and the penalty for non-compliance raised from the current $40 per megawatt-hour, sites with lower wind speeds which have already been identified by developers would become viable.

Even so, since its introduction in April 2001, Australia's wind capacity has grown from around 30MW to the current 104.5MW, with at least 320MW of projects expected to come online by the end of next year in the form of Pacific Hydro's Portland and Challicum Hills projects, the 34.5MW Starfish Hill wind farm currently being constructed on South Australia's Fleurieu Peninsula and Hydro Tasmania's 54MW Bluff Point wind farm being built in north-west Tasmania.

To give an indication of the hype currently rife in the wind sector, some developers claim to have more than 1000MW of planned projects up their sleeve, and some state governments claim to be considering more than 2000MW of projects. Actually, there are so many projects being pursued by private and government-owned wind developers which are in various stages of approval, construction and assessment, that it is difficult to confidently predict which projects are likely to get up over the next few years. Our tables provide an indication of projects that are already commissioned, those currently under construction and some of the projects that are in the public realm but have not yet reached the construction phase (apologies for any omissions, and note that details may change).

It is an exciting time in the wind industry, but a lot rides on the April 2003 review of the MRET—if the target is not increased, many of the planned wind projects will never get off the ground—even if they have already gained the required planning and building approvals.

Push for MRET increase

The Australian Business Council for Sustainable Energy (BCSE) (formerly Australian EcoGeneration Association) is pushing for MRET to be increased to at least 21,400GWh by 2010 (around a five per cent increase in renewable market share). The Australian Wind Energy Association and Greenpeace are gunning for at least a 10 per cent increase. The MRET in its current form is likely to deliver only a 0.5 per cent increase in renewable market share over its 20-year life to 2020, which, according to the BCSE, will see just 1000MW of wind installed in Australia to 2020—quite a bit less than the industry's potential for that period, said to be 10 times that. It is also significantly less than targets being pursued in the European Union and the United States.

And if serious energy efficiency and demand management strategies were put in place, any additional renewable generation would represent a higher percentage of Australia's electricity supply. If wind and other renewables began to meet existing as well as new demand for electricity, we may even see one of Australia's polluting coal-fired power stations decommissioned yet! ✲

Sustainable education

Australia offers some of the best renewable energy courses in the world. John Kelly examines recent changes to TAFE courses and asks what the best option is for potential students

The renewable energy industry is one of the fastest growing industries in the world today. Projections suggest the sustainable technology sector will be amongst the biggest global industries sometime this century. Despite Australia being one of the biggest greenhouse gas polluters and our refusal to ratify international climate protocols, we have a growing renewables industry. Contributing to this greater awareness are the ever increasing education options available in the sustainable energy sector.

The Australian energy industry is tipped to need a range of professionally trained people in the coming years. There are a number of areas where graduates of TAFE and university programs are needed. According to the Australian Cooperative Research Centre for Renewable Energy (ACRE) at Murdoch University in Perth, these include renewable energy systems design and planning, energy policy, energy economics, energy management and efficiency consulting, social and environmental impacts assessment of renewable energy systems, and renewable energy research and development.

Many people also wish to study renewable energy courses for their own knowledge and to be able to design their own home systems.

Australia has a range of renewable energy courses available to suit various needs. Wendy Miller from the Renewable Energy Centre at ACRE's Brisbane office says Australia's renewables training compares favourably with the rest of the world.

'Australia is ahead of the rest of the western world for accredited training programs. We have well-established qualifications and programs that countries such as the USA, Canada and the UK are only now starting to think about. We have the best range of renewable energy training courses in the world.'

TAFE teachers from around the country at the Renewable Energy Centre at Brisbane Institute of TAFE learn about new renewable courses at the 'Train the Trainer' program funded by the Australian Cooperative Research Centre for Renewable Energy (ACRE).

Australia has a range of courses available at the tertiary level. Universities in every state offer environmental science and engineering courses, each catering to different needs.

According to ACRE, there are many university courses available around the country based in environmental sciences and engineering faculties, many of which are suited to people wishing to work in the energy industry and in energy policy development.

The best known renewables course to date has been the Certificate IV in Renewable Energy. The Certificate IV course was established in 1995 to cater to the growing need for a comprehensive training program for people interested in the practical aspects of sustainability. Current students and past graduates generally give good reports about this course.

The course has now been redesigned following consultation among government, industry and training groups, and the new system of qualifications was developed in response to a need for standardised accreditation across the country, as well as changes within the national vocational training structure. The Electrotechnology Industry Training Board has overseen the process of turning the Certificate IV into a selection of specialist courses able to cater to specific needs. The new range of nationally accredited qualifications were

TAFE contacts around the country

State	Institute	Contact name	Phone	Email
ACT	CIT (Canberra TAFE)	Greg Hartup	02 6207 4038	greg.hartup@cit.act.edu.au
		Max Klemke	02 6207 4945	max.klemke@cit.act.edu.au
NSW	Sydney TAFE	Warren Heydon	02 9217 3288	warren.heydon@tafensw.edu.au
NSW	Mt Druitt	Reg Langley	02 9208 6293	reg.langley@tafensw.edu.au
NSW	Hunter (Muswellbrook)	Michael Valantine	02 6542 1112	michael.valantine@tafensw.edu.au
NSW	South West Sydney	Adil Khambatta	02 9682 9670	adil.khambatta@tafensw.edu.au
NSW	Granville	Keith Higgins	02 9862 0434	electrix@hermes.net.au
NSW	OTEN	Ian Leggo	02 9715 8478	Ian.leggo@tafensw.edu.au
NT	NT University / TAFE	Gordon Roberts	08 8946 7284	gordon.roberts@ntu.edu.au
NT	Centralian (Alice Springs)	Steve Gray	08 9859 5208	steve.gray@centralian.nt.edu.au
QLD	CSIT (Cooloola-Sunshine			
	TAFE, Nambour)	Alex Thorogood	07 5459 3538	alex_thorogood@hotmail.com
QLD	Brisbane / NorthPoint TAFE		13 12 48	rec.bit@det.qld.gov.au
QLD	Tropical North QLD (Cairns)	John Hatton	07 4042 2447	jhatton@bigpond.com
SA	Spencer (Port Augusta)	John Naisbitt	08 8648 9978	johnnais@sp.tafe.sa.edu.au
SA	Regency (Adelaide)	Ian Flemming	08 8348 4481	ian.fleming@regency.tafe.sa.edu.au
SA	Torrens Valley	Tony Holland	1800 247 487	
VIC	Chisholm	John Flanders	03 9212 4585	john.flanders@chisholm.vic.edu.au
VIC	Gordon (Geelong)	Ray Black	03 5225 0500	rblack@gordontafe.edu.au
VIC	NMIT	John Sakalauskas	03 9269 1093	johns-elt@nmit.vic.edu.au
VIC	Swinburne	Andrew Reid	03 9269 1093	areid@swin.edu.au
WA	Central (Perth)	Ian Dawson	08 6211 2264	dawsoi@ecentral.training.wa.gov.au

formulated by the Electrotechnology Industry Training Board in conjunction with the Sustainable Energy Industry Association, now called the Australian Business Council for Sustainable Energy (BCSE), the Australian Greenhouse Office, ACRE and various TAFE colleges. Brisbane Institute of TAFE was largely responsible for developing the course content, with funding and support from ACRE.

There are now six national qualifications at TAFE level for prospective students to choose from. Depending on local TAFE rules and regulations, individual modules within each of the qualifications may be available for study as 'independent' units.

The **Certificate I in Sustainable Energy** is aimed at secondary school level students and aims to give a broad overview of the principles of renewable energy use and systems, as well as greenhouse gas emissions, abatement strategies and climate change issues.

The **Certificate II—Electrotechnology Servicing: (Renewable Energy Specialisation)** is aimed at trades assistants. It contains the basic elements of systems design and basic assembling and repairing of electrical components. There is also a specialisation that will allow graduates to obtain industry accreditation as RAPS installers.

The new **Certificate IV—Electrotechnology (Renewable Energy)** is now only available as a whole qualification for electrical tradespeople and licensed electricians. It offers core units in renewable energy apparatus and systems to develop skills in a number of areas. These include planning the installation (including basic system sizing), testing, undertaking commissioning procedures, coordinating maintenance and diagnosing and rectifying faults. Students can specialise in one of three areas: fuel cells, micro-hydro systems, or wind energy systems. Electricians will be able to carry out low-voltage connections for renewable energy systems.

Electrical trades professionals and licensed electricians may choose to further their study via the **Diploma – Electrotechnology (Renewable Energy)** course. Students will learn to assess renewable energy apparatus and installations and design renewable energy systems. Students can complete modules specialising in grid-connected supply, energy management systems and energy-efficient building design.

The **Advance Diploma in Renewable Energy** is most like the current Certificate IV course in terms of its scope and range, though it has many differences. It is designed for people with an interest in renewable energy technologies who may want to design their own system or work in the renewable industry. Students should develop core competencies in a number of areas, from basic re-

pairs and assembly of RE apparatus through to designing photovoltaic systems and grid connected supply systems, covering much of the same material as is taught in the Certificates III and IV as well as the Diploma courses (though graduates will not be able to sign off on low voltage connections). The course also contains an element of business management for those wishing to use their new skills commercially. All up, the course takes 1600 hours, although students can leave after 1200 hours with a diploma qualification.

The change of qualification structures and rules has not been without problems and unexpected delays. Although the new courses come into effect from January 2003, some TAFEs are still unsure of what they will be offering next year and there has been some confusion over what is happening with the courses and what the changes will mean for current students. Prospective students are warned to expect some 'teething problems' in the initial stages.

Students who are currently enrolled and working in the current Certificate IV and who will not finish this year should be able to complete their courses next year. However, anyone currently enrolled in a course or planning to enrol should check on conditions with their nearest TAFE college. The TAFEs' accreditation and regulations will vary from state to state and participants need to make themselves aware of what their local situation is. Check with local TAFEs to find out what's happening near you.

TAFEs by state

Queensland

Brisbane Institute of TAFE is planning to run the Certificate IV, Diploma and Advanced Diploma next year, possibly in both full time and part time modes, with a combination of day and night time classes, as well as BCSE accreditation. Brisbane also offer online courses/units for distance education. The website is www.brisbane.tafe.net/ren_energy/

CSIT (Cooloola-Sunshine TAFE) has offered the Certificate IV course and should do so again next year.

Cairns TAFE is investigating the viability of offering one of the qualifications in 2003.

Victoria

In Melbourne a number of TAFEs have offered the Certificate IV course. Some will continue with the new courses next year.

Swinburne Institute of TAFE will offer the new Certificate IV, Diploma and Advanced Diploma in Renewable Energy—Electrotechnology.

Chisholm TAFE will offer its own Diploma course in Renewable Technology as a replacement to the old Certificate IV.

Northern Metropolitan Institute of TAFE is offering Certificate IV.

Gordon TAFE is offering Certificate IV next year depending upon student numbers. They also offer part time units in photovoltaics, energy efficient building, solar hot water and wind energy systems.

Northern Territory

Northern Territory University is planning to offer the Certificate II next year. In addition, the NT University is geared up to begin offering a newly accredited Bachelor of Electrical and Electronics Engineering Degree which contains some renewable energy units.

Centralian TAFE in Alice Springs may offer some units of the new qualifications.

New South Wales

Ultimo TAFE in NSW is offering a TAFE Statement of Attainment in Renewable Technology which serves as an introduction to the field.

Muswellbrook TAFE will offer this Statement of Attainment at the start of 2003. Other NSW TAFEs are also considering offering this Statement of Attainment.

See the contacts list in this article for other NSW TAFEs that are contemplating offering courses next year.

Western Australia

Central TAFE in Perth has WA's version of a Certificate III, Diploma and Advanced Diploma in Renewable Energy and also runs the SEIA accreditation courses for both RAPS and Hybrid Accreditation. Some courses are open to school leavers and one in the Certificate III is available to licensed electricians and tradespeople.

South Australia

Regency TAFE and **Spencer TAFE** are both expecting to offer some parts of the new qualifications for 2003.

Universities

Australia

Murdoch University in Perth, home to ACRE, offers a range of graduate and post-graduate energy studies programs, both on campus and via distance education.

Australian National University is home to the Centre for Sustainable Energy Systems and offers two degree courses—a Bachelor of Engineering (Sustainable Energy) and a Bachelor of Sustainable Engineering (Environmental Systems).

The **University of Canberr**a offers post-graduate courses in systems redesign and eco-innovation. They are designed for people working in planning or environmental management. They also offer short courses.

University of New South Wales offers a Bachelor of Engineering in Photovoltaics and Solar Energy. It is also home to the Key Centre for Photovoltaic Engineering, one of the pre-eminent centres for renewable technology education.

New Zealand

Massey University offers a range of energy management short courses and qualifications.

Southern Institute of Technology (Te Whare Wananga O Murihiku) at Invercargill is currently developing New Zealand's first technical qualification in renewable energy, based on the Australian models. Classes may be available from 2003.

Domestic cleaning products: how safe is 'safe'?

Committed 'green cleaner' Bridget Gardner tells us what she knows, and what she is planning to find out, about safer cleaning practices for our health, homes and environment

I have a confession to make: I like cleaning! Looking for a change of direction 18 months ago, I decided to put that claim to the test and started a domestic cleaning business, with a commitment to using non-toxic and sustainable products and practices. Armed with handmade soft soaps and sprays made from bicarbonate of soda, vinegar, castile soap and essential oils, I advertised a service that cleaned without chemicals, and was overwhelmed with the response. Green dollar signs were flashing in my eyes—I could franchise the business and market the products. However, the modern surfaces of stainless steel, shower glass and white tiling grout were not as forgiving as the pre-90s renovated homes I was used to cleaning, and I quickly ran into problems and out of time.

Bridget Gardner is passionate about 'green' cleaning! She is pictured here in action at one of her client's homes.

Bi-carb soda blues

I found the combination of sodium bicarbonate (bi-carb soda) and scourers caused havoc on the stainless steel stove tops and glass shower screens—not only as they scratched really easily, but the chalky residue they left seemed impossible to remove. Apartment bathrooms often lacked adequate ventilation, which didn't make cleaning acres of white tiling grout with vinegar instead of bleach any easier. While conventional cleaners are designed to clean a particular surface, that is, floor or window, whether it be greasy or just dusty, the cleaning action of natural agents were more limited. I often found greasy smears or stains on a surface I thought I had cleaned.

Looking for help, I consulted several green cleaning books, but found few instructions regarding techniques, storage, equipment or how to dispense basic cleaning agents. What I really needed to know was *how* they actually worked. But, as a professional cleaner, I felt a responsibility toward other people's health and of more concern was the issue of bacteria. Could I confidently claim that vinegar was adequate for toilets and that disinfecting all surfaces was unnecessary? The amount of water required to rinse off bi-carb soda residue, and the pesticides being used in the production of wine vinegar, also caused misgivings. Was I really being so environmentally friendly? It was obvious that a lot of research was necessary before I could market my products, so I decided not to reinvent the wheel when 'safe' cleaning products were already available. And that's when I became *really* confused!

Commercial confusion

The desire to be environmentally responsible has spawned a whole industry of 'safe' domestic cleaning products. I had assumed that all I needed to do

was discover which manufacturer had got it 100 per cent right. However, the different claims as to what substances were safe or toxic often conflicted, as did various retailers' advice as to which brand I could trust. After trying one brand, the glass shower screens were definitely clearer, but I wasn't. I wondered how much kinder to the environment was a detergent that was naturally, rather than synthetically, derived.

But, as I investigated further, I began to appreciate how complex this issue was. Although it seemed reasonable that plant-based detergents would biodegrade more easily, this was not easy to prove scientifically. All detergents are formed through a chemical process, and the chemical structure of plant-based detergents is similar to those derived from petroleum. The label 'Biodegradable' refers only to the 'organic' component of a product to breakdown, which may only be the fragrance! Also, testing takes place in a laboratory, where the warmer, aerated water biodegrades the surfactant more rapidly than it would in our rivers or the sea.

Although it is good that there are now phosphate-free products, some environmentalists have expressed concerns that some of the phosphate alternatives are capable of dissolving heavy metals in the sediment of waterways, which would make these waterways extremely toxic. As Professor Frank Fisher, head of Monash Graduate School of Environmental Science, said to me, conservation is just that: conserving—consuming less.

It's not just what we use, but how we use it

By supplying products in convenient 'spray and wipe' packaging and marketing a product for every situation, commercially manufactured cleaners are designed to encourage us to use more, not less. So, I decided that a fundamental problem I needed to address was the way I used cleaning products—it was all too easy to aim, pull the trigger and squirt onto every surface, every time. It was costing me a lot of money in product, so I felt it must have been costing the environment as well, no matter how 'safe' it claimed to be.

In response to this I began to decrease the amount I used, which led me to make a great discovery: hot water cleaned fantastically! I simply needed to allow a little more time for it to work. My initial experiences with natural cleaning agents had been unsuccessful because I had been expecting the same convenience and instant results offered by commercial cleaners. As I experimented again with hot water, bi-carb soda, pure soap, vinegar and essential oils, the techniques and equipment I used became as important as the ingredients. Not only to improve their effectiveness but also to reduce the quantities required.

These methods (which are detailed at the end of this article) allowed me to professionally clean the most modern of interiors without using manufactured cleaning agents, but it took a conscious decision and commitment to succeed. I had to break my spray and wipe habits. As exciting as this was to me, I still wanted to expand my business. Even with

the best methods and training in the world, I couldn't guarantee that, under pressure of a ticking clock, an employee wouldn't 'hit the Jif'! They would need an incentive—they needed to know *why*.

Changing habits

Teaching employees about the damage that toxic chemicals can do to the environment and their health was going to be vital for me to achieve the commitment needed from staff to clean without chemicals. But why keep this information to my own company? The initial problems and confusion that I encountered trying various methods to clean 'green' had given me an understanding of why consumers are often reluctant to trust and use natural cleaning agents. Without a 'brand name you can trust', can you be sure natural cleaning agents are good enough? Many consumers, especially mothers, *are* concerned about the health and environmental consequences of using cleaning chemicals, but are equally worried about hygiene and bacteria; a fear fuelled by the aggressive and often misleading advertising campaigns for disinfectants and antibacterial agents.

The question is not which disinfectant is safe, but rather, do we *need* to disinfect? Over-disinfecting upsets the balance needed between the different strains of bacteria in order to keep those that can cause disease in check. Bacteria requires food and water in order to thrive, therefore a surface needs only to be cleaned, then dried with a clean, dry cloth. (You could

dryfit

Sonnenschein

Reliable for life!

Sonnenschein's dryfit® "Solar" range of batteries has been continuously developed since 1958. From the inventors of the Gel maintenance free battery comes a specially designed battery for all renewable energy applications.
Proven performance, over the last three decades in thousands of sites throughout the harshest regions in Australia and the world back up their reputation as the ultimate Solar battery.

Solar Block: Grid Plate monobloc batteries for heavy-duty applications, with a service life of 8-10 years. Designed for 1200 X 100% extracted capacity (according to IEC 896T2). Sizes: 12V 60Ah to 6V 300Ah

A600 Solar: The world's only Tubular Plate gel battery designed for Solar applications, this is the ultimate in ultra high discharging lead acid batteries. 15+ year service life and up to 1600 X 100% extracted capacity (according to IEC 896T2). Sizes: 2V 240Ah to 2V 3500Ah

Consider these advantages:

* **Absolutely maintenance free: no more topping up acid; no danger to user, children or animals.**
* **Safe: no acid discharges, fumes or spillages.**
* **Simple battery room required: install almost anywhere, even indoors!**
* **High cyclic performance & high C10 discharge rate: smaller battery bank required.**
* **Patented cyclic additive: proven long life, even at high temperatures.**
* **Deep discharge resistant: added safety for remote sites.**
* **High energy acceptance: very efficient and can be easily fast charged.**
* **Manufactured to extremely high quality (ISO9001) for the highest reliability.**
* **Fully recyclable: environmentally friendly.**

Don't settle for second best, buy the best. Get reliable for life.

Contact us for your nearest distributor
Sonnenschein dryfit Solar. Ph: 1300 733 004
www.mhpower.com.au

MH POWER SYSTEMS
M&H 22346

Tips for environmentally safer home cleaning

- Small buckets are indispensable (two litre Fetta cheese buckets are great). Mix vinegar or essential oils with hot water as required (they deteriorate over time in spray bottles, and clean more effectively warm). Fill with hot water to rinse the cleaning cloth in, rather than under the tap. This also keeps the cloth clean and hot so that most surfaces (without grease or soap-scum) can then be cleaned without any cleaning agent at all.
- I use flannelette nappies to dry every surface I clean, leaving them streak and bi-carb residue free. Wash, dry and re-use over and over.
- Bi-carb in an icing sugar shaker avoids overuse and spoiling through moisture. A sprinkle on a damp (not wet) 'textured' cloth or scourer is enough to clean bathrooms and white goods. Rinse often in a bucket of hot water, and re-sprinkle. *Do not mix with vinegar, as they neutralise each other.* Buy bulk from Friends of the Earth.
- Keep pure soap (olive oil is great) in a travel soap dish and lightly wipe a damp cloth over it to clean trouble spots only. This method uses less than when added to water, and is twice as effective. For extra punch (that is, crayon on walls) add a sprinkle of bi-carb.
- Mix two to three drops of eucalyptus oil in one litre of hot water and pour over stainless steel stove tops 10 minutes prior to cleaning with cloth. Use the same procedure for ovens, then pre-heat 10 minutes on low before scouring with this mixture and a little soap, if necessary. Use an oil bottle with 'dripulator' top.
- Buy quality equipment with replaceable parts. They save resources and are more effective. Microfibre cloths (HA-RA or ENJO brands) are expensive but excellent, especially for shower screens. Squeegees for windows and shower screens, and VILEDA chamois for mirrors.
- Squirt vinegar into a bucket of hot water for floors, tiling grout and toilets (keep a separate bucket and cloth just for the toilet). For grout, crop a dustpan brush to 3cm and use that for scrubbing.
- Open windows and burn essential oils for air fresheners!

use borax as an antiseptic if infection is present, mixed at 3:1 weight/weight.) Rinse cleaning cloths in a bucket of water to remove all food particles and then hang to dry when not in use.

Independent information concerning why and how to clean without toxic chemicals can be found throughout various medical journals, books and environmental publications. But it takes time and initiative to search and work it out—the reality is that most people simply don't. My aim is to pull together this knowledge and present it in a way that is easily understood and relevant to cleaning and cleaning agents. If you are aware of any research, articles or websites you think may be of use, please contact me via the details at the end of this article. I believe that, for information to have credibility, it needs to be scientifically based and tested, and provided by an organisation without a vested interest in commercial products. For it to be of value it should enable us to trust our own common sense.

I have come to the conclusion that it is impossible to scientifically claim that any one product or method is 100 per cent safe for the environment. No matter what we do we leave a footprint on this earth. Therefore we need to find ways to lessen the pressure.

