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Issue 96 July-Sept 2006
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A shopping trolley that doubles as a bike trailer—that's a great idea. See Products, page 69.

From the Editor

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 $65 per year, and offers a range of other benefits.

Publisher: ATA

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Special thanks to David Johns, Stephen Whately, Lisa Mariah, John Davies and Olivia Neville-Smith.

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

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Next advertising deadlines: Booking 3 July 2006, copy due 14 July 2006.
Next editorial copy deadline: 28 July 2006.

Are we really going to have a nuclear debate based on facts?

Just over twelve months ago in *ReNew 91* I discussed the rise of the nuclear industry spin doctors, who were using the growing concern of climate change as an opportunity to promote nuclear power. At the time I thought this was just an opportunistic way of pushing for the expansion of uranium mining in Australia. It appears I have underestimated the influence and lobbying power of the industry.

The Australian Government has just announced an inquiry into the viability of nuclear power plants and uranium enrichment. The inquiry is to be headed by Australia's chief scientist Jim Peacock, a strong supporter of nuclear power. Prime Minister John Howard is calling for a full and frank debate on nuclear power, a debate based on facts, not emotion. I agree but have grave concerns that we will not get one!

At the same time as announcing the review, the Federal Government extolled the findings of a report by the pro-nuclear Australian Nuclear Science and Technology Organisation that nuclear power could be cheaper than electricity produced by coal and gas. However the report assumes that the government (and the taxpayers) would subsidise the development of nuclear power stations.

Dr Mark Diesendorf, from the University of New South Wales, told the ABC's *7.30 Report*, 'The study does not reveal the most fundamental, basic parameters of the problem; it doesn't tell us the basic capital cost of the nuclear power station; and it doesn't tell us the interest rates used on the capital, in order to calculate the cost of electricity. All it does is present us with a bottom line that suggests that given some subsidies from the Federal Government, nuclear power might become competitive.'

So are we really going to have a debate based on facts, when even the debate whether nuclear power is economically viable seems to be lopsided already? Let alone the debate on other issues; storing, transporting and managing the toxic waste, power plants as potential targets for terrorist attacks, potential accidents and our role in the proliferation of nuclear weapons.

Once again the safest ways to reduce greenhouse gas emissions—reducing our energy use and the development of the renewable energy industry—have been dropped off the radar. Let's hope that all the options will be rigorously analysed and that the debate goes beyond the five second soundbite.

Donna Luckman

Printed by Enterprise Web. Print production by Caidex Print Management. Distributed in Australia and New Zealand by Gordon and Gotch.

$7.50 (Aus) $8.15 (NZ) Recommended Retail Price Registered for posting by Aust Post: No VBG 4172

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

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

(2) The prizes are not redeemable for cash. Price includes GST.

(3) Kyocera Solar reserve the right to change specifications without notice.

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

(5) The competition runs from 20 May 2006 to 17 November 2006. Subscriptions/memberships must be paid by 4pm on Friday 17 November 2006 to be eligible.

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

(8) To subscribe or join the ATA, use the subscription form in this issue (or a copy of it), visit our website (www.ata.org.au), or call the ATA on (03) 9639 1500 to pay by credit card.

(9) The competition is only open to Australian and New Zealand entries and includes delivery. This competition is not open to other overseas residents.

The *ReNew*/Kyocera Solar subscriber competition is proudly sponsored by Kyocera Solar, Level 3, 6-10 Talavera Rd, North Ryde NSW 2113, ph:1800 242 118 email: info@kyocerasolar.com.au, www.kyocerasolar.com.au

[Letters]

Sustainable burials in NZ

Further to your article on eco-funerals, Living Legacies provides such a service here in New Zealand. For more information go to www.livinglegacies.co.nz

Bruce Geddes
b.geddes@clear.net.nz

Burial alternatives

With regards to Vanessa Murray's article in *ReNew 95* on sustainable burials, try and get a copy of *Stiff* by Mary Roach as she mentions two new methods of disposing of the dead.

In one, Kevin McCabe, owner of an American funeral home, is interested in using the same system used by the veterinary teaching hospitals. The bodies enter a bath of lye (an alkali) which breaks all tissue down. This destroys all pathogens, including the prions which cause mad cow disease. This system is similar to cremation but done with water. The fluids, now completely inert, can be safely flushed away. Bone pieces go into a crusher.

The lye system is said to be one-tenth the cost of cremation. No gas is used, no pollution produced, no embalming fluids used, and should be of interest in country areas where the irregular firing up of cremation furnaces causes premature wear on the ovens.

The second system is now being pioneered in Sweden. The deceased person goes into a tank of liquid nitrogen and is deep frozen, then into another tank to be microwaved, which breaks the body down into smaller pieces which are then freeze dried. The resulting pellets can be used for a memorial tree or bush, family plot, or even the compost heap.

Mary's book is a great read and not as macabre as you may think.

Well, there you are—bury me deep in the compost heap, and you can grow roses while I decomposes!

Alan Stewart,
Alexandra Hills QLD

Write to us!