Bridget Gardner is the manager of *A Fresh Green Clean*. She is available for talks, workshops and demonstrations.
Her contact details are: PO Box 61 Clifton Hill VIC 3068, mobile: 0417 519 251, email: freshgc@alphalink.com.au

Further resources

Our Stolen Future, Theo Colborn, Dianne Dumanoski & John Peterson Myers, 1996 Plume/Penguin Books.

The Green Cleaner by Barbara Lord, 1990 S&W Books.

Sick Homes Part 1, Dr Peter Dingle & Toni Brown, PO Box 397 Mundaring WA.

Chemistry in the Market Place, Ben Slenlinger, 3ed, 1988, Harcourt Brace Jovanovich Group Pty, Australia.

A-Z of Chemicals in the Home, Toxic Chemicals Committee of the Total Environment Centre, 1996 CHOICE Books (Sydney).

W.H.E.N. Australia Inc, Worldwide Home Environmentalists Network. Ph: (03)9836 0431.

Centre for Community Child Health, Children's Hospital, Judy Grey: Education. Ph: (03)9345 6530.

Friends of the Earth Food Co-operative, 312 Smith St, Collingwood, Ph: (03)9416 2081.

Environmental Choices Australia, Environment Australia, Canberra, Ph: (02)6274 1111.

Recycling is not the answer!

Have we become obsessed with recycling and neglected other forms of resource management? Warren McLaren and Lucy Rowe from The Bower Reuse and Repair Centre look at another option

Why would you want a bicycle wheel in your kitchen? A snow ski in your lounge room? A fridge in your garden? Circuit boards sitting on your bedside table? A lounge sofa at your market stall? A Venetian blind on your ceiling? Why? Because the materials inherent in these products make them ideally suited for applications their creators could not have imagined. But more on that soon.

The team at The Bower, in Marrickville, Sydney, have being applying creative solutions to a curly problem—household waste. A large portion of this finds its way quickly to landfill. To great big holes in the ground.

The Bower is a community co-operative and a registered charity. Housed in a volunteer-built, strawbale constructed retail shop, The Bower sells 'stuff'. Stuff that one person did not need but is now useful to another. The co-operative 'mines' the alluvial deposits of household waste, before it becomes buried again. Council kerbside clean-ups are trawled to find working or near-to-working household artefacts. Customers can arrange pick-ups from their premises or make direct donations.

Given its limited size and staffing resources, The Bower is selective about what it can accept, but the breadth of goods offered is staggering. Slide projectors, dentists chairs, ladders, indigenous artefact carvings, matchbox cars, roofing iron, fluffy toys, Soviet era wood planes and chisels, doors, windows, sinks, basins, spiral staircases, sewing machines, suitcases, dressers, vases, light fixtures, computers, VCRs, movie props...well you get the picture. As one customer put it: 'There is no other place like The Bower. It's one stop shopping.'

Why does The Bower have all these wonderful goods? Several reasons. Some stem from the fact that community relations have broken down. We no longer know the name of the person in the corner shop (even those folk who still shop there, instead of the supermarket.) We know little about our neighbours, except what car they drive because it is parked out front, and what beer they drink because we see inside their recycling bin. In our cities of millions of people we simply don't know anyone who might want our old toaster or lounge suite or art deco vase. So to make room for the newer version we might have a garage sale or advertise in the Trading Post. But if these options bear no fruit we send it to landfill. Not knowing our neighbours also means we all fill our houses with identical products, duplicating the quantity of goods in existence. How many of us have a neighbour who pops through the hole in the adjoining fence to use our washing machine? The same neighbour who might then loan us their fruit juicer? Alas, it is more likely that 20 houses all in a row will each have 20 lawn mowers that get just a 30 minute workout once a week.

Fashions change too. Pink ceramic toilets are no longer in vogue.

Discarded materials are brought back to life in new products, such as this table and utensil rack, available at The Bower.

Carpets are out and floorboards are now *de riguer* (or are carpets making a comeback? Who can keep track?) Who wants a tape player when CDs are the go? A VCR when the kids demand DVD? Who needs a perfectly good computer with a 500MB hard drive when Harvey Norman has new 6GB models and you don't need to pay for another two years?

So society has product 'churn'. Out with the old—in with the new. The old needs to go somewhere. A tiny portion of it comes to roost at The Bower. A fire-twirling baton might take months to find another home, while a very cute bedside table might only spend an hour in the store before it begins it's new life. What The Bower provides is a halfway house between one existence for a product and its next adventure. Some products even cycle through the place on a regular basis, like sofas and wardrobes going to a succession of student share-houses. It also has a section set aside for pieces placed 'on consignment' by members, who are artists and craftspeople. They have lovingly brought goods back to life or conjured new items from old materials.

But The Bower is not recycling. This is re-use. The difference being that products, or at least the materials in them, are re-used in their original condition. They are not melted, chipped, shredded, pulped into tiny pieces and reprocessed. A metal stool is reused as a stool, not melted down to become a tin can or roof truss. A bookcase goes off to be a bookcase, instead of being chipped for garden mulch. The longer materials can be maintained in their original state the less energy the world needs to find to reprocess them via recycling. And the less forests felled, ore mined and oil extracted. Re-use is so much more energy efficient and environmentally responsible than recycling.

The staff at The Bower are, however, playing with some industrial alchemy. With the foresight of the centre's previous co-ordinator, Mark McKenzie, and the assistance of a Community Waste Grant, managed by the New South Wales EPA, they are bringing disparate materials together, developing brand new products. Not quite making gold from lead and copper but certainly the materials resource equivalent, more correctly termed 're-manufacture'—an innovative form of re-use.

Saucepan pot racks have been fashioned from bicycle wheels with the spokes acting as the hooks. Light stands use the strength of snow skis standing in a pre-loved motorbike helmet. Fridges have been converted into self-contained worm farms. Ex-army circuit boards shed a gentle diffuse light when formed into bedside lamps. Trestle legs have been made of salvaged structural timbers inside lounges. Venetian blinds are reincarnated as light shades when threaded onto old wire coat-hangers. Thrown away bike frames now form the chassis of a robust bicycle trailer. Louvre shutters combine to create a smart 'flat-pack' corner shelving unit. And many more ideas are pushing their way out of the workshop.

The Bower team have scoured far and wide for concepts they can develop to give these materials a useful second life. While many of the products are unique, some have been inspired by work elsewhere. But when faced with an endless supply of wardrobe drawers, golf clubs, exercise equipment, dead toasters, computer monitors, garden hose reels, and tubular steel chairs—the search goes on for other solutions.

And, fortunately, Australians are renowned for their creativity, particularly with odd materials. Witness the legendary Coolgardie safe made from kerosene tins or the mini band-saw, crafted from a sewing machine that was donated to The Bower. The team at The Bower would be delighted to hear from anyone happy to share their adventures in re-use and re-manufacturing.

Visit The Bower at: Building 34, 142 Addison Road, Marrickville NSW 2202, ph: (02)9568 6280, fax (02)9564 1034 email:thebower@pacific.net.au, http://home.pacific.net.au/~thebower/

Home-grown solar power

Rachel Ollivier assesses what electricity retailers are paying for home-generated electricity to help you calculate the cost of installing your own solar power system

Many people would like to install a solar power system that generates all or part of their household's electricity needs. Some even dream of producing excess solar electricity, where the household covers all their electricity needs over a year and then 'sells back' electricity to their supplier.

In this article we outline some of the important factors to take into account on the connection side of such systems, including the various costs and requirements which are over and above the cost of the solar system itself.

It can be difficult to find out how much grid connection is likely to cost, as the information you need from your electricity retailer or distribution company to make this assessment can be hard to come by. When researching this article I found it was common to speak to three or four people before talking to the right one. In some cases we were referred by the retailer's call centre outside the company, in one case to the Master Builders Association and in another, to a government department. Only two companies knew exactly who to put me through to. Hopefully the information presented in this article will save you some time and provide you with some useful information to take that first step—assessing your potential to get connected.

What does it cost?

Leaving aside the solar power system itself, there are a range of costs and prices associated with connecting it to the electricity grid that depend on the geographic area you are in. The table on page 35 provides a guide to the costs and requirements that apply in your local area.

See the table at the end of this article to find out the metering requirements for your area.

If you are in Victoria, New South Wales or South Australia you may be able to change your electricity retail company, which means you can choose between the pricing options each company offers.

Metering and inspections

One of the largest variables in price is associated with the installation of a new meter, as a normal household electricity meter does not provide all the information retailers require. Each distribution company has specific requirements for meter types and inspections of systems. In some areas meters are provided free of charge, but in other areas there are charges ranging from $120 to $1000 (see the table for more on this).

You have no choice of distribution company (also known as 'poles and wires' or network companies) because it is dictated entirely by your geographic location. The difference between electricity retailers and distribution companies is explained in the break-out box .

Service charges

Service charges are the component of an electricity bill that remains even if you don't use any power—it is what you pay for having the ongoing connection to the electricity grid. Service charges vary widely from state to state and between local regulatory frameworks. In some cases, your choice of electricity plan (or 'tariff') can reduce or increase your service charges. But these are the same for households with or without grid-connected solar systems.

For example, Tasmania has a very low service charge at $5.30 per quarter because the cost of service and the cost per kilowatt-hour (kWh) of electricity delivered have never been separated out, but in Victoria service charges on standard domestic electricity plans are around $38 per quarter. In Queensland you pay a minimum monthly payment, whether or not you use the minimum amount of power.

Net-metering

Most companies offer to calculate your bills using 'net-metering' (or 'offsetting'). This effectively involves the retailer buying electricity at the same rate that they sell it—or in other words, you only pay for the electricity used over and above that generated by your system over the billing period. Usually your bill will be calculated over three months

and net-metering can allow you to store credits for up to one year to take seasonal variation into account.

The exception to net-metering is Western Power, where householders have the choice of a better deal—Western Power rewards customers by paying more per kilowatt-hour for electricity generated in peak demand periods of the day.

Also be aware that households may still be charged a GST component even if net-metering is offered. We did not investigate this in detail so make sure you ask. You may be able to avoid such a charge if you have an Australian Business Number (ABN).

Price of electricity you buy

All home systems should be designed with reference to the expected energy usage of the household. If, on average, you expect to require extra energy from the grid, then its price will be a significant consideration when calculating the overall cost of your energy needs.

The price you pay depends on the various pricing plans or 'tariffs' offered by electricity retailers. These are usually listed on company websites. Currently, only customers in New South Wales and Victoria have a choice of electricity retailer. South Australian customers will have this choice from January 2003. Queensland and ACT customers will have this choice in the future, but a date has not been set.

Price of excess generated electricity

If, on average, you expect to generate more electricity than you use, you may be able to earn an income from your system. There are not many household grid-connect systems in Australia that are large enough to generate a realistic income.

About half of the electricity retailers in Australia will now send a cheque for excess energy produced, whilst others will only ever offer a credit on an electricity bill. In the latter case there is no

Renewable Energy Certificates (RECs)

RECs are official certificates that prove the amount of renewable energy production in Australia. Once produced, these certificates can be bought and traded and their validity is monitored by a government body. Each REC certifies one megawatt-hour (MWh) of renewable energy as being produced.

RECs are the common currency of two separate market systems that encourage renewables development: green power (consumer driven) and the Mandatory Renewable Energy Target (MRET) (government legislation).

When supplying consumers that choose to buy green power, an electricity retailer is required to verify this renewable energy has been supplied with a corresponding number of RECs.

Totally separate from their customer-driven green power commitments, resellers and wholesalers of electricity are required by the Renewable Energy (Electricity) Act 2000 to surrender a certain number of RECs each year to proportionally meet the MRET. The MRET is increased each year to reach 9500 gigawatt-hours of new renewable generation in 2010, and annually thereafter to 2020. And this currently produces the major market for RECs. Companies ensuring that they comply with this are currently buying RECs at just under $40 each.

New solar hot water systems, solar electricity systems and wind power are all able to benefit by cashing in RECs. For domestic systems, certificates can also be generated in advance for a period of five years and these are referred to as deemed certificates. For many solar hot water systems, manufacturers will offer to buy the deemed certificates from the customer at point of purchase, and this then acts like a discount on the system. Some companies that sell solar electricity systems are also now offering this option. Visit www.orer.gov.au to calculate the value of RECs for your proposed system.

The National Electricity Market (NEM)

Supplying electricity was, for much of last century, considered a natural monopoly industry, but recent decades have seen the industry split up to various degrees in an attempt to introduce market competition.

The NEM was set up in late 1998 as part of this process of deregulation. A key objective of the NEM is to stimulate competition during the different stages of the electricity supply chain, including between retailers of electricity. South Australia, Victoria, New South Wales, ACT and Queensland all joined the NEM, however only SA, Victoria and NSW have so far gone 'contestable'. Tasmania plans to join on completion of the Basslink electricity cable that will connect Tasmania's electricity grid to Victoria's.

Retailers and distributors—the difference

Under the NEM, distribution companies are responsible for poles and wires in a region and retailers are responsible for pricing, servicing customers and buying power from sources in order to meet requirements under the MRET and their commitments to green power customers.

'Contestable' customers under the NEM are now able to choose their own electricity retailer (the company your bill comes from), but not distribution company. Some companies have both retail and distribution arms. When a retailer refers to their 'network area' they are referring to the geographic region that their distribution arm is responsible for.

financial benefit in oversizing the system (despite the public good benefit).

If your solar power system is not designed to produce excess power over a 12 month period, then the rate offered will not be an important factor in your decision to go ahead with a system.

Renewable Energy Certificates (RECs)

See the break-out box for a description of RECs. Some electricity retailers give you an option to sell your RECs to them, some simply write it into the contract that they own them, and others don't deal with them at all—meaning that the household retains ownership of them, and, if they wish to sell them, will need to find another buyer.

The possibility of selling 'deemed' RECs for a home system *before* connecting it to the grid is an unusual special case that retailers may not yet have dealt with. In this instance there would then be no green benefits for an electricity retailer to own, even if this is built into their contract.

Searching for the best deal

In most parts of Australia you have no choice between electricity retailers. In Victoria and New South Wales (and soon South Australia) you do have a choice, but if you have a grid-connect system it is more limited than you may expect. First, you can choose only between the price of electricity bought and sold, and whether RECs are bought from you—but you can't change your metering costs (which are fixed). Second, only a few electricity retailers currently offer buy-back or net-metering outside their 'network areas'—where they own the poles and wires (see pull out box). Don't be confused by the fact that some companies will offer to sell you power outside their network area but they won't offer to buy power back off you—if in doubt, ask them directly.

Considering all costs, we found that there appears to be little difference between areas with and without a choice of retailer.

For example, Western Power (the only retailer in WA) offers a good pricing structure for customers, but this is balanced by an upfront application assessment fee. And Aurora Energy, which is the only retailer in Tasmania, has very low service charges, which cuts quarterly costs, but their contract is written in such a way that it owns all green benefits, which can be worth $250 per household system over five years.

Do retailers sell the power I produce as green power?

At this point no company we spoke to said they were currently selling the electricity generated by households to other customers under an accredited Green Power product. However, contracts that transfer ownership of 'green benefits' to the company do leave the door open for this. This is because, if a retailer buys RECs from the householder, it does have the choice to either hand them in to meet either their obligations under the Mandatory Renewable Energy Target or their Green Power commitments (see RECs section in the break-out box for more on this).

Making the process as easy as possible

A number of electricity companies are now offering to install solar electricity systems for their customers—in some cases, meaning that the same company will take you through all the steps of design, installation and connection to the grid. This can make the process easier for the householder, but a good independent installer will also facilitate the connection the same way. Your choice of system should take into account your lifestyle, price and other preferences.

Selecting a designer and installer

Ideally, the installer will manage the process of getting the approvals from the local distribution company and from the relevant electricity retailer. In particular, the distribution company needs to approve the inverter that will be used in the system. This approval should be sought at the design stage and definitely before the inverter has been bought and installed.

A good installer will make sure that all the right paperwork is lodged and the process runs smoothly. Make sure the installer is asked to include this cost when they are providing a quote. See our article in *ReNew* issue 81 for how to select a good installer.

Talk to your electricity retailer early

It is important to speak to the electricity retailer before installing your solar power system. Find out what they require and what their application process is. Ask them about prices and charges. Some electricity retailers have preferred suppliers and will recommend them strongly. It is still, however, your choice as to who you use to install your system.

Understand the requirements of your distribution company

Because distribution company requirements vary so much, but can make a big difference to your budget, it is worth getting in touch with them. You need to know what their charges are and it helps to understand what the paper trail is going to be, even though your installer should follow through most of this. Your existing power company can tell you who your distribution company is.

Breaking out the bubbly

Once final inspection and sign off is complete (and you do need to make sure you have it signed off), you should be able to flick the switch and watch the meter start clocking up the first power generated by your system. It is recommended that this be done in style, perhaps with a BBQ or street party. ☆

Electricity retailer	Geographic areas served	Likely metering requirements & costs	Billing method used	RECs	Comment
ACTEW AGL Ph: (02)6209 8946 Contact: Technical enquiries www.actewagl.com.au (No. grid connect customers: 17)	Australian Capital Territory	A separate meter on the solar output. Actew AGL supplies and installs the meter.	Net-metering offered. Excess power can only be claimed as a credit on your bill. Bought at 7.4c/kWh	Actew AGL owns the RECs. Power is not sold as green power	Prices only apply for systems up to 10kW
AGL Victoria: Ph:131 766 SA: Ph:132 245 www.agl.com.au	South Australia and Victoria	Incumbent distribution company will install it. Import/export meter. Approx cost is $240 for meter	Net-metering offered. Excess power bought at 12.84c/kWh in VIC and 15.09c/kWh in SA	AGL will not purchase RECs. Recommend customers to Pacific Solar who will buy for approx $25/MWh	$65 inspection fee. Strongly recommend a Plug and Power solar electricity system
Aurora Energy Ph:(03)6237 3527 Contact: Soheil Haee, soheil.haee@auroraenergy.com.au www.auroraenergy.com.au	Tasmania	Smart meter, currently installed by Aurora free of charge.	Net-metering offered. Excess power bought at wholesale spot price	Aurora owns RECs as part of the contract	Prices only apply for systems up to 3kW
Country Energy Ph:(02)4927 7100 Contact: Energy Answers Business www.countryenergy.com.au (No. grid connect customers: 50)	75% of New South Wales, in their network area only (outside metro areas)	Additional meter likely to be required. Country Energy must do the installation. Price varies	Net-metering offered. Excess power bought at 10 to 12c/kWh depending on your region	Customer retains ownership. No option to sell them to Country Energy	-
Energex Ph:(07)3407 6106 www.energex.com.au Contact: John Hamilton-Smith, National Sales Manager Energy Efficiency	South East Queensland	Export meter. Provided free of charge	Net-metering offered. Excess power bought at 8c/kWh. Calculated over a quarter	Energex owns all green benefits including RECs. $30/MWh is paid to the customer	-
Ergon Ph:131 046 www.ergon.com.au You will be directed to the local Ergon Customer Service Officers	Queensland except the south east	Export meter. Provided free of charge	Net-metering offered. Excess power can only be claimed as a credit on your bill. Bought at same rate that customer buys power at	Ergon owns these as part of the retail agreement. No payment is offered	Prices only apply for systems up to 1.5kW
Energy Australia Ph:(02)4951 9395 www.energyaustralia.com.au Contact: Paul Meyer (No. grid connect customers: approx 750, incl ~500 at Olympic village)	Sydney (northern and eastern areas, the Central coast, and Hunter Region of NSW). Considering policy outside this area. Applications considered on a case-by-case basis	Bi-directional meter required. Must be installed by Energy Australia	Net-metering offered. Excess power bought at same rate sold to customer. (GST may be added, if customer doesn't have an ABN)	Customer owns RECs. No option to sell them to Energy Australia, but this is being investigated	-
Integral Energy Ph:131 002 www.integral.com.au	NSW: Greater Western Sydney, The Illawarra and Southern Highlands network region only	Additional meter installed free of charge	Net-metering offered on Sun-Power plan. Excess power bought at between 6 and 11c/kWh	Customer owns RECs	-
Origin Energy Ph:(03)9652 5585 www.originenergy.com.au Contact: Alex Clarkin (No. grid connect customers: over 100)	All of Victoria, majority of NSW, from 2003 also South Australia	Depends on the requirements of distribution company. In general, they are total input and output meters. Cost from $150 to $1000	Net-metering offered. Excess power: choose between two plans, 30c/kWh up to 1000kWh excess, or 6c/kWh with no limit	Can choose to sell them to Origin for $30/MWh	Can choose to use Origin to install solar power system
Power & Water Authority Ph:(08)8924 7093 www.nt.gov.au/powerwater Contact: Trevor Horman, Manager Sustainable Energy (No. grid connect customers: 1 in Darwin, 2 in Alice Springs)	Northern Territory: Darwin-Katherine grid, Tennant Creek grid, Alice Springs grid	Gross export meter - solar system must be approved and certified. Power and Water installs the meter at a cost of $120	Net-metering offered. Excess power bought at 14.02c/kWh which is same as price of domestic electricity sold to the customer	Power and Water owns these as part of the retail agreement. No payment is offered	$100 application fee
TXU Ph:133 466 www.txu.com.au Ask for connection procedures for photovoltaic. (No. grid connect customers: ~50)	Eastern Victoria in their network area only. Considering policy outside this area	Bi-directional meter. Cost up to $500 but depends on existing meter. Must be installed by TXU	Net-metering offered. Excess power bought at same rate sold to the customer, which depends on the specific pricing plan the customer is on	Customer owns RECs, TXU has no option to buy them	Prices only apply for systems up to 1.5 kW in size
Western Power Ph:(08)9326 4511 www.wpcorp.com.au Contact: Energy Trading Branch (No. grid connect customers: 51 residential, 13 educational)	WA - south west grid interconnected region only	Meter costs depend on existing meter and house. Ranges from approx $300 to $1000	Net-metering offered (A1 tariff) or SmartPower tariff, which pays and costs more during peak periods. This rewards solar power generators for producing power in peak, but using it in offpeak periods. Bought at 18.38c/kWh peak, 5.96c/kWh off peak	Customer owns RECs, Western Power has no option to buy them	$107 assessment fee. Prices only apply to systems between 500W and 5kW in size

This table provides an indication of the services offered to grid-connect customers and the likely costs involved with dealing with Australia's electricity retailers. For information specific to your residence and system, contact retailers directly.

Help cut air pollution—use a push lawn mower!

Andrew Moore argues for the return of the trusty push mower

Push mowers come under a lot of different names: push mowers, hand lawn mowers, manual lawn mowers, but they all have one thing in common, they are powered by renewable energy—YOU!

Push lawn mowers use a simple system of gears in the wheels to drive the blades when you push them. They are up there with the bicycle as one of the most efficient human-powered machines. In fact, they were the first type of mechanical lawn mower invented. A lot of improvements have been made since they were first invented in 1830 by the English engineer Edwin Budding. His push mower was constructed from cast iron and required two people to operate! With the use of new materials, the weight has been dramatically reduced from over 30kg (for the old vintage models) to around 10kg for modern push mowers. Yes, they are still being made! Other advances, such as the non-contact cutting system, (where the two parts to the scissor-like blade come within a fraction of a millimetre of each other but do not actually touch) make push mowing easier and quieter, and the blades need sharpening less often.

There are so many benefits from using a push mower that you have to ask yourself—'why don't I use one?'

Environmental benefits

Human-powered mowers have a lot of environmental benefits. A Californian study calculated that a petrol mower running for 30 minutes produces the same amount of air pollution as a car traveling approximately 300km. To put that another way, because a petrol mower has a less sophisticated engine it produces the same particulate pollution as 40 new cars running for the same period of time. The average Australian lawn takes between 30 minutes and an hour to mow so the air quality in your yard would be similar to that if you had 40 cars parked in your backyard running for the same length of time—yuk. When you consider that most people mow their lawns on the weekend, this can have a huge impact on the air quality of your neighbourhood.

In terms of smog-forming volatile organic compounds, the average petrol mower produces the equivalent emissions of a car traveling 42,000km per year. So your petrol lawn mower is probably emitting more air pollutants than your car!

A study on lawn mower use in Australian capital cities has found they produce a total of 108,000 tonnes of carbon monoxide, 34,000 tonnes of hydrocarbons (excluding methane), 450 tonnes of nitrogen oxides, and 370,000 tonnes of CO_2 equivalent greenhouse gases

every year. To put this in context, the emissions from motor vehicles in the Sydney-Newcastle-Wollongong area produced 800,000 tonnes of carbon monoxide for the 2000 to 2001 period—208,000 tonnes less than that produced by all the lawn mowers in Australia's capital cities!

Although electric mowers produce far less air pollution than their petrol cousins, this air pollution can be totally avoided by using a push lawn mower.

One of the best things about push lawn mowers is that they are quiet to operate. All you hear is the swish of the blades as they cut the lawn, so you don't wake the whole street on Saturday morning. Mowers with the non-contact cutting system are even quieter, as the blades don't rub—all you hear is the lawn being cut. I have even been mowing the lawn while I have been talking on the phone, and the person on the other end hasn't even noticed!

Safer than your average mower

Push mowers don't need any fuel so you no longer have to store or handle hazardous fuels. Ten per cent of the emissions from lawn mowers in Australia are actually caused by fuel spills as people re-fuel their mowers. In the United States, over 64 million litres of fuel are spilt every year while re-fuelling gardening equipment—that's more than was spilt from the Exxon Valdez.

You also don't have to manage extension cords or worry about running them over with the threat of electrocution. The blades stop turning when you stop pushing, which makes them perfect for tricky or sloping lawns where heavy power mowers are dangerous. They don't throw rocks and debris with quite the same energy as conventional mowers. Despite generally being safer, use your common sense: the blades are very sharp and will cut fingers and toes if you get them in the way.

Less maintenance

Push mowers are designed to have as few moving parts as possible, so are low maintenance by design. They require no fuels, no tune-ups and have no ongoing running costs. All you have to do to maintain them is occasionally oil and adjust the blades, and keep them clean. Like all reel mowers, whether powered or push, they should be sharpened every other season, unless they have a non-contact cutting system, in which case you only have to sharpen them every five to eight years.

Easy to use

Push mowers are fun to use! Much of the frustration is taken out of mowing

the lawn, as there is no fuelling, no starting and no preparation time—you just push it and it mows. Being lightweight, they take about the same effort to push as a standard mower, even though you have to provide the energy to drive the blades. Push mowers are generally about half the weight of petrol powered mowers so they are easier to store, manoeuvre, or carry through the house to get to those small backyard lawns. You can hang them in the garage without worrying about oil dripping everywhere or you can even pack them up in the box they came in and store them in a cupboard. I love the fact that they don't blow fumes into your face while you are mowing—so you get to exercise and enjoy it.

Cheap to run

Push mowers are generally cheaper than standard mowers, as they are a far simpler machine to manufacture. Good push mowers are well built and designed to last. Like many environmentally friendly options, a push mower will save you money as they cost less to buy and have no running costs, so you effectively get an immediate return on your investment.

A better cut

There are basically two types of lawn mowers: reel/cylinder mowers and rotary mowers. Push mowers are all reel/cylinder lawn mowers. Reel/cylinder mowers cut the lawn using a scissor action with a rotating blade spinning next to a stationary cutting bed. As a result the grass is cut very cleanly, leaving the end of the blade of grass undamaged and less susceptible to disease. Rotary mowers cut by slashing the grass blades at high speed with a horizontally spinning blade. This type of cutting action ends up tearing the end of the grass blade, leaving it damaged. Often, lawns cut with reel/cylinder mowers appear greener, as the ends of the grass blades do not go brown with damage.

Push mowers are the original mulch mowers (grass-cycling)—where the lawn clippings are cut fine, evenly dispersed, and then left to break down into the lawn. Of course, you can get a catcher for your push mower if you wish, but the benefits of mulch mowing include reduced fertiliser use, reduced mowing time (that is, not having to empty the catcher), reduced broad leaf weeds, and increased lawn growth rates. If you find that clippings are not breaking down fast enough during the peak-growing season just use a catcher on alternate mows.

Limitations

The main limitation with push mowers is that they are designed for maintained lawns and are no good for mowing down the back paddock. Lawns that have a lot of long grass, large amounts of sticks or rocks, or are muddy bogs are not ideal for push mowers. If you try to mow a wet lawn with a push mower you will find that the wheels will skid, so the lawn won't be cut very well.

Cutting height is usually adjustable from 1cm to 4cm—which may seem on the short side, but most cutting height recommendations for lawns are based on rotary mowers which damage rather than cut the grass blades. Push mowers will help you keep a low-water, healthy and energy-efficient lawn.

If you have large areas to mow, a push mower may not be for you, but you will be surprised how quick they are. If it takes you more than a couple of hours to mow your lawn with a conventional mower then maybe you should look at reducing the amount of lawn you have before getting a push mower.

Push mowing tips

The key to using a push mower is to use it regularly. This way you keep the lawn under control, make it easier to cut, and reduce the size of the clippings left on the lawn. Try to resist using a sawing action (backwards and forwards) if the lawn is a bit long or thick and hard to cut. Instead, try raising the cut height, do several passes with greater overlap between passes, or do double passes. You will find this requires a lot less effort.

If you are converting from a standard mower to a push mower it often pays to do a final mow with the powered mower then follow up with the push mower the next day. If your lawn is really out of control and you don't have a powered mower, you may need to hire or borrow one to get it under control to start with. From then on just use the push mower on a regular basis.

There are many companies using entirely human-powered equipment to maintain lawns and gardens (see more information section for some contacts). Some even use bicycles to go from job to job taking all their equipment along in bicycle trailers! If you prefer to have someone else do your mowing, inquire in your area for someone who uses human-powered equipment, or better still, start your own sustainable lawn mowing business.

You will find that regular mowing with a push mower isn't a chore, as it is so easy to do and it's fun! ✲

Further information

General websites

www.cleanairgardening.com
www.peoplepoweredmachines.com
Air Quality in Australia, Environment Australia: www.ea.gov.au/atmosphere/airquality/urban-air/
National Pollution Inventory: www.npi.gov.au

Ecological/Sustainable Lawn Care

Ecologically Sound Lawn Care for the Pacific North West, USA: www.ci.seattle.wa.us/util/lawncare/LawnReport.htm
City Farmer: www.cityfarmer.org

Manufacturers (available in Australia)

Flymo (Eletrolux Pty Ltd): www.flymo.com, (03)8756 7445
Al-Ko International Pty Ltd/ Ginge: www.ginge.com, (03)9796 3700
Stiga: www.stiga.com
Bosch: www.bosch.com.au, (03)9541 5555

Manufacturers (other)

Brill USA Distributor: www.sunlawn.com
American Lawn Mower Co/Great States: www.reelin.com
Husqvarna: www.husqvarna.com

Solar drying at home

Always wanted to dry produce in the sun, but haven't got around to it yet? Bob Fuller provides some invaluable hints to help you on your way

With summer just around the corner, now is the right time to start thinking about solar drying. It's too late once the fruit is dropping off the trees or the tomatos are ready to pick to start thinking about building or even buying a solar dryer. So, if you are one of those people who enjoy eating healthy and naturally dried food, now's the time to prepare for the summer months of home drying using the sun. This article describes briefly what types of solar dryer there are, what you can buy and what you can make for yourself to help you do this. It also gives you some tips to ensure success.

A Kialla Solar direct solar dryer.

Sun and solar drying

But first, let's clear up one common misconception! Solar drying does not mean just putting your fruit or veggies out in the sun to dry. That's called *sun drying*. This method of drying is still practiced on a large scale all over the world, even in Australia. It is a cheap and reasonably effective way of drying, but does have some disadvantages. Because the product is uncovered and out in the open, it can get contaminated with dust, dirt and insects. And since the drying temperatures are only close to the outside air temperature, drying is slow and product quality can suffer. Solar drying, on the other hand, uses some sort of technology, often quite simple, to enhance the action of the sun. The product is covered and temperatures are much higher, so drying is faster, more reliable and the final product is almost always better.

Types of solar dryer

There are two types of solar dryer. They have become known as the 'direct' and 'indirect' types. This terminology refers to the way in which solar radiation is captured. *Direct* type solar dryers allow the sun's radiation to fall directly onto the drying crop. This happens because the drying chamber is glazed. The solar radiation passes through the glazing and is absorbed by the crop and internal surfaces of the dryer. The bamboo tray solar dryer described by Ian Reilly (*ReNew*, issue 57) is an example of this type of solar dryer.

In the *indirect* type solar dryer, on the other hand, the crop does not 'see' the sun directly. Heat has to be generated in a different way. This is usually done by a solar collector of some sort (see the Jura Sol solar dryer pictured on page 40). Heat is transferred to the crop by convection.

A bamboo tray solar dryer.

Which is best?

Simple calculations will show that absorbing the sun's radiation directly (as in the *direct* type of solar dryer) is the most effective way of transferring the sun's radiation to the crop. Some crops, like apricots, even need some direct exposure to the sun to ensure good colour. However, some crops, particularly those containing chlorophyll, such as green vegetables and herbs, will lose their colour and the final quality will be inferior if they are exposed directly to the sun.

Commercial solar dryers

Unlike solar water heaters or photovoltaic (PV) panels, there are very few commercial solar dryers currently available. The Solar Safe (a *direct* type solar dryer) made by Sharron Batt and John McLean of Euroa is unfortunately no longer available. Several hundred of these were made (according to John) and are hopefully still working well. My information is that the Jura Sol solar dryer is also no longer manufactured. This was an *indirect* solar dryer, which used a 0.76 m^2 solar collector to heat the air before it entered the drying trays.

One small *direct* solar dryer that is currently available is made by Kialla Solar Dryers in Shepparton. The unit will hold one to two kilograms of fresh product and sells for about $200 (see lead photo).

Some solar drying tips

Some tips to ensure your home solar drying is successful.

- **Blanching, that is, dipping in boiling hot water for a minute or so, is a good way to help preserve the original colour and retard browning of the crop.**
- **Small pieces dry faster than big ones because the moisture has less distance to travel to the outside surface. So pieces and slices should be six to 10mm in thickness.**
- **If you get condensation forming on the inside of your dryer, then you have insufficient airflow through the dryer.**
- **Good airflow is more important in the early stages of drying when more moisture is released.**
- **Higher temperatures are more important in the latter stages of drying because it gets progressively more difficult to remove the moisture.**
- **The moisture content level for safe storage should be about 10 to 12 per cent. The product should feel slightly leathery, dry on the outside, soft inside, and you should not be able to squeeze moisture from it.**

Jura Sol solar dryer.

Home built solar dryers

Solar dryers are not hard to build yourself. A simple *indirect* solar herb dryer was described in *ReNew* 65. It uses an unglazed black metal sheet to absorb solar radiation, which is turned into heat and then radiated to the herbs below. Temperatures will be lower in this dryer than most other solar dryers, but this should suit herbs. Past issues of *ReNew* (issue 47) and its predecessor *Soft Technology* (issue 6) had articles with construction details of a simple *direct* solar dryer. There are also plans for this design in the ATA's booklet 'Do-it-yourself Solar Fruit Drying'. The design is well-proven and originated from the Brace Research Institute in Canada in the 1970s.

One word of caution, however. Some people advocate using polystyrene fruit boxes as the basis for this dryer. I have some misgivings about this because I have concerns about the effect of heating polystyrene to temperatures of 50 to 60^{0}C. We know that many of the plastics in the home can deteriorate and pollute the indoor environment over time at normal temperatures. Chemical reactions are accelerated by temperature and since the solar dryer is used to produce food, my advice would be to play it safe and avoid plastics of this sort in the dryer. ✲

A simpler rainwater flushing system

In issue 80 of *ReNew* we described the ATA's dual supply toilet flushing system. One of our readers, Dave Keenan, has been using a similar but simpler system for years and describes it here

Now that we're paying for our town water by the kilolitre, it's good that many of us have figured out that a rain water collection and storage system can actually save us money in the long term. And, like other decentralised technologies such as onsite waste treatment and renewable energy systems, it has the added benefit of making us more resistant to disasters, whether they be natural or man-made, and gives other environmental benefits such as reducing stormwater runoff.

Many of my letters to *ReNew* over the years have pointed out the mistakes or omissions of others, so I was determined to offer something original and positive when I decided to outline my simple and reliable method of providing automatic changeover between water supplies. My system performs the same function as the one described in issue 80 of *ReNew*, but I feel my system is simpler and more suited to the average user.

I describe here only a part of my rainwater collection and storage system: the part that automatically switches back to town water when the rainwater tank runs dry (or if the pump or its electricity supply fails). It is a plumbing-only solution, not reliant on electricity. The principle is quite familiar to electronics designers, where it is used to automatically changeover between DC electricity supplies. But its analogous application to water supplies is less than obvious to most people.

For example, back when I was researching it, I was told by a plumbing adviser at a well-known plumbing supply company that if I ever got such a thing to work I should patent it! It has been working for some years now with no problems. I have no intention of trying to patent it.

Here the dual check valve and pressure reducing valve (and Dave's son Hunter) can be seen. The council water meter and stopcock are just on the other side of the fence.

How it works

Figure 1 shows the design of the system. The two supplies are connected together via one-way valves. The valve on the rainwater side is sometimes integral to the pump. The only other component required for the basic system is an adjustable pressure-reducing valve, which reduces the pressure of the town water so that it is just slightly less than the pressure supplied by the rainwater pump. As water will flow only from the supply with the highest pressure, the system favours the rainwater whenever it is available. This makes it simple and reliable.

I used the 312 model pressure reducing valve from RWC, which has a maximum flow rate of 56 litres per minute. Note that this is quite different from a pressure-limiting valve.

The float switch in the tank is of a type that is extremely reliable and commonly available. The float looks like an oversized bar of soap with the contacts sealed inside it. It operates at up to 240 volts and so can control any pump directly. It switches on when it reaches 45 degrees up, and off when it reaches 45 degrees down. It comes with a weight that slides along the cord and can be fixed at any position to determine the difference in water height between on and off. For our purposes, we just set this as close as possible to the float. You hang it by its cable from a properly grommetted hole in the roof of the tank and adjust the length of the cable so it

turns off just before the water level goes below the outlet. This float switch is required to protect the pump from running dry.

The foolproof nature of this system in guaranteeing water supply could mean that if the pump fails you might not realise it for months. However, you are usually aware (from the smell or taste, the slight variations in pressure, or the sound of the pump) whether you are using town water or rainwater. And if you also have a readily visible water level indicator on your tank, such as that described by Wesley Trotman in *ReNew* issue 80, it should soon come to your attention if something goes wrong with the pump or its electricity supply.

I also have onsite greywater treatment via an aerobic sand filter; another marvellous piece of ultra-low maintenance technology (my blackwater still goes to the town sewer). I use the treated greywater for irrigation. I use the same automatic changeover system (one-way valves and pressure-reducing valve) to supply the irrigation system from the rainwater/town water supply when the treated greywater runs out. The pressure switch on the treated greywater pump must be set to a slightly lower pressure than that on the rainwater pump. The same kind of float switch is used to control the treated greywater pump, but this time it is attached by a

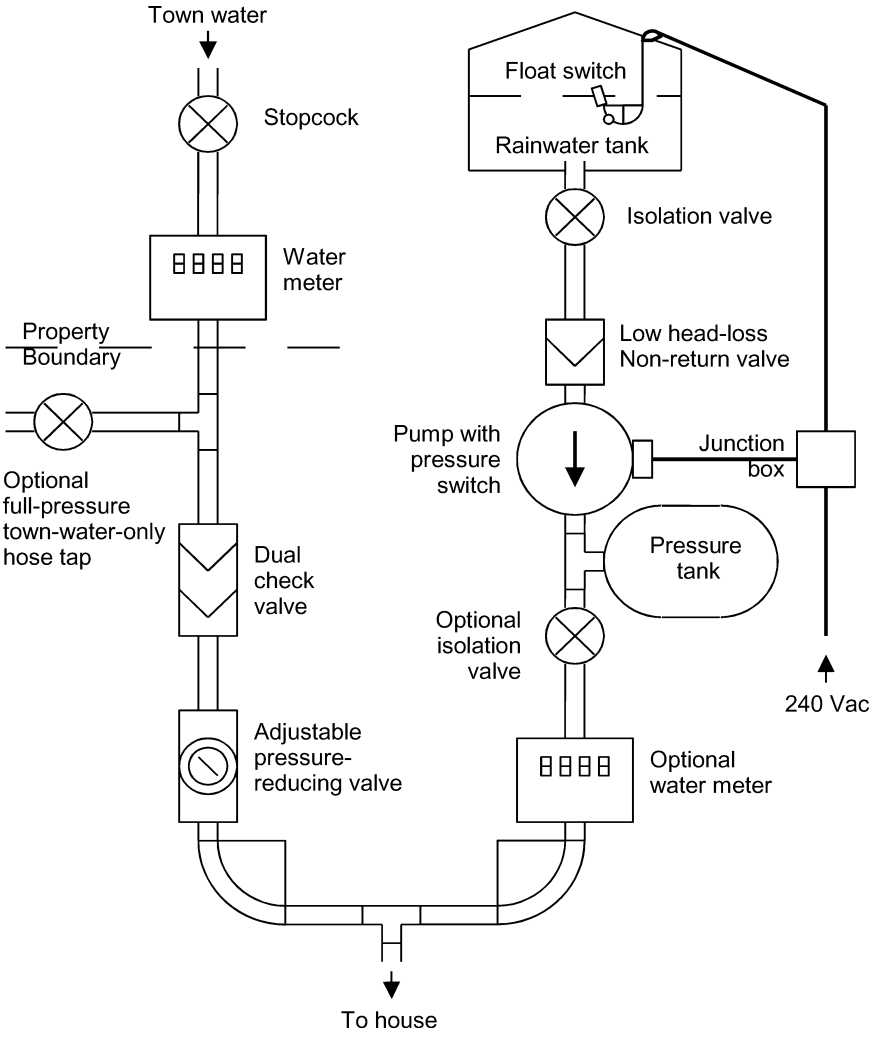


Figure 1. The schematic for the rainwater/mains water supply system.

cable tie to the intake pipe, just above the foot valve, in the pond that stores the treated greywater.

The council is impressed!

Brisbane City Council (BCC) recently decided that it would be a good idea to start encouraging rainwater systems. Some nice folks from BCC water supply found me via a note on my website regarding rainwater tank sizing. (http://uq.net.au/~zzdkeena/RainwaterTankSizing.htm). They asked if they could come out and have a look at my system. I readily agreed.

I was telling them how to adjust the pressure reducing valve by running a tap somewhere and winding down the pressure until the town water meter stops turning, and they got really excited when I said, 'But you don't stop the meter turning completely. You adjust it so you get a little bit of town water every time the pressure tank nears its lowest pressure, just before the pump switches back on to charge it up again. That way you don't have stagnant water sitting in the town water supply pipe, possibly for months, and then coming into your house next time you run out of rainwater.'

They had, in fact, been rather worried about the health risks associated with stagnant town water, which would occur if rainwater users controlled their town water flow by either manually closing a stopcock or by an electrical solenoid valve or float valve.

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	$ 699
Uni-Solar US-42	3.0A	$ 529
Uni-Solar US-32	2.25A	$ 429

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
Aerogen 412	12v	72 / 240 watts	$1425
Soma 400	12/24v	400 / 530 watts	$3158
Roaring Forties	24v	1000 / 1200 watts	$3500
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

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	$ 275
PL-60	12/24/48 volt 60 amp smart controller	$ 575

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 530-BKZ-48	48v 3000 / 9000 watt	$ 2796
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.

EXIDE 24RP670T	24v 17640 watt-hours	$ 2456
EXIDE 24RP830T	24v 21840 watt-hours	$ 2984
EXIDE 24RP910T	24v 24000 watt-hours	$ 3700
EXIDE 24RP1080T	24v 28320 watt-hours	$ 4179
EXIDE 24RP1350T	24v 34800 watt-hours	$ 5079

Solar Technology Designers Catalogue 2002

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;

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) Ph 0418 934 607
www.unisun.com.au email: cdarker@unisun.com.au

Keep talking energy efficiency

Alan Pears comments on a variety of recent high-level energy developments—urging governments not to neglect energy efficiency

It has certainly been an interesting time on the energy front over the past few months.

Kyoto, Johannesburg and all that

The Australian government's spin doctors have been struggling since the surprise outcome at Johannesburg that enough countries are prepared to ratify the Kyoto Protocol for it to come into force. Every major newspaper editorial, and many business leaders, including former Coalition leader John Hewson, now support ratification, so it's tough for Environment Minister David Kemp. Hewson is now tainted, according to the PM, because he has a vested interest in an emissions trading business—in contrast, the PM seems to believe that leaders of the coal and resources industries have no conflict of interest when they oppose Kyoto. Indeed, Kemp's uncomfortable body language makes me suspect he really thinks that we should ratify, and that it is only his leader's determination to back the US at all costs and differentiate himself from leadership contender Peter Costello (who I suspect might ratify, given his more progressive views) that keeps him parroting lame justifications of Australia's position. Then again, maybe the real strategy is to delay ratification until just before the next national election, so that the Labor opposition will have its major point of differentiation removed, but won't have time to reposition itself?