We welcome letters on any subject, whether it be something you have read in ReNew, a problem you have experienced, or a great idea you have had. Please limit letters to 350 words.
Send letters to: ReNew, Level 1, 39 Little Collins St, Melbourne VIC 3000,
email: renew@ata.org.au

Natural Death Centre to open in Byron Bay

Thank you for your excellent article on innovations in the funeral industry.

We have begun a Natural Death Centre here in Australia to promote and advocate for more alternatives in the death industry. We are based in Byron Bay and will be opening a funeral centre soon.

You asked for anyone who knows of any other eco coffins available in Australia. Although not available yet we are in the process of importing bamboo coffins (pictured above).

For more information go to www.naturaldeathcentre.com.au

Michael Murray,
Byron Bay NSW

A simple idea

It seems that everyone is buying split-system air-conditioners. It would be better if they were water cooled—a small water jacket would collect the heat. This heat could be used to preheat the cold water supply to your hot water system.

Davis S Reed,
manager@sandford.com

Making windfarms more attractive

A caller to radio explained why windfarms attract so much community opposition—it's the farmer (the radio caller) who owns the land who gets all the money, and in his words, he gets $5000 to $10,000 per turbine each year! No wonder the neighbours get snitchy!

Just suppose all the neighbours with a dwelling within one kilometre (for the sake of argument) of the windfarm got a share of the annual loot. As in many things, a reasonable amount of money can assuage many hurts.

My proposal is for a fixed percentage, say 20%, of each turbine's income to go to the farmer owning the land. The other 80% is divided amongst the neighbours for every turbine within one kilometre of their residence at the time of turbine placement.

This payment would be based on sound disturbance, with no compensation for loss of perceived scenery, views, or any other supposed loss of amenity. The calculation is dead simple. Sound intensity, loudness or whatever one calls it, decreases in inverse square of the distance. That is, twice as far away, one quarter of the sound. So, just do the same with the money.

- Calculate the distance from every dwelling to every turbine (easy with GPS), ignoring those beyond one kilometre
- For each dwelling, calculate the square of the distance to each turbine in range and divide into 1 to get the inverse square
- For each dwelling, add the inverse squares to give the sum of inverse squares
- Add the sums of inverse squares, and calculate the percentage each dwelling gets of the total money pool (the 80%).

The resident who lives closer to the turbines than the land owner can get a tidy sum for their loss of amenity. Anybody one kilometre away will hear little, and consequently, receive little.

The figures may need a bit of refining as to the fixed rent and the distance taken in calculation, but the mathematics of the 'sum of inverse squares' is what makes the 'noise' compensation calculation fair, and is not to be changed.

A much harder line needs to be taken with respect to 'amenity' or 'eyesore' objections, as few landscapes now represent what was once 'natural,' and we have to make progress on greenhouse-free energy generation—the NIMBYs too, have to share the responsibility and the pain. How many species will go extinct if we do nothing?

Maybe not everyone is happy, but with such a system, at least the income is spread around a bit more equitably.

Robert Vickers,
waowombo@optusnet.com.au

Low wattage kettle available

I saw Paul Tracey's question in *ReNew 94* regarding low-wattage kettles for use with inverters. We have a Kambrook KE9 and are very happy with it. We run a Selectronic 1500 watt sinewave inverter and the kettle runs very happily on it.

We got ours from Rainbow Power Company in Nimbin NSW. Dave Lambert is our contact there, he was able to get it from a local K-mart and was happy to send one down for the price of postage.

Peter Bell

Peter has since informed us that K-mart stores generally stock the KE9 kettle, and we had no trouble finding it at our local store. It is rated at 1250 watts, around half that of many modern kettles, so it should be fine for any 1500 watt or greater inverter.

Lance Turner

Some article suggestions

Congratulations on a fine magazine!

I am writing to suggest that you write two feature articles. One on Michael Mobbs' sustainable Sydney house. I am curious about which waste treatment system he uses. It apparently takes both greywater and sewage and turns it into drinkable water. How does he get rid of vege scraps and garden waste? How does he deal with grease or fat in kitchen waste water? Does he put more electricity into the grid than he takes out? Does he have air conditioners? Which insulation?

Secondly, I would like to see an article on vertical axis wind turbine generators. Propeller types kill a lot of birds and night-flying birds can't see them as well. In California, the propeller types have been banned because of bird kills. I hear the vertical axis types do not kill birds, are much quieter and are more efficient at catching the breeze. When are Australians going to wake up?

Greg Hynes,
Rainworth QLD

We actually featured Michael Mobbs' house in ReNew 60—it was even on the cover. While this issue is no longer available, the ATA can supply a printed or PDF copy of the article for $5 including postage or for free if you are an ATA member.

Michael Mobbs has also written a book about his house called Sustainable House, *which is available from environment bookshops and Choice Books.*

We have looked at vertical axis turbines in the past, and I have to say I am a big fan of these machines, and I feel they are grossly underrated. Vertical axis machines are generally robust, especially the Savonius type, and are simpler to make at home than horizontal axis machines. While Savonius turbines are not very efficient, they do produce massive torque and operate in low wind speeds. Vertical axis machines don't need to be rotated into the wind—they always face the wind, regardless of direction. This means they also don't need sliprings to get the power from the generator down the tower.