Minister Kemp is now on the record as recognising that global reductions in greenhouse gas emissions of 50 to 60 per cent are necessary to limit global warming. And there is a clear commitment to meet our Kyoto target (even though staying out of the Protocol makes that more difficult). Australia's rationale for not ratifying Kyoto is that the Protocol is not enough (nothing to do with Australia's efforts to water it down, of course), while it leaves us vulnerable to possible difficult targets beyond the first compliance period of 2008 to 2012. The spectre of mass departures of our supposedly vital energy intensive industries has been raised repeatedly. But other industries are threatening to move offshore to countries where they can capture Clean Development credits and participate in emissions trading, and our rapidly growing LNG (liquified natural gas) industry could well make more money from emission credits than it makes from selling gas—if we ratify.

I recommend that you read the full government press release of 15 August on www.greenhouse.gov.au . It includes some interesting contradictions but also some hints of stronger action that will provide clear signals of the 'need for the economy to move to a lower greenhouse signature while businesses retain flexibility to plan efficient pathways to achieve that.' Sounds as though a carbon levy, local emissions trading or something like that is on the agenda.

Also worth reading is the series of Australia Institute press releases listing and refuting *Silly Excuses on Kyoto* (www.tai.org.au).

IPART—a regulator with an ear to the ground

IPART is the NSW government energy regulator. It is the only energy regulator that has made any real attempt to give sustainable energy a fair go in energy markets over the past few years—but has still had limited success. It has just released its final report on demand management and other options for delivery of energy services (at www.ipart.nsw.gov.au). IPART suggests improved pricing signals, better planning, clearer regulation of monopoly networks, and explicit incorporation of environmental objectives in decision making. It wants to see an active market in demand management services. Its recommendations include establishing a demand management fund, strengthening current government programs, stronger pricing signals, streamlined connection agreements for small generators, and standard agreements covering demand management. Other states and national regulators could learn a lot from IPART, it seems.

Lets hope IPART can now speedily implement its proposals. Since there's a NSW election not too far off, and the Carr government needs to avoid the price rises experienced in South Australia and Victoria, there may well be some interesting developments.

Action on energy efficiency at last?

I lamented recently about how energy efficiency has become the wallflow-

er of the energy sector over the past decade (*ReNew* issue 79). Maybe change is in the wind. The Commonwealth-State Ministerial Council on Energy now has a working group called the Energy Efficiency and Greenhouse Gas (E^2G^2). And there is a process for Commonwealth and State governments to develop a joint energy efficiency strategy, with Victoria's Sustainable Energy Authority coordinating the process. As noted above, regulators are also beginning to get serious about demand-side action. Of course, there's a long way to go, but when governments finally accept that they have to do something about global warming and the cost of energy supply, energy efficiency stands out as an exceptionally cost-effective option. I hope I'm not disappointed yet again. I would really rather not be a cynic.

Building codes

The Australian Building Codes Board has formally declared that it will be introducing national Building Code amendments covering residential building energy efficiency in January 2003. The new requirements are a bit messy, and are limited in scope. But this is an outcome of the difficulties of coordinating state agencies and industry groups and the inadequacies of information stemming from years of failure to fund important research and monitoring. Many people have worked hard and with goodwill to progress this step; let's hope the focus will be on improving the code, rather than criticising the obvious limitations of this first step. My involvement in this process reminds me of many of the issues we faced when introducing Victoria's insulation regulations in 1991—ignorance and fear made that process difficult, and many states and industry participants are still where Victorians were over a decade ago with regard to their understanding of building energy issues.

Meanwhile, Victoria's attempt to lead Australia by declaring a mandatory minimum five-star requirement for new houses is under fire from the Housing Industry Association, which wants implementation delayed until 2005. To encourage the government to hold its ground, you could make a submission to the Building Commission before 29 November 2002. A Regulatory Information Bulletin has been published (www.buildingcommission.com.au) on the proposed energy efficiency standards, and comments are sought until that date.

Now let's get serious about commercial buildings!

Business Council for Sustainable Energy

Big news on the industry association front is that the Australian Ecogeneration Association (AEA) and the Sustainable Energy Industry Association (SEIA) have amalgamated to form the Australian Business Council for Sustainable Energy. Ric Brazzale, the very active former CEO of the AEA, is now running BCSE, and the amalgamated organisation consolidates the capacity and resources of both organisations. This is great news for sustainable energy. There is no doubt that bureaucrats and politicians prefer to deal with fewer organisations that represent more companies, and people like me will be able to focus our attention on supporting one organisation instead of two. BCSE will face challenges trying to represent the even wider range of businesses now included in its membership. But the other side of the coin is that lobbying efforts on issues that affect most areas of sustainable energy can be more focused and effective. Their website is www.bcse.org.au ✲

Getting smart with a Smart Drive

Michael Lawley takes the use of washing machine motors as generators to a new level. Take a look at what can be done with these motors

There comes a time when one should stop thinking of generating one's own power and actually do it. Not many people choose to enter the realm of renewable energy from purely an environmental perspective; it often boils down to economics. You're a good distance from the grid, bought some land cheap in the back blocks and haven't a lot of cash to spend on an off-the-shelf renewable energy system—but would like to give it a go. You have been using a generator for a while (got a cheap one after the Y2K meltdown never happened), but it's not environmentally friendly and you keep telling yourself that one day, when you have a bit of spare cash, you'll install that micro-hydro plant in the creek. But before that day comes your generator dies from exhaustion and you buy another—'one day', you keep telling yourself…

Power generation from a simple waterwheel is possible using a washing machine motor!

Living in the back blocks you have some good practical skills itching to be employed on a renewable energy project. Well, that's what I've been doing for the past seven years—tinkering with renewable energy projects. My background in mechanical engineering certainly helped.

If you're on a limited budget, photovoltaic (PV) panels are still a fantasy for most. Though they are the preferred environmental option, their cost is simply too high for many considering renewable energy.

That leaves wind and water. Both of these require a generator—one that is commonly available and cheap would be great, a recycled one even better. This is where Fisher and Paykel and their Smart Drive washing machine motors have come to the rescue. These machines have been on the market for over 10 years now and are starting to trickle into the local dump and recycling centres. You can even buy them fairly cheap on the secondhand market.

Description of the Smart Drive unit

The units consist of a magnetic rotor (with an outside diameter of 270mm), copper wire wound stator, 25mm stainless steel shaft, aluminum extruded bearing assembly, washers and fixings.

The bearing assembly must be cut from the bottom of the washing machine bowl (if you intend to make a small Pelton or Turgo generator do not cut it from the bowl as the bowl can be used to house the runner). If you turn a Smart Drive washing machine upside down, remove the agitator and replace it with a Pelton/Turgo runner, reconnect the windings on the motor, add a rectifier and some nozzles, and you have a low-cost micro-hydro plant.

The motor can be easily converted (it takes about three hours if you know what to do) for use as a generator for many renewable energy projects, such as water wheels, other water turbines, wind turbines, standby generators (connect to petrol engine) or even as drive motors for a small electric vehicles, perhaps. I've installed them on several water wheels and done a Turgo water turbine installation with great success.

After you've got your hands on a unit you will need to reconnect it into the configuration that results in the correct power output for a given speed, depending upon your application. I've spent several hundred hours testing these units to determine their performance. An overview of these results for a 24V system is shown in Figure 1.

The units come in three different wire

Model	Wire diameter (mm)	Configuration	Numer of turns	Effective wire area (mm²)	Max current (amps)
100 S	1.0	Series	616	0.79	8
100 SP	1.0	Series/Parallel	88	5.50	56
100 P	1.0	Parallel	44	11.00	112
80 S	0.8	Series	1610	0.50	3
80 SP	0.8	Series/Parallel	230	3.52	21
80 P	0.8	Parallel	115	7.04	42
60 S	0.6	Series	2380	0.28	3.5
60 SP	0.6	Series/Parallel	340	2.00	25
60 P	0.6	Parallel	170	4.00	50

Table 1. Smart Drive generator winding connection options.

sizes—each can be connected in three different ways. They can also be wired in either a star or delta configuration. This results in 18 different performance curves for the units. When tested, charging a battery bank at 12, 24 and 48 volts, this results in 54 performance graphs.

With so many options available, confusion rapidly starts to set in, so an identification system is essential.

The current ratings in Table 1 are based on test work, with some extrapolated results. They are only indicative at this stage. The 100P model has not been tested, as it requires speeds in excess of 1000 revolutions per minute (rpm). This unit would be suitable for direct connection to small petrol engines.

The performance of the units can be tuned by packing the magnetic rotor up from the fully home position. This reduces the magnetic field strength and increases the operating speed of the units.

The S model is as the motor is originally wound—this is what you find at the local tip. The SP model involves cutting and reconnecting half of the windings from series into parallel. The P model involves cutting and reconnecting all the windings from series into parallel. Although this is easy if you've done it before, it is not that straightforward. Cutting 42 wires and having deal with the 84 ends can become a little confusing. Fortunately, I've written a manual that includes how to reconnect these units and it also includes the full set of test results, including efficiency curves. If you purchase a unit through *EcoInnovation*, this manual is supplied with the unit.

They may look like junk to most people, but these washing machine motors can be given a new life making power for your home.

If you are daunted by the prospect of reconnecting a unit yourself, I can post a rewound unit to you complete with manual (see contact details at the end of this article).

The best way to illustrate how to use these units is by considering actual working examples.

Overshot water wheel

Water wheels have been used for thousand of years, mainly to run machinery or for milling cereals.

Overshot water wheels have some advantages over other types of hydro schemes, namely:

- they run on low heads, usually one to four metres
- they can run when half submerged in floodwater
- they can handle varying flow, from dry to wet periods, without adjustment
- they can be fabricated at home with common materials
- they maintain good efficiency over varying flows
- they are aesthetically pleasing.

The only significant drawback is that waterwheels require a step-up gearbox. Smart Drive generators are low speed devices, so the ratio required is much lower than for other types of generators.

You need to find a site for your wheel, diverting water above a falling part of the river and then returning the water over the wheel back to the river. You may have a natural waterfall that can be used or damming may be an option. For environmental reasons, dams should be avoided if at all possible. Another method is to send in a digger to level the falling part of the creek in order to provide an abrupt fall.

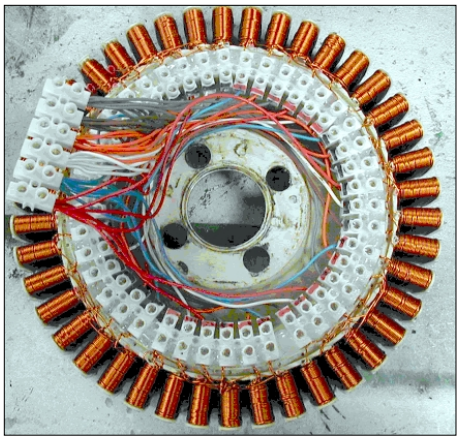
Resource consent issues

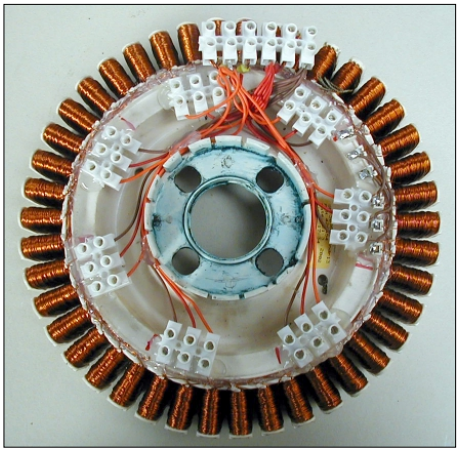
Every site is different and the method employed will vary. If the stream is small and you are not preventing fish passage then it should be okay—but check with your regional council about a permit. This can be fairly straightforward, but can also be a long-winded, expensive experience if the Department of Fish and Game (or whatever your local equivalent is called) take exception to your plans. However, the impact in most cases is negligible and should be of little concern to them. Try to make your scheme fit into permitted activities of your regional council Fresh Water Plan. This requires a bit of lateral thinking, but if you can achieve this the process will be a lot easier and cheaper.

How much water do I need?

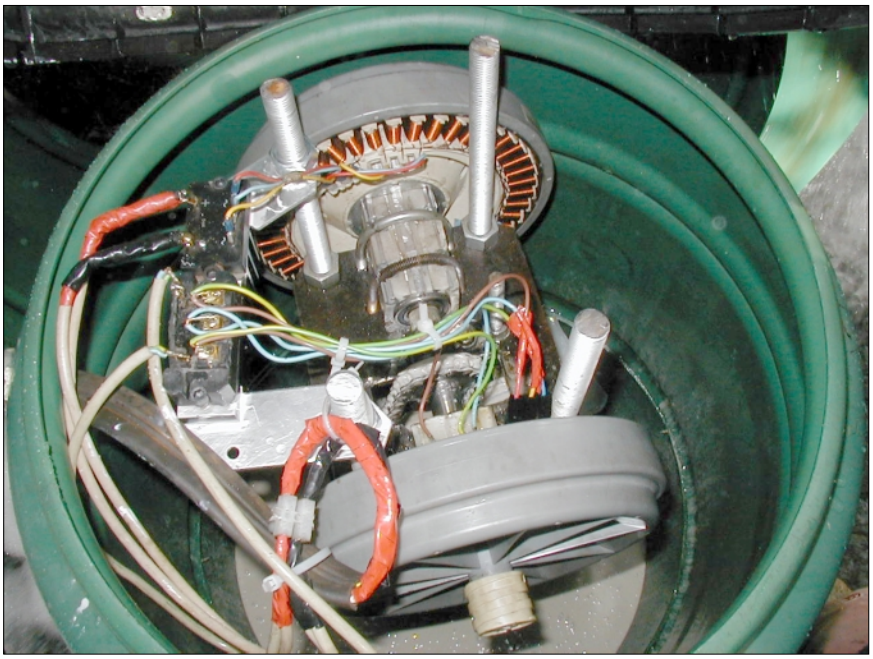
I've looked at many rivers where the client has informed me over the phone that there is 'lots of water' to find little more than a trickle.

Water wheels need a lot of water since they are low head. As a rule of thumb,





The stators can be reconnected in numerous configurations, including series/parallel (left) and parallel (right).



Oil bath chain transmission driving two Smart Drive units.

use the formula:

Power generated (watts) = flow (liters/second) x wheel diameter (metres) x 6.

So, if you have 20 litres per second over a 1.8 metre diameter water wheel, you could expect to generate 216 watts, which over a 24-hour period adds up to 5.1 kilowatt-hours. To generate this from PVs you would require at least a 1200 watt array, costing about $12,000 to purchase and install. There's a good chance that in winter there will be more water so the wheel will really be pumping when a 1200 watt array would be struggling in the low-light conditions.

Gearbox

Your 1.8 metre wheel will need a gearbox. You can work out the ratio by dividing the generator rpm by the wheel rpm. For a small 1.8m wheel a speed of 15 rpm is typical. The gearbox ratio required is therefore 20:1. You can make this yourself using a two-stage chain drive or try purchasing a secondhand industrial gearbox. A New Zealand company, Pyramid Machinery Ltd (www.pyramidmachinery.co.nz), can usually supply a suitable unit. I purchased a 25:1 gearbox a few weeks ago in a scrap yard for $5 that would be suitable for this application. Avoid worm and wheel gearboxes as these cannot be run backwards. Look for inline spur, helical or epicyclical gearboxes.

DIY water wheel

The article lead photo shows an overshot waterwheel made from a car wheel rim. The circular steel side frames are from a discarded portable water trough welded onto the wheel rim. Zincalume roofing steel is then pop-riveted to these circular frames and zinculume rainwater spouting (cut to length) is pop-riveted to the backing steel to form the buckets. Plywood (17mm) is cut into circular sections and fixed to the end of the spouting.

The wheel is then connected to the half shaft from the car's rear axle. The half shaft is mounted on two plumber block bearings. The end of the shaft is connected to the largest rear motorcycle sprocket you can find (usually 50 to 54 teeth—visit the wrecker's yard) and drives a small industrial sprocket (11 to 12 teeth) mounted on an idler shaft . A second large sprocket is mounted on the idler shaft, and this final stage drives a smaller sprocket mounted onto the stainless steel shaft of the Smart Drive unit.

Put all this equipment in a large container (old plastic drum) and add oil to lubricate. Pay attention to detail to ensure rain/flood water cannot get in to displace your oil (which would end up in the river). Two Smart Drive units can be mounted onto the same shaft if you require higher power outputs or a lower generator rpm.

Always make your hydro system and test it before your install it. You can turn the wheel over by hand. This way, any changes can be made in the workshop

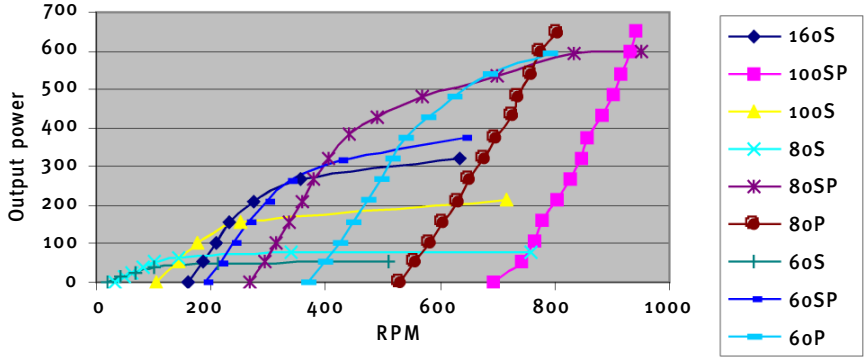


Figure 1. Smart Drive performance curves for a 24 volt system using a star wiring configuration.

The Smart Drive motors can be driven directly from a Turgo turbine runner.

rather than the more difficult environment at the bottom of a creek.

In this example we were very fortunate in that the site is at a small natural waterfall with a large rock at the bottom acting as a natural foundation block. If this block had not been there, we would have slung a beam across the river (old truck chassis or tanalised timber truss) and hung the wheel from it in order to save the difficult job of pouring foundations in a flowing river. This job did not require a permit, as the wheel is not mounted in the bed of the river, the pipe and concrete intake does not increase the height of the river by more than 300mm, and is permitted under Regional Council rules for the placement of a culvert in a river. It is not an obstacle to fish passage as the waterfall is naturally occurring.

The example here cost only $1000 in parts and a couple of weeks work to complete, and enabled a client who wouldn't have been able to afford to quit his generator addiction to do so. If a permit is required (under a different set of conditions) this will usually cost around $1000 to $2000 to obtain if you make the application yourself. For small schemes use your common sense, but try and avoid the need for a permit.

Once free of the generator it's amazing how much money you save in fuel each week, which can be used to buy some PV panels for when the creek dries up in summer.

Small Turgo turbine

You can also use these motors with Turgo turbines on low to medium heads of five metres and upwards. Small water turbines can be very cost effective and have the following advantages:

- they are small and cheap to make
- they do not require large flow rates
- they do not require dams in rivers
- they do not require a permit (in most cases)

However, they:

- require heads greater than five metres
- can't be run partially submerged in flood water
- prefer constant flow rates.

Water is extracted from the river by laying a polyethylene pipe (usually 50mm) in the bed of the river, gradually easing the pipe onto the bank once sufficient fall has been achieved. Water is allowed to flow through the pipe, its velocity increased by using a nozzle prior to impacting on the curved Turgo turbine buckets. These buckets try to reverse the direction of water flow, which imparts a force to the buckets which turns the runner which turns the generator. The exhaust water is then allowed to return to the river.

Plastic injection-moulded buckets for both Turgo and pelton wheels are available via mail order over the internet. These items are relatively cheap, all you need is a good generator.

The photo at left shows a home-built unit. The Turgo buckets are mounted on a Smart Drive motor rotor (with the outside magnetic rim removed) as this fits perfectly onto the other end of the shaft. To design your Turgo generator you will need to do a few calculations. Fortunately, the internet provides the answers. At www.geocities.com/Turgo_gen/Turgo_drive.html you can download a spreadsheet programme to do the calculations for you. You can also buy Turgo runners from this site (www.geocities.com/Turgo_gen).

You will need to enter into the spreadsheet the following information:

- the net system head (actual head minus pipe friction head)
- runner pitch circle diameter
- nozzle diameter
- number of nozzles.

The program will determine:

- the power generated
- the rpm of the runner
- the flow of water required.

You can vary your input data until you fine-tune the result to match your gen-

erator output at the same rpm. As the Smart Drive units have so many possible variations it is more than likely that you will find a suitable match.

All you need to do to finish your turbine is to mount it in a plywood box (or inside an old stainless steel sink, or leave it in the original washing machine bowl) and add the nozzle(s). Then you'll have power 24 hours a day.

Wind applications

I'm still working on this. The Smart Drive units do suffer from cogging. This problem means that they will not start in light winds. I'm giving some thought to how this cogging can be reduced. Certainly some people have tried but I don't know how successful they have been in light wind conditions. Hopefully this will be the subject of another article in the future. ✶

Smart Drive motors are available from: Eco Innovation, email: ecoinn@paradise.net.nz, ph:(06) 752 2765, in Australia, phone 0011 64 6 752 2765. Unit prices: 60S/80S/100S: NZ$150 each, 60SP/80SP/100SP/60P/80P: NZ$250 each, economy air freight (10-15 days): NZ$50 each unit. Manual only including postage: NZ$50 each.

Remote pumping buyers' guide

Moving water is a requirement on nearly every remote and rural property. We take a look at the different types of pumping systems, and what pumps are on the market. Tables by Amanda Day

Whether it be for watering stock, plant irrigation, or for providing potable water for household use, pumping systems must be reliable and easy to maintain. And because many rural properties have to supply their own power, or the pump is far removed from the house, they will usually have to be other than mains electricity powered.

Water may need to be pumped from a creek or river, sometimes from a dam, and often, water needs to be drawn up from a well or bore. These tasks all require different pumps, and the amount of water, and the head it needs to be pumped to, all vary from one site to another.

Because of these variations in pumping requirements, there are now many different types of pumps on the market. These include the well-known windmill-powered bore pumps, solar bore pumps, reticulation pumps and pressure pumps. There are also numerous types of each of these categories, making selecting a pump for a particular job a less than simple task.

One type of pump we will not look at in this guide is the 240-volt powered pump. There are so many of these on the market, in so many shapes and sizes, that it would simply be impossible to cover them all, and in most cases, they are unsuitable for remote pumping, as they require AC power to operate, necessitating the use of batteries and inverters, thus increasing system cost and complexity. There are some wind-turbine based systems that will drive an AC pump directly, but these are not overly common.

Water pumps come in a great types, sizes, and shapes, and can be driven from electricity, wind or water.

Pumps work in a number of different ways. Windmill bore pumps, for instance, use pistons, buckets or cups to lift the water up inside a plastic or metal tube that runs down inside the bore to below water level.

Electric pumps come in many flavours, including centrifugal (similar to a pump used on a swimming pool) diaphragm, helical rotor and piston. The latter type can be either single or double acting, and are often just a standard windmill-style bore pumping arrangement with an electric motor and gearbox replacing the windmill.

In putting together this guide we found many different pumps, and there were a few new and interesting units that have appeared since the last pumping guide was published in *ReNew* issue 67.

Some companies will sell a specific pump on its own, while others will sell a package with a pump, solar panels, a maximiser and wiring harness. This has made it difficult to give accurate prices for some of the pumps, as the costs of the packages vary from supplier to supplier.

What to look for

Things to look for in a pump include

the use of non-corrosive fittings and components, particularly stainless steel, as this is very strong and long-lasting.

Many of the bore pumps now use PVC pipe in place of the older galvanised steel pipe, and are not prone to early failure due to corrosion from salty water.

In general, the pumps known as positive displacement pumps will have higher efficiencies than centrifugal types, especially when pumping to high heads, so if getting the most out of your solar panel pumping system is important to you, a positive displacement pump would be best. If you are not sure that the pump you are looking at is this type, ask your supplier.

There are also a few terms that you should understand, including head, lift and flow rate.

Head is how high the pump can push water above it. It is not the total distance up a hill, only the vertical height component. In a bore pump, it also includes the depth from the pumping head, inside the bore, to the surface.

Lift is sort of the opposite of head. It is generally how far a pump can raise water from below it. A pump's lift rating is usually a lot lower than its head rating, and some pumps cannot lift water at all.

The flow rate is the amount of water that the pump will move over a given time period. For electric pumps, the flow rate depends on several factors, including the amount of electrical input power, the head and lift the pump must deal with and the diameter of the pipes connected to the pump.

Wind-powered pumps are dependent on wind speed, head, lift and pipe diameter.

DC pumps

There are a large variety of pumps made to run on extra-low-voltage DC power supplies. Some are meant to be run from battery systems, while others are run directly from solar panels via a maximiser-style device, which matches the load of the pump motor to the panels.

The pumps usually consist of a DC motor, either electronically commutated (brushless) or brushed, connected to a pump head of some kind.

Some pumps have all of the components in a compact package, such as the Shurflo submersible bore pumps, while others have them mounted separately and coupled via a shaft or belt drive. The Sunergy Mono is an example of this type of pump, using a standard Mono helical rotor pump coupled to a 1/3 horsepower DC motor.

Circulation pumps

These are used to circulate water through a closed system, such as through a remote coupled solar hot water system where the tank is lower than the panels.

They can also be used for many other purposes that do not require high differential pressure across the pump, though many can withstand high system pressures, making them suitable for use in mains-pressure systems. They are generally not suited to pumping to high heads.

General purpose pumps

These include all sorts of small and large pumps. They are often used for moving water or other liquids from one

place to another, over relatively short distances, and at low pressures and heads. An example of these are bilge pumps, which are often used to move water from one tank to another, or in water fountains and low-pressure irrigation. Bilge pumps are available from marine supply shops, and are not included in this guide, as they are not designed to run continuously.

Mains pressure pumps

These are used to provide the equivalent of mains pressure water to a house from a water tank, dam or other reservoir.

Pressure pumps usually come complete with a pressure switch that allows them to run only when the system pressure drops below a certain level. They are normally used in conjunction with a small pressure vessel or tank that helps maintain an even system pressure, and acts as a pressure reservoir (the pressure vessel contains a 'bubble' of compressed air).

Bore pumps

Submersible bore pumps are generally cylindrical in shape, with a wire mesh screen intake at one end. They are mounted inside the bore itself, and can pump water at relatively high flows and to high heads. They usually pump up to a water tank or dam for storage.

Most bore pumps can pump silty water without damage, though, as with many pumping systems, regular maintenance will need to be carried out.

Another type of bore pump is the remotely coupled piston pump, where a pump at the bottom of the bore is connected to the driving motor at the surface by rods and couplings.

Wind-powered pumps

You can pump water with the wind in a number of different ways. The most well-known is the use of a low-speed, high torque wind turbine to drive a mechanical pump directly at the base of the turbine tower. The Oasis windmill is an example of this type of pumping system. This is a tried and proven pumping method, and pumps of this type have been providing water to farms and remote buildings around the world for over a century.

Another way of pumping with the wind is to use an electricity-producing wind turbine to drive an electric pump.

A third method is to use a wind turbine to compress air, which can then be used to drive a pump of some sort. Two examples of home-built pumps of this type appeared in *ReNew* issue 66.

Water-driven pumping

It may sound strange, but running water can indeed be used to pump water, and to quite high heads.

The Glockemann ram pump is an example of such a system. A relatively large flow at low pressure, such as the diverted flow from a river or stream, is used to pump a much lower volume of water to much higher pressure, so that it may be pumped to a high head.

Maximisers

A maximiser, or maximum power point tracker, is a small electronic device used with solar panels that enable a pump or motor to keep operating in conditions

Contact details

Below is a list of manufacturers and distributors. Due to space constraints, it is not possible to list all of the dealers. We suggest that you contact those companies listed below, or your local solar dealer and see what they can supply.

Badu: BW Solar, ph/fax:(08)9341 8790, http://bwsolar.tripod.com

Davy Industries, RMB 1036, Barnawartha Nth VIC 3688, ph:(02)6026 7711.

Eta Pump: BW Solar, ph/fax:(08)9341 8790, http://bwsolar.tripod.com

Grundfos Pumps P/L, unit 3/2 Sarton Rd Clayton VIC 3168, ph:(03)9561 0111, fax:(03)9561 0211.

Glockemann Peck: Glockemann Peck Engineering, PO Box 357, West Ryde NSW 1685, ph/fax:(02)9708 0900, email: glocpump@zip.com.au

LVM: Energy Today, PO Box 440, Rose Bay NSW 2029, ph:(02)9371 6600, fax:(02)9371 6623, www.quirks.com.au

New Mill Solar P/L, 2/6 Duffy St, Burwood VIC 3125, ph:(03)9888 9953, fax:(03)9888 9954.

Mono pumps: Mono Pumps Pty Ltd, 338-348 Lower Dandenong Rd, Mordialloc VIC 3195, ph:(03)9580 5211, fax:(03)9580 6659, www.mono-pumps.com

OASE: Energy Today, PO Box 440, Rose Bay NSW 2029, ph:(02)9371 6600, fax:(02)9371 6623, www.quirks.com.au

Oasis: Oasis Windmills, 30 Baldock St, Dookie VIC 3646, ph:(03)5828 6452.

Grant McRostie, Emerald Park, Licola Rd, Jamieson VIC 3723, ph:(03)5777 0569, fax:(03)5777 0800.

Ropatec: AirMarine Australia, 43 St Hellier St, Heidelberg Heights VIC 3081, ph:(03)9459 2888, fax:(03)9459 4327, www.airaus.com

Shurflo Pumps, 27 Treforest Drive, Clayton VIC 3168, ph:(03)9562 6162, www.sureflo.com

Solarjack: WD Moore and Co, ph:1800 654 766.

Solar Energy Systems Pty Ltd, 3/81 Guthrie St, Osborne Park WA 6017, ph:(08)9204 1521.

Solarstar: Enviro Options, ph:(02)9456 0172, fax:(02)9456 0173, enviro-options.com.au

Southern Cross: Southern Cross Machinery Australia, ph: 131 786.

Southwest Windpower: AirMarine Australia, 43 St Hellier St, Heidelberg Heights VIC 3081, ph:(03)9459 2888, fax:(03)9459 4327, email: airaus@hotkey.net.au, www.airaus.com

Sunergy Mono Mini: Solar Charge Pty Ltd, 115 Martin St Brighton VIC 3186, ph:(03)9596 1974, fax:(03)9596 1389, www.solarcharge.com.au

Thumpa Pumpa: Southwest Pumps N Solar, 46 Wyndham St, Roma QLD 4455, ph:(07)4622 4528.

WD Moore and Co, ph:1800 654 766.

Table 1. Wind-powered pumps and pump heads

Make	Model	Pump type	Blade diameter	Tower	Maximum head (m)	Used for	Comments	Warranty	Price
New Mill Solar	Mondesh	Multi-cup PVC bore pump	-	-	60m	Bore pumping	Multi-cup system. Designed to be self-cleaning. Available in 2 versions, 2.5 and 3 inch versions	1 year	POA
Oasis		¾" to 1½" double acting bore pump	900mm, 1350mm	1.8, 3, 4.5m lattice	6m to 80m	Bore pumping	Four different pump sizes and gear ratios available	1 year	$1050 with 1.8m, tower $1650 with 3m tower, $2000 with 4.5m tower
Ropatec	WW-2000-1P	Series 1: Piston pump	1.6m	3m	-	Ponds and drinking water supply	In frost periods the pump can be removed easily. Also includes automatic switch-off in strong winds	2 years	$5340
	WW-2000-1S	Series 1: Stamp pump				Bore pumping	Specifically suited for lower water levels up to 12 metres. Can stay active throughout the year as pump is frost safe		$6236
	WW-2000-2M	Series 2: Diaphragm pump					Pumping system can easily be cleaned and it is not neccessary to disassemble pump		$6400
	WW-2000-4M	Series 4: Diaphragm pump	2.2m	6m			Includes strong wind shut down and controller for strong winds. Also available with piston-stamp pumps for lower water levels		$13,560
	WW-2000-4PS	Series 4: Piston-punch pump							$14,600
	WW-2000-5M	Series 5: Diaphragm pump	2.85m	6m			This series is similar to the 4 Series (above) however, the system offers a higher extraction capacity		$16,640
	WW-2000-5PS	Series 5: Piston-stamp pump							$18,240
	WW-2000-7K	Series 7	2m	3m			This series is designed to extract large volumes of water to supply fields of biotypes etc. The pump is relocated in the shaft so the shaft does not freeze, allowing use during cold periods		$31,800
	WW-2000-8K	Series 8							$42,000
Southern Cross	IZA	Stainless steel piston pump	1.8m	To suit towers: 6m, 7.6m, 9m, 12m, 15m, 18m	up to 135m	Bore pumping	Towers available in both three and four post models	3 years	$2423 for Windmill Head With Tower: From $3311 to $5845
	IZB		2.4m						$2515 for Windmill Head With Tower: From $3403 to $5937
	IZC		3.0m	To suit towers: 7.6m, 9m, 12m, 15, 18m					$3084 for Windmill Head With Tower: From $4548 to $6751
	IZD		3.6m	To suit towers: 9m, 12m, 15m, 18m					$4169 for Windmill Head With Tower: From $6031 to $9149
	IZE		4.3m						$4982 for Windmill Head With Tower: From $6629 to $9725
Southwest Pumps 'N' Solar	PolyRod	Windmill column and rod	-	-	60m	Bore pumping	Used in conjunction with standard bore pump. Replaces galvanised steel pipes and rods	1 year	POA
	Flexi-Column	Windmill column and rod	-	-	52m		Flexible, one-piece bore pipe. Used in conjunction with standard bore pump. Replaces galvanised steel pipes and rods. Standard or heavy duty units.		POA
Southwest Windpower	Whisper H80	Wind-electric water-pumper uses any conventional ¾hp three-phase 230 VAC centrifugal submersible or surface pump	3m	24ft to 80ft	-	Bore pumping	Comes in a kit that includes: Southwest Windpower's Whisper H80 1000 watt high voltage wind turbine and 3-phase high voltage pump controller	2 years	$8,780
WD Moore	Tempest	3 Post model		20ft or 30ft	-	Bore pumping	Can use yellowtail tower or existing tower. Direct action machine sold with or without Furling mechnism. Automatic governing to limit speed	-	From $1,770

Table 2. Water-powered pumps

Make	Model	Pump type	Pumping Flow rate	Supply fall	Supply flow rate	Maximum head (m)	Used for	Comments	Warranty	Price
Glockemann Peck	160 Water Dragon	Diaphragm piston pump	up to 5000L/day	0.5 to 2m 1.5L/sec or more	1.5L/sec minimum	100m	General water supply pumping	Available with 35, 48 and 60mm pump bores. Flow rate depends on supply head.	1 year	$990
	320 Oasis		up to over 22,100L/day	0.4 to 2m		200m		Available with 35, 48, 60, 73, 98 and 124mm pump bores. Flow rate depends on supply head.		$1950
Grant McRostie	Rapids River Pump	High pressure positive displacement piston pump	-	-	2,000L/day	40m	General water supply pumping	Three different stroke settings for different heads, stainless steel bearings to reduce the problem of rust and provide an estimated life of 20 years. Made from 100% recycled plastic pipe. The pump measures 650mm x 2m long and weighs approximately 50kg	-	$1990
		Low pressure positive displacement piston pump			5,000L/day	25m				$2190

of cloud and low light levels.

Many pumps will simply stop when a cloud causes the solar panel output to reduce. This happens because the pump motor places too high a load on the panels, and their voltage drops dramatically, thus reducing their output power. The maximiser works by preventing this, and will allow the pump to keep operating, thus pumping more water than it otherwise would.

If you are installing a solar-powered pumping system, then you really should consider a maximiser in the system. Most pumping suppliers have them, and they range in price from less than $100 to over $1000, depending on their power handling capabilities and features.

What's available

The pumps are listed in three separate tables—wind-powered pumping systems, water-powered pumps, and solar and DC pumps (table overleaf).

Many of the pumps listed in table three actually come as pumping packages, including solar panels, and sometimes a maximiser-style controller. If panels are included, this is detailed in the comments column in the table.

The wind-powered pump table also includes those systems that just consist of a pump pipe, rods and buckets etc, without a wind turbine or tower. These can usually be attached to any standard water pumping windmill, but can also be used in conjunction an electric motor and solar panel system.

Table 3. DC pumps and pumping packages

Make	Model	Pump type	Voltages	Max. current	Solar panels	Flow (L) at head (m)	Maximum head (m)	Used for	Comments	Warranty	Price
Badu	C 90/11	Centrifugal	-	-	-	14,000 L/hr	10m	Water transfer	Just pump head, requires Etadrive motor	2 years	$990
Davies Craig	EBP	Magnetically coupled impeller	12	1.3	-	13 L/min	-	Water circulation in solar water heaters, general low head pumping	Designed for automotive uses, can withstand boiling water	-	$201.45
Davy Industries	Budget Piston Pump	Solar piston	12	-	From 60 watts	1,500 L/day at 30 m head, 2,000 L/day at 18m head.		Water transfer	Mini Piston Pump, very reliable and cost effective water pumping system	1 year	$1990 (including solar modules)
	Chang Feng Piston Pump		29 to 90	-	150 watts to 600 watts	8,000 L/day to 28,000 L/day	48m	Water transfer	Very reliable and well proven.	1 year	From $3500
Energy Today	Congo	Centrifugal submersible and inline	12, 24	6 @ 12V	-	2200 L/hr	14psi	Fresh and sea water transfer, diesel transfer	Small diameter inline pump suitable for general use	150 hours of pumping	$164, $181
	Amazon			4.5 @ 12V		1100 L/hr	14psi		Small diameter inline pump suitable for general use. Temperatures to 80°C		$123, $140
	Nile		12	2.5		764 L/hr	11psi				$105
	Niagara			2.8			14psi	Fresh and sea water transfer	Small diameter inline pump suitable for general use. Temperatures to 80°C		$80
	Zambezi	Centrifugal inline	12, 24	4.5 @ 12V		1100 L/hr	15psi	Fresh water transfer	Water temperature to 80°C		$123, $136
	Missouri	Flexible impeller inline	12, 24	9 @ 12V		1100 L/hr	16psi	Diesel, fresh and sea water transfer	Temperatures from 4 to 60°C. Cannot run dry for more than 30 seconds		$330, $360
Environ Options	Solastar	Positive displacement	-	-	10 x 100 watts	13,050 L/hr	200m	Bore pumping	Can run dry. All stainless steel and bronze. Needs optimiser to run	2 years	Pump $3212 Optimiser $470
Etapump	HR 04	Helical rotor positive displacement	-	-	-	840 L/hr	0-80m	Bore pumping (96mm diameter)	Just pump head, requires Etadrive motor	2 years	$990
	HR 14					2800 L/hr	0-50m				
	HR 07					1300 L/hr	0-90m				
	HR 04H					790 L/hr	80-150m				
	HR 03H					480 L/hr	80-240m				
Grundfos	SQ Flex	Submersible pump	-	-	Up to 0.9 Kilowatts	70,000 L/day	10m	Stock water, community water supply and remote house supply	-	-	$5500 to $20,000
	SPA Series		-	-	Up to 1500 Watts	10,000 L/day	120m				
Johnson	F2P10-19	Flexible impeller	12, 24	120 watts	-	15 L/min	9psi	General transfer and low pressure pumping	Water temperatures up to 80°C. Cannot run dry for more than 30 seconds	1 year	$386
	F3B-19			120 watts	-	16 L/min	9psi				$439
	F4B-19			250 watts	-	48 L/min	9psi				$460
	F5B-19			270 watts	-	55 L/min	15psi				$1272
	CM10P7-1	Magnetically coupled impeller	12, 24	1.2	-	-	Max system pressure 35psi	Circulation of water in cooling systems and general transfer. Solar hot water systems	Water temperatures up to 100°C. Should not be run dry. For clean water only - not dirt tolerant		$459
	CM30P7-1			2.2	-	-					$517
	CO90P5-1			7.4	-	-	Max system pressure 30psi				$580
	P75	Diaphragm	12, 24	-	-	7.5 L/min	40psi	Mains pressure water supply, washdown	Pump only		$262
	WPS 10-24604-03			-	-	9 L/min					$229
	WPS Aquajet 10-13250-03			-	-	13 L/min					$287
	WPS Aquajet 10-13250-07			-	-	19 L/min					$354
	WPS Aquajet UNO 10-13281-01			-	-	13 L/min			Complete package with pump, filter and pressure tank		$684
	WPS Aquajet UNO 10-13281-03			-	-	19 L/min					$740
	WPS Aquajet DUO 10-13273-01			-	-	38 L/min					$1295
New Mill Solar	Big Red	Bore pump head	24	-	-	up to 1200 L/hr	60m	Bore pumping	Designed to be coupled with the Mondesh PVC bore pump or other bore pumps	1 year	from $3357
Mono Pumps	Sun Sub	Helical rotor/ progressive cavity	-	-	BP Solar 150 watt up to 1200 watt. Tracking and stationary arrays available	115,000 L/day @ 5m head (1200 watt system)	120m (17000L/day)	Agriculture, 4" and greater bores, windmill replacement	Supplied as a complete system. Brushless DC motor and Mono Powermaster controller	1 year	$6100 to $22,000
	Sun Buddy		-	-	BP Solar 150 watt	9000 L/day @ 5m head	50m (2400L/day)				$4150
	Sun Ray		-	-	BP Solar 150Wp up to 1575Wp. Tracking and stationary arrays available	170,000 L/day @ 5m head (1575 watt system)	100m (23,000L/day)	Agriculture, surface water transfer	Surface and floating options available. Supplied as a complete system. Includes Mono Powermaster controller		$4150 to $24,000
	Sun Downer		-	-	BP Solar 150Wp up to 1575Wp. Tracking and stationary arrays available	144,000 L/day @ 5m head (1575 watt system)	100m (18,500L/day)	Agriculture, 4" bores and windmill replacement	Line-shaft borehole pump. Supplied as a complete system. Includes Mono Powermaster		$7500 to $31,000
OASE	Aquasolar 700	Centrifugal	12 - 24	8 watts	1 x 10 watts	720 L/hr @ 24V	2m	Fountains and water features. Continuous use	Submersible. Also available as a package with solar panel, fountain and nozzels	3 years	$180 (pump), $205 (panel)
	Aquasolar 1500			17 watts	1 x 20 watts	1500 L/hr @ 24V	3m				$340 (pump), $330 (panel)
Shurflo	9325	Submersible	24	-	1 x 50 watts to 2 x 80 watts	3,150 L/day	70m	Potable water well pump	Features limited internal bypass, heavy duty motor and non corrosive construction	1 year	$2596 to $3872
	2088-422-144	Diaphragm	12	7	-	10.6 L/min	45 psi	Mains pressure water supply	-	1 year	$152
	2088-473-143		24	3.5	-		30 psi				$196
Solar Energy Systems	Sun Mill 100	Piston	24-30	-	100 watts	4700 L/day	30m	Stock water and household use	-	2 years	$3700
	Sun Mill 200				200 watts	13,000 L/day	50m				$6675
	Sun Mill 400		48-60		400 watts	18,000 L/day	60m				$9150
	Sun Mill 600				600 watts	37,500 L/day	50m				$11,750
Solarjack	SDS series	Submersible diaphragm	12 to 30	-	up to 2 x 83 watts	up to 840 L/hr	up to 40m	General and bore pumping	Can be used in open vented or pressurised system. Available to suit 4 or 5 inch bores	1 year	POA
Southwest Pumps 'n' Solar	Thumpa Pumpa	Piston	58	-	2 x 60 watt to 4- 8 x 60 watts	up to 28,000 L/day	up to 48m	General water pumping	Available in six versions to suit requirements. Uses AERL controller	1 year	$3950 to $7850
Sunergy	CP25: Mono Mini Solar Pump	Mono helical rotor	-	-	2 x 50 watts	6,600 L/day	5m	General surface water pumping	Highly tolerant of sandy and silted water. Sunergy optimiser permits remote switching of pump by float or pressure switch	1 year	$ 2761
WD Moore	Sola-Flo	Positive displacement bore	48	-	4 x 64 watt	up to 10,000 L/day	up to 200	Bore pumping	Includes low water level sensing, stainless steel construction. Fits 4 inch bore casing	1 year	POA
	SF series	Positive displacement surface	12, 24	-	2 x 64 to 4 x 64 watts	up to 18,000 L/day	up to 30m	Pumping from dams and lakes	Low water level sensing built in. Also available as a floating pontoon system		

Enhance your summer comfort

Alan Pears outlines some simple and effective changes you can make to your home to avoid a hot, uncomfortable summer

It's all very well to talk about solar houses and the ultimate in energy-efficient house performance. But the reality is that most of us live in pretty ordinary houses that could be made to work a lot better—with improved comfort and lower energy bills. This article aims to help you make your home more energy efficient.

The main issues to think about with regard to making a house comfortable and energy efficient are:

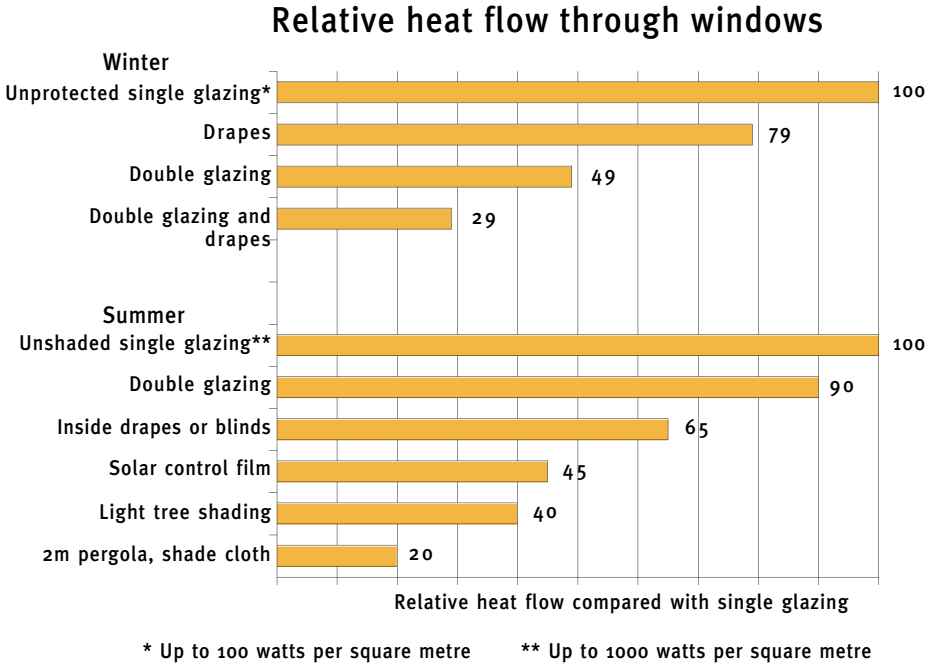
- windows
- air leakage
- energy flows through floors, walls and ceiling
- building mass.

Windows

Windows are critical to the energy performance of a building. In winter, heat loss through a window can be as much as 100 watts per square metre—that means every 10 square metres of window will lose as much heat as a single bar radiator produces, and cost between five and 15 cents per hour in heating bills. But well-oriented windows can also capture useful winter sunshine. A typical centrally heated house with 40 square metres of glass will pay up to 20 cents an hour to balance that heat loss, which amounts to over $200 each winter. If you have ducted heating, windows may lose even more heat, as hot air from duct outlets often flows over the windows, doubling or tripling heat loss. Clip-on plastic deflectors that direct the hot air away from the window and into the room cost less than $10 each and can cut heating bills by up to 20 per cent.

In summer, a window exposed to direct sun can let in almost 1000 watts per square metre: if you have a large area of west facing glass, that's like hanging a bank of single bar radiators on the wall, and switching them on at the hottest time of day! Sounds bizarre, yet that's what many Australians put up with every summer. No wonder they're uncomfortable.

In summer, the best way of cutting heat flow through glass is by fitting shading. Effective shading can cut heat



This graph shows the heat flow through a window in watts per square metre of glass.

gain by up to 80 per cent. But this still leaves up to 200 watts per square metre of heat gain. About half of this heat is due to the temperature difference across the glass, and the remainder is radiation getting past the shading. A few options can help cut this heat gain:

- Tight fitting, light coloured internal blinds or curtains. The light colour reflects heat back out through the window to some extent, and the air seal around the covering traps a layer of insulating still air between the glass and the window covering. Luxaflex Duette blinds are an example of an effective solution.
- Double glazing or, even better, double glazing with a 'low emissivity' coating to cut conducted heat flow and (if low-e coated) block heat re-radiated from the ground
- Shading the area around the window, so the ground is cooler

For east and west windows, wide eaves, verandas or pergolas are often used. These are only moderately effective, as they still allow the low summer sun to reach the glass. But adding a cheap blind hung from the edge of the veranda can make a big difference—and it can be easily rolled up when not needed. Also, if the veranda roof is dark coloured and not insulated, the hot roof can radiate quite a lot of heat into the house—so insulate! In parts of Australia where winter heating is needed, fixed overhangs block out useful winter sun and light, so think carefully about spending a lot of money on verandas.

For north windows, horizontal shading systems such as pergolas or wide eaves can work quite well. But there is a trade-off. The wider the shading the better it works in summer, but the more it blocks out winter sun. Even for north-facing windows, adjustable shading is really preferable. Also, it's preferable to shade the ground in front of north windows, to cut the amount of heat reflected or re-radiated from the ground near the windows. So, even if you have wide eaves, you can improve summer performance by adding extra removable shading, or even by hanging some shadecloth vertically from the edge of the eave.

Fixed wide eaves may not block heat out effectively late in summer and early in autumn, when it can still be quite hot, because the sun is lower in the sky. Again, adjustable shading can help here.

Adjustable shading is often expensive, but it need not be. Light coloured 90 per cent shadecloth (that is, shadecloth that blocks 90 per cent of the heat; you can also get 70 per cent shadecloth) is quite cheap, just a few dollars per square metre. With yachting clips, pulleys, ropes and cleats, it can be used to set up shading screens that can be easily pulled into place when they're needed.

And what if you have special difficulties, like an upstairs window? You can buy motorised or winder-operated external blinds and shutters if you have the budget. If you have external flywire screens, you can make up a second set of screens with light coloured shadecloth instead of wire mesh—these can be fitted just for the summer.

If the only window treatment option is an internal cover, keep in mind that the aim is to reflect as much heat as possible back out through the glass (use white or reflective surfaces), and to insulate the hot glass and the hot air next to it from the room. This means sealing around the edges of the window covering, so that hot air can't leak into the room, especially through a gap at the top.

Also, a window cover with some insulation built into it can be worthwhile: a lined curtain has an extra air space, but you can also use polyester wadding (often sold as Dacron) from a fabric shop. Products like Astrofoil (foil-coated bubble wrap, now called Aircell), or strips of polystyrene foam can be incorporated into blinds or insulating panels. You could even make sliding insulating panels. These solutions are also very effective in winter. You can try simple experiments, fixing these materials temporarily to your windows to see how well they may work.

What about tinted or reflective glass? This can be useful, especially for upstairs windows where shading is not easily fit-

ted. But be careful. Tinted glass blocks out useful winter sun as well as hot summer sun. And it reduces the light level all the time, whether it's bright or dull outside. Traditional tinted glass used to dramatically reduce light transmission. Over the past few years, new technologies such as low-emissivity and spectrally-selective coatings have meant that windows can allow a larger proportion of the visible light to pass through, but block out the UV and infrared wavelengths. Particularly when an outer pane of spectrally-selective tinted glass is combined with an inner pane of clear glass, a reduction of 60 per cent or more in heat gain can be achieved without blocking too much light.

A voluntary *Window Energy Rating Scheme* (www.wers.com.au) has been adopted by many Australian window manufacturers. This not only rates summer and winter performance of the glazing, but also takes into account the energy performance of the window frame as well. This scheme can help you select appropriate windows.

Another thing to think about is the use of combinations of window treatments over different parts of windows. For example, leaving a gap between the house and the start of your shading allows some daylight to enter but the shading still keeps most of the sun out. Leaving part of a window unshaded so that you can maintain a visual link to outdoors can make life more pleasant, and can be set up so that not much heat enters. Small clear panels in the roof of a veranda also allow some daylight in, and they can be covered over if it gets really hot. If your shading is made in separate sections, you can also adjust the extent of shading to match the amount of heat you're trying to exclude.

Window frames—the often-forgotten factor

Metal window frames are very good conductors of heat, but that is exactly what we don't want in a window frame. Switching from standard aluminium window frames to timber or 'improved' aluminium (that is, aluminium window frames that have a thermal break of plastic or timber to reduce the heat flow) gains about a half star rating on the *FirstRate* house energy rating system, which equates to about an eight per cent decrease in total heating and cooling energy requirements for a house. But even this is not the full story. If your metal window frames are painted a dark colour and are exposed to direct sun, they can absorb solar radiation and dump the heat into your house. Painting the win-

Before these roller shutters were installed, this upstairs, north-facing, room was unbearable in summer, yet pleasant in winter—now it can be used year-round.

dow frames a light colour can make a big difference, but covering over as much of the metal framing on the inside of the window with timber can create a fairly effective thermal break, further improving performance.

Air leakage

Air leakage is the hidden source of surprising amounts of heat (or cold). If it's 10°C hotter (or colder) outside, then a house with one airchange per hour more than the 'best practice value of 0.5 airchanges will continuously gain (or lose) about 1.5 kilowatts more heat, the output of one and a half single bar radiators. But what's an airchange per hour? Air leakage of one airchange per hour means that a volume of air equal to the volume of the house is replaced each hour. For a typical house, that's about 450 cubic metres of air.

On a windy day, an open fireplace can create around 10 airchanges per hour, continuously gaining or losing 15 kilowatts of heat! Remember, they are designed to extract smoky air from a house, and they work whether or not there's a fire. Block off that fireplace when it's not in use.

Just a 25mm gap under an external door on a windy day will let around 1.5 kilowatts of heat continuously enter (or leave). And most homes have a lot more leaks than this. Install draught-proofing! Many owners of older homes have, in recent years, ripped up the carpets and sanded back their floorboards. Too bad that the boards have usually shrunk, and large amounts of air leak through the gaps. It is sometimes possible to fill the gaps, but it may be worth thinking about installing insulation under the floor—a good thing for winter anyway.

Ceilings, walls and floors

Insulation is the key strategy for reducing heat flow through ceilings, walls and floors. Effective insulation cuts the heat flow by 70 to 90 per cent. I prefer to use a combination of reflective and bulk insulation, with reflective foil (and maybe blanket) directly under the roofing, and bulk insulation on the ceiling. Of course, you could write a book on insulation, but the aim of this article is just to highlight some key issues.

If foil is used, it is essential that there is an airgap next to the shiny surface: it doesn't work if the foil is sandwiched between two materials, because aluminium is a good conductor, and the heat just conducts through. Also, many people don't realise that a downward-facing foil surface works about as well as an upward-facing one when installed, and a lot better in the long term, because the upward facing surface will eventually be covered by dust. This surprising outcome is because aluminium is both a very reflective material and also a low-emissivity material. Low emissivity means that, when it is hot, it is unable to radiate very much heat away. To see how this works, switch on an iron with an aluminium baseplate and put your hand, say, 100mm away from it. Even though the iron is very hot, your hand doesn't feel particularly hot, because of the low emissivity surface. If you then painted the iron black and repeated the experiment, your hand would feel much hotter because black is a very effective radiator of heat.

Insulation reduces the rate of heat flow for a given temperature difference between indoors and outdoors. But there are ways of reducing the temperature difference, and thus reducing the driving force pushing heat into the building.

Painting surfaces exposed to direct

sun in light colours reduces the radiant heat load. For example, a light beige surface might reach 20 to 25°C above ambient in direct sun, but a dark colour can be 45°C or more above ambient. If you can't use light colours, extra insulation can compensate.

If you can't insulate your walls (or even your roof), shading them can make a big difference, especially if they are a dark colour. For example, fitting shadecloth between the top of the side fence and the eaves of a house can dramatically improve summer comfort.

There are a few issues to consider with insulation. First, if the insulation is squashed or there are gaps in it, its effectiveness can be seriously reduced. Many homes that have had insulation installed after construction have a strip of ceiling around the edge where the roof is low that is simply not insulated! Also, homes with extra-low-voltage halogen lamps are not only wasting lighting energy (see issue 81 of *ReNew*), but the lamps must not be covered with insulation to avoid overheating problems: this allows summer heat to enter the house. If five per cent of the ceiling is not insulated, heat flow through the total ceiling will increase by around 15 per cent.

Thermal bridges can also compromise the effectiveness of insulation. For example, if you have metal roof or wall framing, the effectiveness of the insulation can be reduced by as much as 30 per cent. This problem can be reduced by fitting rigid insulation or even timber strips over the metal to create a thermal break. Another thermal bridge most people don't think about is the heat flow through concrete slabs that extend beyond the building to form veranda floors. Concrete is actually a poor insulator (which is why you should insulate under suspended concrete slab floors). This is a difficult one to fix, although it is possible to install shading or even timber decking over a concrete veranda floor to keep the sun off it.

It's also important to remember that a well-insulated house with large areas of unprotected glazing will become a solar oven on hot days. You need to manage the glazing as well.

Conclusion

There's lots more to discuss about making buildings work better—for example the role of mass. But in this article the major issues that can be easily addressed in an existing home have been discussed. Hopefully you can now get to work and have a much more comfortable summer.

With your help, we can tackle climate change...

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:

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

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 68

Special deal for professionals:

Both ATA & ANZSES m'ship for $80 (was $104)

Until 31 December 2002, you can become a member of both ATA and ANZSES for just $80 (was $104) or $60 concession.

ANZSES' current members number almost 1000 and are professionals, researchers and people with extra interest in renewable energy.

The professional package offers you:

- ✶ **Full membership of the ATA (see page 67)**
- ✶ ***Solar Progress* magazine each quarter**
- ✶ **Discount on the annual ANZSES professional conference**
- ✶ **Regular monthly branch meetings and branch newsletters**
- ✶ **Free participation in ANZSES events**
- ✶ **Associate membership of the International Solar Energy Society**

Like *ReNew*? —join the ATA

ATA is a not-for-profit association that now represents over 2400 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 30,000 readers, and for its practical, independent information. ATA's 12 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.

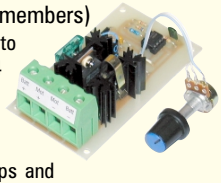
Locations of ATA branches are: Adelaide, Alice Springs, Brisbane, Cairns, Canberra, Coffs Harbour, Gold Coast, Melbourne, Perth, Sunshine Coast, Sydney, Tasmania, New Zealand and Wimmera (Western Victoria). Contact the ATA national office for further details.

ATA shop by mail

Maximiser kits and other amazing things

20 amp speed controller kit

Price: $40 ($35 for ATA members)

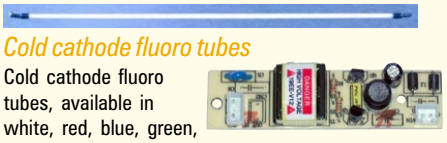


This controller allows you to vary the speed of 12 or 24 volt DC motors from 0 to 100%. It is also ideal for controlling loads such as incandescent/halogen lamps and heating elements. It is ideal for use on small electric vehicle projects, such as electrically assisted bikes and go-carts.

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

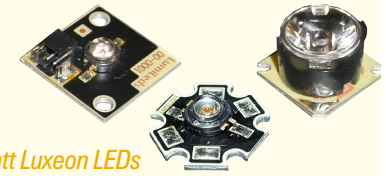
Cold cathode fluoro tubes



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.

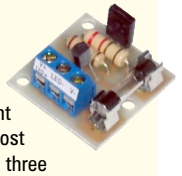
For more information, prices and to order, go to the ATA's website at www.ata.org.au or call Lance on (03)9380 3411.

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.

Constant current circuit kit



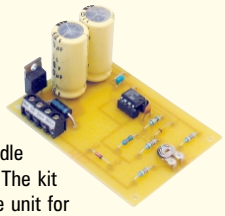
This short form kit allows you to build a simple constant current circuit for driving LEDs from almost any DC voltage. It is available in three sizes, 20mA, 300mA (for the Luxeon LEDs above) and 650mA (for the 5 watt Luxeon LEDs, due in January 2003). These kits could also be used to charge nicad and 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).

Mini-maximiser kit

Price: $35 ($30 for ATA members)

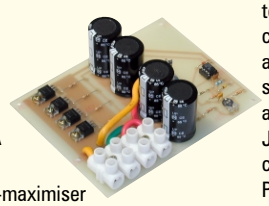


Our popular mini-maximiser kit will handle pumps up to 6 amps. The kit allows you to build the unit for use on either 12 or 24 volts.

Item code: MINIMAX

Maxi-maximiser kit

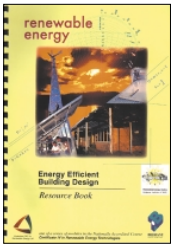
Price: 12 amp: $80 ($75 for ATA members), 20 amp: $140 ($130 for ATA members)



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

Renewable energy and energy efficiency in detail



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*

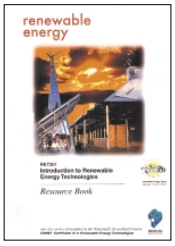
Introduction to Renewable Energy Technologies

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



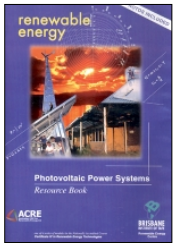
Photovoltaic Power Systems Resource Book

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



Windpower Workshop

Author: Hugh Piggott

Price $30.80, Paperback, 160pp

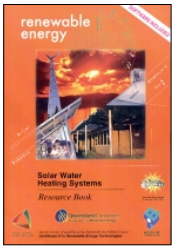
The ultimate resource for anyone who has ever wanted to build their own wind turbine. Provides practical advice on how to design and build a machine up to five metres in diameter. *Item code: WPW*

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



Solar Water Heating Systems Resource Book

Brisbane Institute of TAFE

Price $92.00, Paperback.

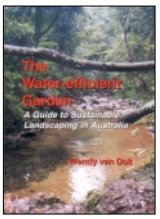
A thorough and comprehensive guide to solar water heating. Covers domestic and commercial solar water heaters and solar pool heating.

Item code: SWHSRB

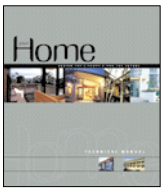
Order on page 68

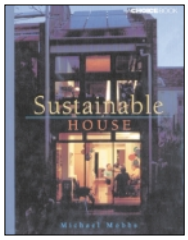
Want the dream house?

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

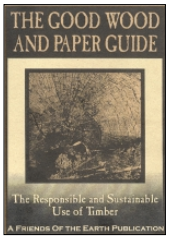


Your Home Technical Manual
Price: $49.50
Gives you the information you need to design and build a more comfortable home that is less expensive to run while being more environmentally friendly. Contains over 60 fact sheets on sustainable solutions for designing and building your home.
Item code: YHTM



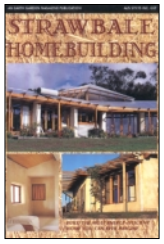


Sustainable House
Author: Michael Mobbs
Price: $38.50, Paperback, 188pp
The sustainable house in Sydney provides all of its own power and waste water recycling on-site. Contains many great ideas on how to make your house less of a burden on the planet.
Item code: SHB

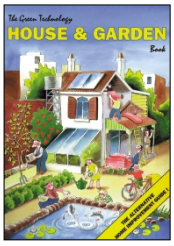


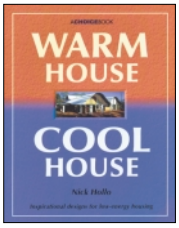
The Good Wood and Paper Guide 9th edition
Anthony Amis (ed) Friends of the Earth, 1999
Price $20, Paperback, 172 pp. Reviewed in *ReNew* #71
Whether you are building a house or buying copy paper for the office, this book provides essential information to help you make the best environmental choice.
Item code: GWPG

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: SHB

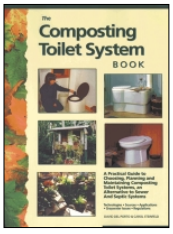


The Green Technology House and Garden Book
Price: $11.00, Paperback
A comprehensive guide to improving your home's energy efficiency. Includes do-it-yourself projects, real life experiences and a comprehensive listing of suppliers.
Item code: GTH&G



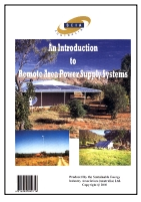


Warm House, Cool House
Author: Nick Hollo
Price: $33.00, Paperback, 172pp
An easy-to-read introduction to the principles of energy-efficient housing design. Covers a broad range of topics and contains an abundance of drawings, plans and photographs. *Item code: WHCH*



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*

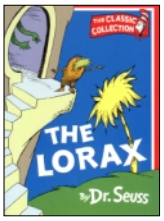
Solar electricity

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.

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.

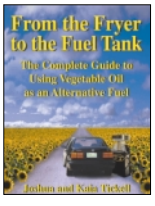
Just for kids



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*

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*

Join ATA and *WIN* a grid-interactive inverter

ATA Supporters, Members and Subscribers who join or renew their support for ATA and *ReNew,* all have the chance to win a SunProfi SP1200 grid interactive inverter (see details on page 5).

Becoming an *ATA Supporter*

ATA Supporters make regular donations to the ATA. With the help of its *Supporters*, the ATA can reach more people with practical advice on reducing energy consumption, and can expand the amount of education and policy work it is involved with.

Benefits of ATA membership

ATA membership ($49, $35 concession) includes:

- A subscription to *ReNew* magazine
- Discounts from selected outlets
- Chance to take part in member practical activities
- Over-the-phone technical advice
- The bi-monthly *Sun* members' newsletter

Subscribe to *ReNew* magazine...

and you'll never miss an issue! Only $28 per annum.

Discounts for ATA members

Current discounts available are:

- Advanced Energy Systems 10%
- AirMarine Australia 10%
- Alternative Fuels: 10%
- Australian Corres Schools 5%
- Birkenhead Batteries and Solar 10%
- BP Architects 5%
- B/W Solar 10%
- Cycletrek Bunbury WA 5%-10%
- Eco Solar Electrical 10%
- EcoSouth $250 off power systems
- Environment Equipment 10%
- Federal Batteries 10%
- Going Solar 10%
- K & C Stork 10%
- Natural Paint 10%
- Pearcedale Conservation Park 10%
- Sandford Electronics & Solar 10%
- Sharpe & Jephcott 10%
- Sola-Kleen 10%
- Solar Charge 10%
- Solar Energy Australia 10%
- Solazone 5%-10%
- Solco 5%
- Sustainable Impact 5%
- Talisman Design 5%
- Winter Windows 9%

Important: the latest issue of *The Sun* newsletter has full details.

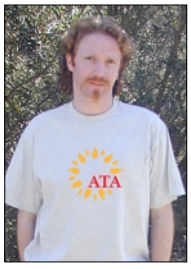
Expand your *ReNew* collection

All available back issues up to issue *ReNew* 77 $6.50 inc. postage within Australia. *ReNew* issue 78 onwards $7.50 inc. postage. For a listing of what is in each issue, see the ATA's web site at www.ata.org.au.

Issues available are: Soft Technology issues 41, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55 and 56. ReNew issues 57, 58, 61, 62, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 80 and 81.

More new products—ideal as Christmas gifts!!!

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

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

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*

Xmas special: order by 10th December and pay no postage on this item.

Order on page 68

ATA order form

Name Year of birth:

Address

State P/C

Phone (BH) (AH)

Fax/Email: (MOB)

Join me up as an ATA Member

Includes *ReNew* magazine four times a year, *The Sun* member newsletter (bi-monthly), discounts on a range of products and services, chance to take part in ATA branch activities

❒ Full membership $49
❒ Concession (proof of entitlement required) .. $35
❒ Household membership $60
❒ Professional package (ATA & ANZSES m'ship) offer ends 31 December 2002 ($60 concession) ... $80
❒ Membership NZ & PNG $57
❒ Membership rest of world $62
❒ Non-profit group/School $80
❒ Corporate/Government $250
❒ *Gift membership/subscription ..... $_____

*** For gift subscriptions or memberships, please provide both the recipient and giver's addresses.**

I only want to subscribe to *ReNew*

❒ Australia $28
❒ NZ & PNG $32
❒ Rest of world $39

This is a ❒ new or ❒ renewal membership/subscription.

Send me books or products

Item or code	Qty	Price $

Postage Postage for books is $8 for the first book plus $2.20 for each additional book. All membership and subscription prices include postage. $

Please accept my donation Donations are tax deductible. A receipt will be issued. $

Total (NB. All prices in $AUD. Prices subject to change) $

I want to be an *ATA Supporter*

Becoming an *ATA Supporter* is a tax deductible donation. For member benefits such as discounts and *ReNew*, also join as an ATA member.

EACH MONTH, I would like to donate

Amount: ❒ $20 ❒ $50 ❒ $100 ❒ Other (min $10) $ ____

ATA will send a tax deductible receipt in July each year.

❒ Debit my credit card (enter card number below)

❒ Debit my bank account (ATA will send you a direct debit form for you to complete and return)

Credit Card payment

Card type: ❒ Visa ❒ Mastercard ❒ Bank card

Cardholder's name

Card no. |__ __ __ __|__ __ __ __|__ __ __ __|__ __ __ __|

Expiry ___/___ Signature

Payment details for m'ship/subscription

Attached is my:

❒ cheque ❒ money order ❒ credit card details

Save paperwork—renew automatically!

❒ Please renew my membership/subscription by automatically charging my credit card each year (enter card details above). You will be charged at the end of this month, once each year, until you cancel the request.

❒ For automatic renewal by Direct Debit of your bank account, please fax or post this form to ATA and we will send you a direct debit request form for you to complete and send back to us.

Send to

ATA, PO Box 2001 Lygon St North, Brunswick East VIC 3057

Note: Please allow up to 28 days for delivery.

82/03

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

Fridge makes lights flicker

I have a Whirlpool WRX32R refrigerator runing on my solar system with a new 700ah, 24 volt battery bank. There are no problems overall except that when the fridge starts the DC lights dim for a split second, indicating a very high starting current, and thus draw on the batteries (wiring and contacts are all up to standard, and power tools, washing machine or vacuum cleaner (1100 watt) don't do it). Presumably this must impact on the life of the batteries.

I know there is a way of 'soft starting' induction motors, such as the fridge, using capacitors, and believe you may have covered this matter in *Soft Technology* or *ReNew* in the past. Would you have a suitable design or circuit for this purpose and is there any risk to the life of the fridge compressor/motor involved?

Andy Yeomans,
Burringbar, NSW

I assume your lights are DC fluoros? They can be a bit prone to voltage variations.

Capacitors are used generally to correct power factor (PF)—induction motors can have a low PF and the caps act as an energy reserve, which takes some of the load off the inverter. However, motors that use different sized caps for starting and running have a speed-controlled switch built into them so that the start caps are switched out as the motor comes up to speed. Your fridge motor won't have this, so you would have to use a timer circuit that drops the caps out of circuit after a second or two, which should be enough to get it started.

Fridges are often a problem, as they have to start with full load on the motor, hence the high surge requirements. Even with the caps, it may not solve the problem. I would suggest getting a few suitable caps, maybe a few 10s of microfarads, and connecting them across the motor with a switch for a test. Turn the fridge on, and, once it has started, switch out the caps. If this works, wire them in with an appropriate timer circuit. It is hard to know what size of cap to use, it will vary with the motor, but if you contact the fridge manufacturer, they might be able to give you some idea what to use.

This high startup surge is normal for the fridge

motor, and won't hurt it. Regarding the batteries, good solar-grade batteries are designed to handle loads such as this without damage.

An alternative that would solve the problem without having to modify the fridge is to wire a large value electrolytic capacitor across each light circuit. Something in the order of 10,000µF at 35 volts should do it. You might have to wire a Schottky diode in series with each light circuit so that the caps are not discharged when the fridge starts, but try it without the diode first. This would be the simplest (and safest) way to solve the problem. Remember, though, that the large value cap will itself draw high currents initially when first charging, so you might want to connect it just before the switch in each circuit, rather than after, as the high currents may burn the switch contacts.

Lance Turner

The best detergents

I heard an interview on the evening show the other night and your web site was referred to.

We are interested in recycling grey water onto our grass and part of the radio interview I heard was different types of washing powder and their soap content. Apparently liquid detergent is better. Is there a list somewhere that explains the differences?

Jenni Chapman, Melbourne VIC

Liquids are by far the best, especially the good eco-type liquids like Earth's Choice, available from supermarkets for around $2 per litre. I use this one—it is great, you don't need much of it and it can go straight on the garden. There are others, of course, and a list can be found in issue 81 of ReNew *or on the Lanfax Labs web site at: www.lanfaxlabs.com.au*

Lance Turner

Compact fluoro interference

I have been recently using energy efficient light bulbs and have found that they interfere with remote controls of television and video recorders (as it happens, both are Panasonic). Have you heard of this problem and do you know of a way to solve it?

Laurie Kemp,
kempskonnect@pacific.net.au

I expect it is because the inverter in the fluoro is running at the same frequency as the remote control, thus causing interference. I have to say that I can't think of any simple fix for it, other than changing the compact fluoro to a different brand. The better quality ones, such as the European version of the Osram, may solve the problem, as may using a CFL with the older electromagnetic style ballast—Philips make a few of these but they are bulkier than the electronic style and take a few seconds to start, much like a normal fluoro.

Apart from that, I don't have any other suggestions, but I'm sure other readers who may have faced the same problem would be interested to hear any solutions you come up with.

Lance Turner

An electric car without batteries?

Well, not exactly, but the Air Car (that's its name!), from Moteur Development International (MDI), could be considered just that.

The car runs on highly compressed air stored in special tanks, and because the compression is usually done using electric-powered compressors, then it is, in effect, an electric car that uses no batteries.

What's more, it has the ability to be 'recharged' (filled with compressed air) at a rate comparable to filling a conventional car with fuel.

The compressed air engine system effectively eliminates three of the problems associated with electric cars—heavy batteries, long refilling times, and limited range. What's more, the infrastructure for providing filling stations for such a vehicle is already in place—the electricity required to run the compressors is available anywhere that petrol is.

The Air Car comes in four versions—a family car, a van, a taxi and a ute. All come with ABS brakes, airbag and air conditioning as standard. The latter is actually a side-effect of the vehicle's propulsion system—the only exhaust from the engine is very cold air!

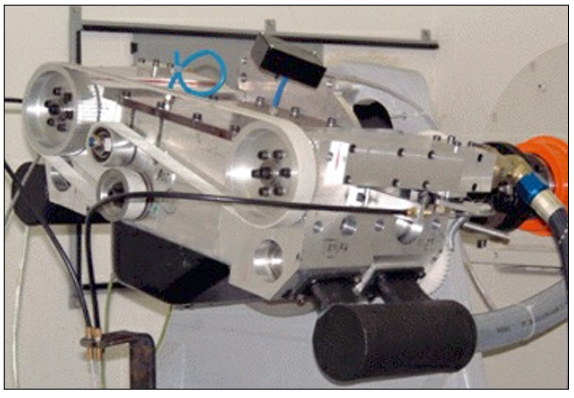
The vehicle has a top speed of 130km/h, with a range of 200 to 300km. Recharging time for the built-in compressor is four hours, or just three minutes at a filling station.

As already mentioned, the Air Car uses very highly compressed air. The initial pressure in the tank is around 300 bar, or over 4000psi! However, while this sounds dangerous, the use of fibre reinforced composites in place of steel means that, even if a tank is ruptured, it won't explode. The air just makes a great deal of noise while escaping.

While the Air Car is not yet in production (the first factory is currently being built in France), the concept is fantastic, and has the potential to greatly reduce city pollution, as well as reliance on fossil fuels. MDI has 400 manufacturing licenses to sell, and, according to their web site, four have been purchased in Australia, so we may yet see the Air Car on Australian roads in the future.

For further information, see the MDI website at www.theaircar.com

The vehicle is available in four versions, and can even look kind of sporty!



Right: The power plant for the Air Car is far simpler than most internal combustion engines, and far lighter, yet uses an interesting articulated conrod system that improves efficiency. Above right: Not the biggest ute around, but with a carrying capacity of 720kg, it can certainly do the job.

Electric ATVs

Many businesses and organisations use small all-terrain vehicles. Most of these are polluting, petrol-powered machines, but the electric all-terrain vehicles from Nybro Holdings offer a low-emission alternative.

The Nybro ATV two-seater is four-wheel drive and is designed to provide mobility for the elderly or disabled, but would have a great many other uses in places like plant nurseries and small farms.

The two-seater specifications include two 24 volt, 1kW and two 24 volt, 0.75kW drive motors, two 12 volt, 90 amp-hour batteries, a recharge time of eight hours, a maximum 30km (20km typical) range on flat ground with two 80kg passengers, electronic brakes, a maximum carrying capacity of 170kg and a maximum pre-set top speed of 10km/h.

The Venture ATV-xm has a 24 volt, 1.2kW motor, two 12 volt, 42 amp-hour sealed batteries (with a maximum of six batteries), a recharge time of six hours, a 30km standard range, with a maximum range of 90km, electronic/regenerative braking, a carrying capacity of up to 125kg and a pre-set top speed of 14km/h.

Manufactured by Nybro Holdings Pty Ltd, 1/11 Endeavour Drive, Kunda Park QLD 4556, ph:(07) 5476 7199, fax:(07) 5476 9055, email: sales@nybro.com.au, www.nybro.com.au

Bigger grid-interactive inverters

If you need to install a large renewable energy system, then you should look at the Optimax range of inverters from Advanced Energy Systems Ltd.

The range includes single phase inverters ranging in size from 5kVA up to 30kVA (10kVA model shown), and three-phase units ranging from 30kVA to 90kVA. The inverters can take energy from multiple sources, including generators, batteries and solar arrays, and automatically matches the most efficient combination of the generator, battery and renewable energy sources to changing load demands, in effect, making the inverter a mini power station controller. This can result in significant fuel (and pollution) savings for diesel generator and similar systems.

Advanced Energy Systems Ltd, 96 Ewing St, Welshpool WA 6016, ph:(08) 9258 8500, fax:(08) 9258 8277, email: info@aesltd.com.au, www.aesltd.com.au

Make fluoros even lower energy users

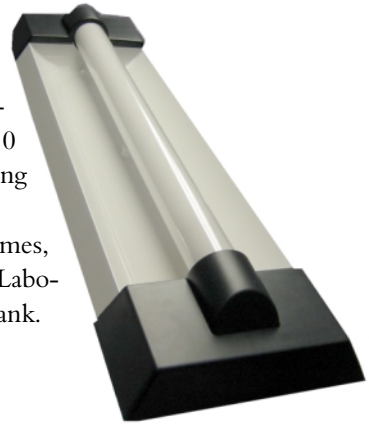
Lighting controllers for gas discharge lamps, such as fluoros and other similar lighting systems, seem to be quite common in many countries, but they are yet to take off in Australia. Yet there are considerable savings to be had with the use of these devices.

Essentially they reduce the voltage, and hence the power consumption, to the lamp once the lamps have started fully. These controllers are said to be able to reduce energy consumption by as much as 35 per cent, which can be a considerable amount of energy (and money) saved in buildings with large numbers of fluoro or similar light fittings.

We looked at one of these controllers a few issues back in *ReNew*, and have since found two others that perform a similar function. At right is the LEC lighting energy controller from Israel, with models capable of handling lighting loads of up to 160 amps, and at left is the Fluoresave controller, which is available in models up to 20 amps.

The LEC units are distributed by Lighting Energy Controllers (Aust) P/L, ph:0414 312 230 or 0417 474 144, while the Fluoresave units are available from Sustainable Solutions, 13 Brenda Crt, Croydon VIC 3136, ph:(03) 9733 5307, mobile:0422 105 638.

10 watt fluorescent lamp



Energy Today (Quirk's Victory Light Company) has added a new product to its range of extra-low-voltage lighting. The A-Light is a complete 12 volt flurescent light fixture, comprising a 10 watt straight fluorescent tube, reflector, 10 watt electronic ballast and armature. This light fitting also features reverse polarity protection, and is operated by a simple on/off rocker switch.

Energy Today suggests possible uses for the light include interior lighting applications, in homes, caravans and weekenders, or emergency lighting. The A-Light has been tested by Underwriters Laboratories Inc. (New York) and was found to conform to specifications laid down by the World Bank.

The light measures 427mm long x 123mm wide x 49mm deep.

rrp: $45.00 including GST.

For more information, contact Energy Today, PO Box 340, Botany NSW 2019, ph:(02) 9700 0960, fax:(02) 9700 0964, email: energytoday@quirks.com.au, www.quirks.com.au

Teeny weeny compact fluoro

Philips have a good range of compact fluorescent lamps (CFLs), and have recently added to it with the Essential series of compact fluorescents. This includes the Genie range—which has lamps of various sizes, including the smallest lamps we have seen available in Australia.

The smallest is the tiny five-watt lamp that is designed to replace a standard 25 watt incandescent. It has a warm white (2700k) output of around 235 lumens, is slightly shorter than a standard incandescent bulb, has an expected life of 6000 hours, and has an operating voltage of 170 to 250 volts, making it ideal for areas with voltage sag problems.

Like most CFLs, it is not suitable for use with light dimmers or other electronic controls. We have been trialling one of these lamps and so far it has been excellent, with great light output for its size.

rrp: around $10.

Our sample came from a local Safeway (Woolworths) store.

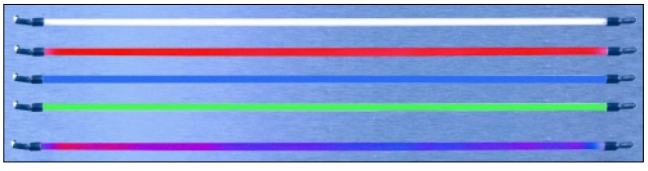
Micro fluoro tubes

Everyone has seen fluoro tubes, but one variation on the fluorescent lamp system is the cold cathode fluorescent lamp (CCFL). These lamps are commonly used to provide backlighting in LCDs in laptop computers, but are now becoming more commonly available for other uses.

Jaycar Electronics has a range of CCFL tubes in both 100 and 300mm lengths. The tubes are 4mm diameter, and are available in white, red, blue, green and blacklight (UV) colours. Also available are small inverters, designed to drive these tubes, which run from any 12 volt DC source. Energy consumption is quite low, with the 300mm inverter drawing less than five watts, and the 100mm unit using around two watts. Despite this, the light output of the lamps is quite good, and is ideal for energy-efficient feature and accent lighting, party lighting, camping lights and small solar or wind powered lighting systems, such as for that dark outside dunny!

rrp: 100mm tubes: $11.95 each; 100mm inverter: $9.95; 300mm tubes: $19.95 each; 300mm inverter: $12.95.

Available from Jaycar Electronics, enquiry ph:(02) 9743 6144, order freecall: 1800 022 888, order freefax: 1800 810 137, email: techstore@jaycar.com.au, www.jaycar.com.au www.jaycar.com.au. The lamps are also available from the ATA, ph:(03)9388 9311, www.ata.org.au



Sealed double glazed windows

PAARHAMMER windows are double-glazed and feature double-rebated timber frames. A special rubber seal provides extra insulation, eliminates drafts and the need for heavy drapes. An aluminium strip drains rainwater away from the window, reducing weather deterioration.

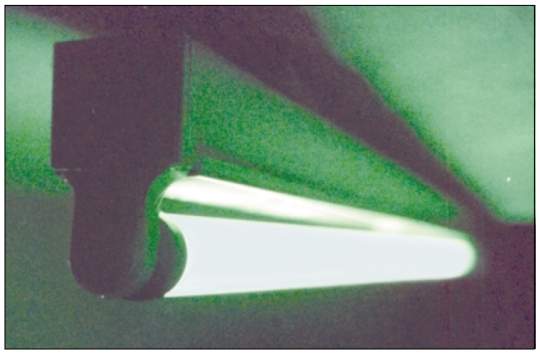
According to the manufacturer, the windows can reduce energy bills by up to 40 per cent, and achieve a sound reduction of 45dB (equivalent to an 80 to 90 per cent reduction).

Each window and conservatory is custom made and there is virtually no limit to size and shape. Any type of glass can be used to construct sealed units, which are factory installed into the frames. Colonial bars are available in either timber on both sides of the glass panes or in powder-coated aluminium sandwiched inside the sealed glass pane. The product range includes double-rebated entrance doors, french doors, sliding-byfold-tilt doors and parallel-sliding-tilt doors.

The window frames are coated with a water based, semi-transparent coating, to reduce maintenance. This coating expands and contracts with the timber without peeling. Other colours are available on request.

They feature 'tilt and turn' fittings, which are made in Germany, and provide the flexibility of two opening positions, operated with one handle. These fittings have locking pins at least every 800mm, to provide multi-point metal-to-metal security locking. Different timbers are available, including plantation timbers such as Hoop Pine and Scandinavian Fir.

PAARHAMMER windows and conservatories are on permanent display at the Building Development Display Centre, 332 Albert Street, East Melbourne, ph:(03)9419 7488, and the factory showroom at Ballan. Delivery can be arranged Australia wide. Manufactured by PAARHAMMER, freecall:1800 676 797, email: mail@paarhammer.com.au, www.paarhammer.com.au.



A longer glow, and no electricity!

Photoluminescent materials (commonly called 'glow-in-the-dark') emit light as a result of being exposed to ambient light. As the material absorbs light, it stores energy. Upon removal of the light source, the stored light is gradually released, producing a visible glow that fades over a period of time.

While many different phosphors have photoluminescent capabilities, zinc sulphide (ZnS) is the compound that has become the industry standard and is used in most photoluminescent products. Unfortunately, due to zinc sulphide's limited capacity for storing energy, the illumination decays rapidly, usually becoming difficult to see within 30 minutes.

A new product, Lumenite™, emits light that is up to 15 times brighter and lasts significantly longer than standard photoluminescent products. The light produced is yellow-green in colour, the same as produced by ZnS, but lasts up to 30 hours—and it 'recharges' in as little as five minutes.

Lumenite is non-radioactive and eliminates the use of battery-powered emergency lighting, thus reducing energy use. It is fire resistant, UV stable and weather resistant for outdoor applications. It is available in sleeves to fit all fluoro tubes, from 18 to 55 watts, and can be installed in a minute or two per tube. The material is also available in other forms, including pellets for moulding, rigid sheets, adhesive rolls and strips, and paint and ink for printing and marking. The only drawback we could see is that some of the products are made of PVC, which is quite toxic, despite what the brochure says!

rrp: The T8 (standard 25mm diameter tube) light sleeve: $39.00 for a 1200mm length, $19.50 each for a 600mm length.

Available from Luna Glow P/L, first floor, 31 Brisbane St, Eltham VIC 3095, freecall:1800 990 599, ph:(03) 9439 5355, fax:(03) 9439 5377, email: enquiries@lunaglow.com.au, www.lunaglow.com.au

A water heater that uses no batteries

Instantaneous gas water heaters are the lowest energy users of all the gas water heating systems, but most still use a gas pilot burner, which can waste a lot of gas. Some time ago, Bosch eliminated the burner with their electronic ignition water heaters, but these required a battery for the ignitor.

The Hydropower, as its name suggests, eliminates the battery and uses energy extracted from the flow of water through the unit to provide the ignition source, in effect, using a tiny hydro generator!

Available in both internal and external models, the HydroPower range has models to suit almost any installation and hot water requirement and is capable of supplying from 600 litres per hour up to 960 litres per hour (10 to 16 litres per minute).

The 10 and 16 litre-per-minute models are five-star rated, while the 13 litre-per-minute model has a 4.6 stars rating. The units also feature user-selectable temperature and flow rate, flame failure safety device, and are available in both natural gas and LP gas versions. They come with a two-year warranty on parts and labour (one year on the internal models), and 10 years on the heat exchanger.

Available from Bosch dealers throughout Australia. Melbourne head office, ph:(03) 9541 5555, fax:(03) 9541 7790, www.bosch.com.au

A big waste digester

The Tat-G Domestic is a large waste digester that uses worms to convert household and garden waste into compost ideal as a garden fertiliser.

The unit has a small battery-powered pump to circulate fluids in the digester. The digester has circuitry that runs the pump twice a day, and also protects the battery from overcharging and excessive discharging. The battery is charged by a small solar panel.

The internal capacity of the Tat-G Domestic is approximately 300 litres, and the unit has a possible digestion rate of around 68kg per week. It is suitable for processing lawn clippings along with all household organic waste. Garden green waste materials can also be processed, after a bit of preparation with your lawnmower!

The unit measures 1.6m long x 0.85m high x 0.7m deep, and weighs 54kg (empty).

rrp: the Domestic unit price starts at $599.00 + GST (worms not included). There is also a commercial unit available, with prices starting at $5999.00 + GST (worms not included).

Manufactured by Tat-G Corp, freecall:1800 725 325 or ph:(03) 5824 2755, fax:(03) 5824 2766, www.tat-g.com.au

Advertisers' Directory

[Kid's stuff]

Noel's Treasures from Trash

To make your own Model solar chimney you will need:

- one square metre of black plastic sheet
- one square metre of clear plastic (a piece of the clear plastic that florists use will do)
- eight bike spokes
- seven elastic bands
- some pieces of 50mm diameter plastic pipe, 1 piece 300mm, the rest any length
- 200 x 200 x 19mm chipboard or wood
- a clear plastic soft drink bottle of any size, an aluminium soft drink can
- two 40mm long pins with large coloured heads
- some matt black paint, insulating tape, some graphite, rubber glue
- tools: hacksaw, drill, file, sharp knife, scissors, compass, vice, gloves.

A solar chimney is really a hot house with a very tall chimney. The warm air rushes up the chimney, turning a turbine and generator and producing electricity. One solar chimney in Spain is 200 metres high and has been producing 100 kilowatts during the day and 40 kilowatts at night for almost 20 years. There are currently plans for a one-kilometre high chimney with a five-square-kilometre hot house to generate 200 megawatts to be built near Mildura on the Murray River.

As with all Noel's Treasures from Trash projects, adult assistance and interest will most definitely be required for this project.

Making the chimney

Start by taking the 300mm piece of pipe. You need to make four windows around the pipe—these will be 50mm x 30mm, with a solid piece about 15mm wide in between. Mark lines 100 and 150mm from one end, then mark in the four windows. Drill several overlapping holes in each corner inside the windows marked so you can get a hacksaw blade through to cut out the windows, cleaning up the hole edges with the file. Opposite each window, drill holes 90mm from the end of the pipe (so they will be 10mm below each window) and push a bike spoke through each with the threaded part on the outside. Tape the spokes to the pipe and bend them outwards so they come near the corners of the piece of chipboard. These form supports for the chimney.

Drill four holes in the chipboard on an angle, push the spokes through until the end of the pipe is about 80mm above the chipboard, bevel the edges of the chipboard with a file, then coat the lot with black paint.

Making the turbine

Cut the top and bottom off the aluminium can, and cut down one side to make a flat sheet (rubbing the sheet over the edge of a table will help flatten it). Draw a circle about 48mm diameter, marking the centre carefully, and cut around the circle. Smooth its edges, then cut lines towards the centre 6mm apart, stopping 5mm from the centre. Twist each blade about 30 degrees. Push one of the long pins through the centre (use some cardboard to support the turbine while you do this) until the head is 10mm above the aluminium and the pin is perpendicular. Glue the pin in place.

The bearings

Cut three pieces 15mm x 51mm lengthways from one scrap piece of pipe. Smooth the edges, then clamp two of them in a vice, concave sides in, with glue between them. Find the exact centre of the long edges, then drill a hole 7mm deep with a drill slightly larger than the pinhead. Push a pin through this hole and through the bottom of the two pieces of plastic, so that the pinhead sits in the hole and the pin protrudes from the bottom of the plastic pieces. Glue the pin in place, keeping the glue off the pinhead. You should now have two pieces of plastic, a hole in between them, with a pinhead at the

bottom and with sides about 2mm above the pinhead to stop the turbine's pin slipping off.

For the top bearing, push a thicker pin 2 to 3mm into the centre of the third piece of plastic that you cut from the pipe earlier, to make a small indentation.

Assembly

Work the larger bearing (made from the two pieces of plastic with the pin) into the centre of the pipe, level with the bottom of the windows. You may need to file a little off the ends to make it fit. Sit the turbine on its bearing and lower the top bearing so that the pin fits loosely into the centre hole.

Now coat the pinheads with graphite (or scrapings of a lead pencil) and check the turbine spins easily. The turbine should spin with a breath of air. If not, check that the bearings are loose. If the turbine hits the inside of the pipe, you can cut a little off the blades.

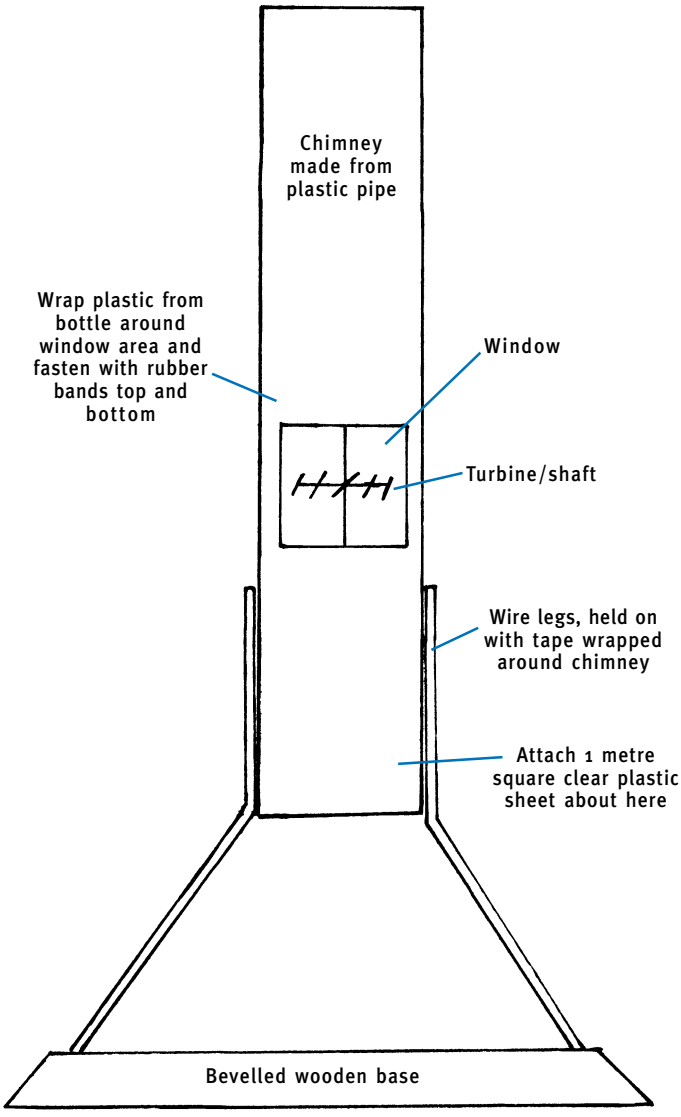
Cut off the top and bottom of the drink bottle, and cut down one side to make a sheet of plastic. Wrap this around the chimney over the windows and hold in place with elastic bands.

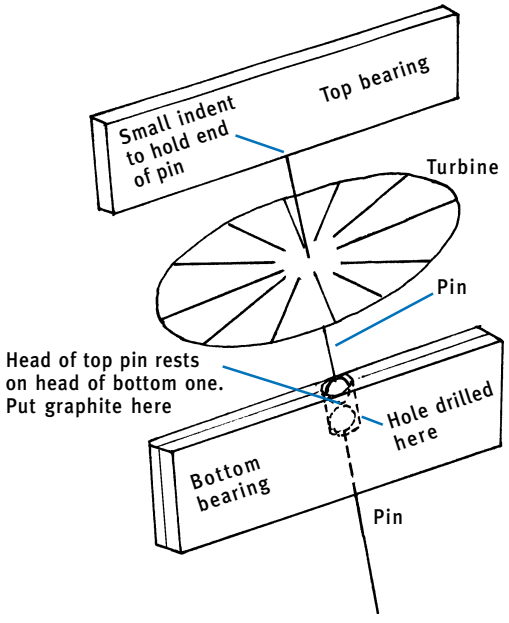
Now for the greenhouse. Glue elastic bands to each corner of the clear plastic and cut a hole in the centre. Reinforce the plastic at the edge of this hole with sticky tape, if needed. Slide the plastic down over the pipe and fix it at the bottom of the pipe.

Put the black plastic on the ground in the sun, place the pipe at the centre, and pull the corners of the clear plastic out and secure with bike spokes driven into the ground. Make sure that the plastic tapers down from the chimney towards the ground, so that the rising air will flow towards the chimney.

Blow down the chimney to check all is well—the turbine should spin with just a gentle blow. On a sunny day the turbine spins from the hot air rising up the tube. If you tape another length of pipe onto the top of the first one to increase the chimney height it will work even better. ✻

This is how the finished solar chimney should look.





Detail of the bearings and turbine.

Classifieds/For Sale

For Sale: Live the Nimbin Dream. 3 bed home, renovated kitchen, lounge/dining, bathroom, separate toilet & shower, laundry, aircon & ceiling fans. Plus 2 sheds approx 210 sqm, vacant block approx 1000sqm, majestic views, zoned village. 3 Titles. $220,000. *ph:(02) 6689 1252.*

For Lease: Olinda, House/rooms rent/lease in 2003. 4.5 acres mountain ash rainforest. Micro-hydro powered, permanent spring water. Solar/woodstove heating, cooking, hot water. Veggie garden. Melbourne Zone 3 bus outside. *Ph:(03)97511439, gneo@ozemail.com.au*

For Sale: 40 x 1.2 Volt 330 Amp Hr Ni-Cad batteries. ALCAD LP330 suit 24 or 48 volt system. Price negotiable. *ph:(08) 8556 7460 (South Australia).*

For Sale: Solahart gas booster fd15, New in box, suit 180-300 litre system $550. Quantum compressor unit $100. Qty various HRC & Diazed fuses 6-100A $2-$20each. *ph:(03) 9304 1652.*

For Sale: Trace Inverter DR 2424, 24V, 2400W, 8000W surge $1400. *ph:(03) 9304 1652.*

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.au* ♦

Living Spaces Design Group: Architects & designers specialising 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

Swinburne University of Technology: Renewable technology courses *ph:(03) 9214 8504.*

Ethical Investment/ Real estate

Australian Ethical Investment & Superannuation: For Investors, Society and the Environment. *Suite 66 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-Loo's, 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.gough.com.au*

RE Equipment/ System Components

Batteries

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 Optimax™ bi-directional inverters (Stand Alone & Grid Interactive UPS 5kW to 250kW) & Enviromax grid-connect inverters (Wind and Solar Series 15kW to 125kW). Australian supplier of Solar Roof & Shell solar products. Catalogue available, *ph: 1300 367 765.*

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* ♦

Water Pumping

B/W Solar: ETADRIVE® (brush-less 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* ♦

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*

Wind

Adtech: Highest quality power systems for Homes, Farms, Wineries, Aquaculture etc. Bergey Wind Turbines & Wind electric pumping systems. Adtech towers, DC engine driven battery chargers etc. Factory installation team. Friendly advice & design. *ph(03) 5341 8232 info@adtech-windpower.com.au*

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 etc/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* ♦

Choice Electric Co: Major distributor for BP & SHARP solar mono & poly-crystalline PV modules. SHURflo solar pumps, bore pumping & pressure systems. SEA Sinewave inverters, inverter/chargers. Fronius Grid Feed Inverters. Enersun Solar Batteries. Choice DC Lighting & Electronic Ballasts. *Freecall:1800 074 007.*

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*

Excelsior Power: Quality Inverters & Battery Chargers. Inverters. Battery Chargers. Deep Cycle Batteries. Solar Panels. *3/4 Apsley Place Seaford Vic 3199, ph:(03) 8796 3260 www.inverter.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 & SEIA 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*

Rainbow Power Co: Australia wide distributors of Photowatt solar modules, regulators, inverters, DC lighting etc. Manufacture, sales & installation of renewable energy systems. Contact us for system design & consultation. SEIA accredited. *1 Alternative Way Nimbin NSW 2480, ph:(02)6689 1430 fax:(02) 6689 1109 sales@rpc.com.au*

Tasman Energy: Kyocera Panels at unbeatable prices. AirX Wind Turbines; SEA, Selectronic & Trace Inverters. Comprehensive "How To" Manuals on Biodiesel, Direct Battery Charging and Solar Electricity. December Special - Kyocera 120W solar panels $990 and AirX Land $1340. *1800 226 626 www.tasmanenergy.com.au*

NSW:

PV Solar Tiles: Integrated rooftop PV systems; withstand hail storms, can be walked on, roofs, awnings, shading & PV skylight option. Aust design/manufacture, CSIRO tested. *PV Solar Energy 28 Florence St, St. Peters NSW 2044, ph:(02) 9557 6657 fax:(02) 9557 6692 mob:0414 895 370 pvsoleng@mpx.com.au see www.seia.com.au*

Sandford Electronics & Solar: TV, video, solar module, deep cycle battery, battery charger, regulator, solar tracker, inverter, meter, wind turbine, micro-hydro, low voltage refrigeration. *Lot 2 Bong Bong Rd Dapto NSW 2530, mob:0416 050 125.* ♦

QLD:

Mastervolt: Smart 3-stage Battery Chargers. Rugged Inverter/Chargers. Stand Alone Pure Sine Inverters. Intelligent Battery Monitors & Instrumentation. *30 Beach St Kippa-Ring QLD 4021, ph:(07) 3283 7800 office@powersolutions.com.au*

VIC:

Going Solar: Renewable Energy and Sustainable Living products & services including solar hot water & solar electricity design & installation. Energy efficiency consultation & design. Composting toilets, greywater systems & rainwater tanks. Bio paints, books & much more. *ph:(03) 9328 4123 retail@goingsolar.com.au www.goingsolar.com.au* ♦

Outlook Alternatives: Central heating—hydronic, ducted, wood & gas systems. Solar—hot water, electricity & pool heating. Solid fuel—room heaters & cookers. Water pumping & filtering systems. *52 Faithfull St Wangaratta Vic 3677, ph:(03) 5721 9900 outlookalternate@netc.net.au*

Solar Charge: Over 25 years serving Victoria. Grid/Remote Solar Power. BP Solar distributor. Solar Home Design advice. Professional dealer network. Working display/showroom at: *115 Martin St. Brighton VIC 3186, ph:(03) 9598 6740 www.solarcharge.com.au* ♦

WA:

Uni-Sun: Your discount mail order solar power station. UniSolar solar panels. True Sinewave inverters. Plasmatronics regulators. Energystore batteries. *Christopher Darker mob:0418 934 607 cdarker@unisun.com.au www.unisun.com.au*

RE Installers

NSW:

Solar Powered Solutions: Full SEIA accreditation. Custom Design, Supply & Installation of Renewable Energy Systems. Solar, Wind & Hydro. *139 Wallace St Braidwood NSW 2622, ph:(02) 4842 1333 fax:(02) 4842 1322 mob:0429 319 068 Edwards.L@bigpond.com*

QLD:

Ausolar: Solar & Renewable Energy Systems. Up to 50% rebate. Conditions apply. Solar Power systems. Wind - Hybrid - Grid-Connected Systems. 20 years experience. Accredited RAPS designer & installer. *PO Box 244 Deception Bay Qld 4508, ph:(07) 3888 5051 fax:(07) 3888 2114 info@ausolar.com www.ausolar.com*

Eco Solar Energy: Professional design, supply, installation of RAPS & grid connect systems. SEIA accreditation FDI 576. *10 Longan Rd Cooloolabin QLD 4561, ph:(07) 5446 8866 fax:(07) 5446 8861 mob:0417 712 751 ecosolar@sun.big.net.au www.ecosolar.com.au* ♦

Planetary Power: Solar, wind & hydro. Remote area power supplies. Electricity, hot water, pumping. Serving all areas. Full SEIA accreditaion. *PO Box 765 Atherton QLD 4883, Freecall:1800 000 765(QLD) www.planetarypower.com.au*

Solar-Mac P/L: Design, supply & installation of solar home power & solar pumping systems. SEIA accreditation FDI 551. *Contact Peter McPherson 8 Sundown Dve Paradise Point Qld 4216, PO Box 488 Oxenford Qld 4210, ph/fax:(07) 5529 6611 mob:0407 110 958 solarmac@bigpond.com*

SA:

Eco South: Grid, RAPS, solar hot water, wind, pumps, lighting, Vestfrost. Government rebates. *Call for free info pack ph:(08) 8338 0790 info@ecosouth.com.au www.ecosouth.com.au*

Natural Technology Systems: Station, Rural, Domestic, Grid Connect Solar Power, Solar Diesel for Homesteads, Domestic—Solar—Electric. *120 Prospect Rd Prospect SA 5082, ph/fax:(08) 8344 7298 www.naturaltechnology.com.au*

Solaris Technology: Solar & Wind Power Solutions. Standalone & Grid Connect. Solar Water Pumping. Solar Modules, Inverters, Batteries, Lighting, Generators. High-efficiency Refrigeration. SEIA Accredited, 20 yrs experience. *426 Churchill Rd Kilburn SA 5084, ph:(08) 8359 1900 fax:(08) 8359 1901 sales@solaris.com.au www.solaris.com.au*

TAS:

Solar Tasmania: Tasmania's leading solar & renewable energy specialists. Consultants, designers, suppliers & installers. Professional advice, quotes & information on request. *Call Noel Stutterd. A division of VK Electronics P/L. 5 Corcellis St Wivenhoe Tas 7320, ph:(03)6431 7733 fax:(03)6431 6555 solartas@hotmail.com*

VIC:

A B & S Solar Industries P/L: DIY Solar pool heating kits or installed. Solar pool controllers. Second hand pool panels. Pool covers and rollers. *Cnr Shafton & Hume Sts Huntingdale VIC 3166, ph:(03) 9543 7249 fax:(03) 9562 9547 abssolar@abssolar.com.au*

K & C Stork Solar Power Consultants: Design installation & maintenance of solar and wind power systems. DC to 240V AC power inverters, solar hot water systems, trade-in of old equipment accepted. *PO Box 177 Bacchus Marsh Vic 3340, ph:(03) 5368 7370 mob:0418 548 499 www.kcsolar.com.au* ♦

Newton Systems: Design and supply of solar electricity systems for 4WDs, off-road campers, caravans and marine. Also suppliers of solar system products. *6 Alma St Malvern East VIC 3145, ph:0500 827 828 mob:0417 736 737.*

Power Alternatives: Design, supply, installation & maintenance of renewable energy power systems for home and farm. Solar, wind, micro-hydro & hybrid systems. Contact us for a site inspection and evaluation. *c/o PO Briagolong Vic 3860, ph:(03)5145 5655 mob:0428 609 810 powalt@netspace.net.au*

Renewable Resources Workshop: Consultation, Design, Sales & Installation. Full SEIA Accreditation. *1 Railway St Colac 3250, ph:(03)5231 3593 fax:(03)5231 1844.*

Sharpe & Jephcott: SEIA accreditation FD1650. New & used equipment (Australia wide). Discount BP solar & Photon panels. Repairs to inverters etc. *5 McLauchlin Ave Sandringham VIC 3191, ph:(03) 9598 5775 fax:(03) 9502 0113 djsharpe@alphalink.com.au*

Solar Direct: The Natural Choice in Solar Energy. Consultation, design & installation of renewable energy systems. Solar hot water. Stand alone power systems. Grid-interactive solar systems. Full SEIA accreditation. *9 Quick Street Pascoe Vale VIC 3044, ph/fax:(03) 9306 8522 mob:0411 269 489 solardirect@optusnet.com.au*

Solar Rays: We offer you quality & choice throughout N & NE Vic. Power systems – Solar, Wind, Hydro. Solar water heating. Solar water pumping. Gas & DC fridges & freezers. Nectre wood heaters. Customised system design. Supply, installation and service. *25 Standish St Myrtleford Vic 3737, ph:(03)5751 1037 fax:(03)5751 1043 solarays@netc.net.au*

Sun Wind & Power SWAP: RAPS Design, Sales, Installation & Service. Wind generator manufacture & repairs. SEIA Full membership & accreditation. 10 years experience in reliable service to eastern Vic. *Call Trevor 1300 132 954 auswind@ozemail.com.au*

The Solar Bloke: Remote Area Power Systems Sales, Service and Installation. We supply complete systems for installation. Upgrades of existing systems. SEIA full membership and accreditation. *Rear 27 Lyttleton St Castlemaine VIC 3450, ph:(03) 5470 5890 AH:(03) 5475 2062.*

Wickton Energy: Gas Turbine, Solar, Wind, Hydro. Custom Design Specialist. SEIA Accreditation. Life Time Warranty. 24x7 Support. Statewide Service. *16 Caladenia Circuit Frankston South 3199, ph:(03) 9775 3491 mob:0408 025 814 wicktonenergy@bigpond.com*

WA:

Outback Energy Supply: Electrical Contractors specialising in Renewable Energy. Solar & Wind. Solar hot water, solar water pumping, low voltage appliances, batteries for all applications. 25 years experience. SEIA FDI627. *36 Burt St Boulder WA 6432, ph:(08) 9093 0400 fax:(08) 9093 0411 oesupply@bigpond.net.au*

Transport

NATIONAL:

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*

Recumbent Bikes: Greenspeed: Manufacturer of a range of energy efficient and ergonomic recumbent bikes, trikes and human powered vehicles (HPVs). *69 Mountain Gate Drv Ferntree Gully Vic 3156, ph:(03)9758 5541 fax:(03)9752 4115 ian@greenspeed.com.au www.greenspeed.com.au*

ALCO BATTERIES

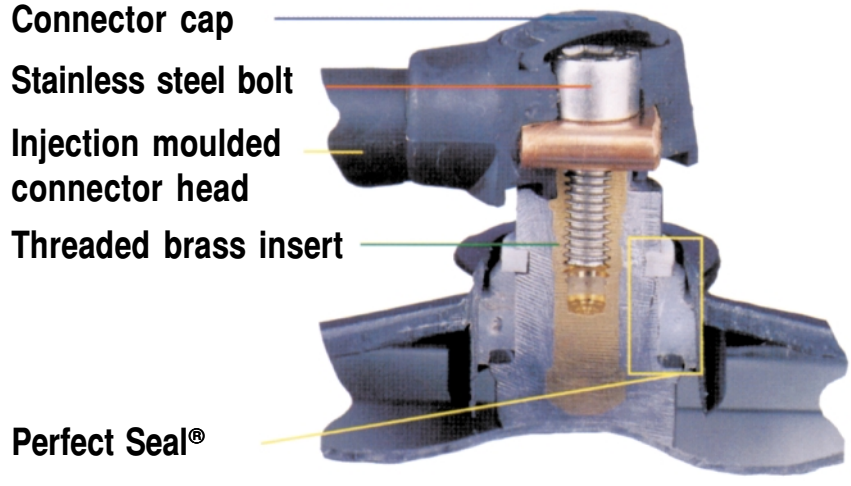
The Supergel Cycling Series. 75 years of Trojan history pushing gel technology to a new standard of performance.

Good things happen when you commit money and minds to technology. Breakthroughs like Supergel, for Example. Now, Trojan Battery is on the scene with a Gel solution for these applications. Emergency lighting. Communications. Wheelchairs. Renewable energy/Solar. Computer backup. Aids to navigation. Security systems. And many other applications.

Trojan powers Golf cars. RV's. EV's. Utility vehicles. Telescopic booms. Fresh and salt water boats. Floor machines. Renewable energy sources. Aerial lifts. Pallet jacks. Whatever's new. Whatever's next. Whatever needs reliable, dependable heavy service deep cycle batteries and the extra value that's so typically Trojan. Ask for Trojan by name. Or by colour. Our batteries are always easy to find. For the nearest Trojan Distributor call (07) 3288 2600.

RAYLITE (when only the best will do)

Quality Since 1932



Call us at

ALCO BATTERY SALES (AUST.) PTY LTD

Sydney 02 4722 2588 **Brisbane 07 3299 2600** **Melbourne 03 9336 4477**

HEAD OFFICE - 3/92-94 Batt St Penrith NSW 2750

Email alcobatt@pnc.com.au

Latronics Power Inverters

WHEN PERFORMANCE AND RELIABILITY IS YOUR ONLY CONCERN...

PV EDGE 1500W GRID CONNECT INVERTER

- ESAA Approved and Safety Certificate Compliant
- Operates with as little as Six 12 Volt Solar Panels
- Stylish Wall Mount Enclosure
- Maximise your Government Rebate

pv edge
GRID INTERACTIVE INVERTER

TRUE SINEWAVE INVERTERS 700W - 3000W

- High Surge and High Efficiency
- Fully Isolated via Toroidal Transformer
- 3 Year Warranty
- Many Models and Options Available

DC-AC SINEWAVE POWER INVERTER

LATRONICS®
A NEW WORLD POWER

For further information contact us or visit our Website

Telephone: **1300 550 204**
Facsimile: 07 5491 6792
Website: ***www.latronics.com***
Email: sales@latronics.com

LATRONIC SUNPOWER PTY LTD.
CALOUNDRA QLD. 4551

DESIGNED & MANUFACTURED IN AUSTRALIA

Mains Power @ your Finger Tips

Also available:

- Modified squarewave inverters for less critical applications
- Industrial input voltages 48Vdc - 125Vdc
- International output voltages 110Vac 60Hz

04/02 ABOUTDESIGN (07) 5493 7590

SETTING THE STANDARD AGAINST WHICH OTHER INVERTERS ARE MEASURED