And, yes, as you have mentioned, they are usually quieter and less of a danger to birds as the spinning rotor is usually more visible, although this is not always the case with Darrius rotors and their derivatives. The problem with the turbines in California wasn't so much with the fact that they have spinning blades as that they are mounted on lattice towers, which allow birds to nest in them, and thus get struck by the blades as the birds launch from their nests. Horizontal axis turbines mounted on pole towers

don't have this problem, and kill fewer birds per metre of blade length than power lines do per metre of cable. Motor vehicles kill thousands of times the number of birds each year than either wind turbines or powerlines.

I would love to see someone in Australia develop a vertical axis Savonius-type machine with direct drive to a low-speed alternator, much like the Windside turbines from Finland (see www.windside.com). These would be very robust, immune to turbulence, and very versatile, and far safer to both birds and people (if you somehow touch them while they are spinning, they just slap your hand away rather than cutting off your fingers!).

Lance Turner

Energy charges no help to solar

Twelve months ago we moved into our new house which has been designed to be as environmentally friendly as possible. Part of this design was a 2kW grid-interactive PV system.

Now it has been operating for a year I have been looking at the costs and energy savings. During the summer months we generated more than we needed during the day but used more off peak, with a net cost of around 20 cents per day. In the winter I will obviously have to buy more power because the PV generating capacity is much reduced. I would like to promote Green Power and after reading the Green Power Buyers' guide in *ReNew 93*, I have been investigating the various options.

My supplier is Origin and I note from the table in the guide that they charge 6.13 cents per kilowatt-hour extra for their Green Earth Solar option. They buy it from me at 18.45 cents which on the surface means they are making around 30% profit when they sell it to someone else.

This hardly seems an incentive for people to purchase solar power. As I see it, apart from Origin providing a separate meter to measure the feed into the grid and the fact that to be able to sell my power they need to purchase my Renewable Energy Certificates (RECs), which at the moment are at a very low value, they should still make a tidy profit.

However, my main point is that I would like to use Green Power for the small amount I have to buy over and above my generating capacity. The way that my grid-interactive system works is that I have separate meters that measure all that comes in and all that goes out to the grid, and I am charged for the net difference.

I rang Origin and asked about the rates they charge for Green Power. Currently they buy solar from me at the same rate that they charge me, 18.45 cents for peak usage and 7.39 cents for off-peak.

If I were to nominate Green Earth Solar, they would charge me the additional 6.13 cents for all the power coming in—that's 24.58 cents peak and 13.52 cents off-peak—but still only buy from me at the lower rate of 18.45 cents peak or 13.52 cents off-peak. So I would be paying a premium not only for the extra I use, but I would have to pay 33% extra to buy back the power I sold to Origin.

I have calculated that this would have cost me an extra $44 on my last bill. Considering that my total cost of electricity (excluding the service charge) was only $25, this seems an incredible policy, in no way designed to promote solar power. Needless to say I am not taking up the Origin Green Earth Solar option.

I am also hanging on to my RECs as this may help to stimulate the renewable sector by feeding green energy into the grid and forcing power companies to go elsewhere to purchase RECs.

Another issue is the service charge. On my last bill it was $35, so it costs me more just to be connected than it does for the power I buy. I agree with your correspondent Alan Baird, also in *ReNew 93,* that the charging is irrational—electricity costs need to provide an incentive for people to use less.

I have been very happy with my PV system and also my solar hot water which between them account for my low usage of energy produced by dirty coal and thus help to reduce my CO_2 emissions. PV in particular provides peak power fed back into the grid, especially on hot days when it is needed most for all those air-conditioners that people just have to have.

If only people would design their houses properly there would be very little need for air-conditioners. Regardless of this, Origin and other companies still don't seem to understand the benefits of the peak power generation provided by PV and their policies do nothing to promote really clean power at the time it is needed.

Roger Ganly,
Aireys Inlet VIC

Steam is great, but...

For the last 40 years I have been working in steam engineering and have gained a lot of knowledge, which I have been lucky to be able to pass on to several people in the hobby steam field. I have always wanted to make this knowledge freely available to any person who is interested, but I feel that the majority of people would misuse the information and cause themselves and others harm.

Heat as an energy source is widely used around the world—it can be used in a small scale to enable people to take control of their lives, but it is very dangerous in the wrong hands.

I really hope people will see the advantages of solar energy in everyday life. For home use and transport, the current systems that are available off the shelf are really quite amazing.

May I wish your magazine well, keep up the good work.

Len Lark

Climate change is speeding up

Climate change is occurring at a faster rate than previously predicted, with temperatures expected to rise 5.8°C by the end of the century, according to a report released by the Australian Government in May.

The report, *Stronger Evidence but New Challenges: Climate Change Science 2001-2005*, analyses the latest international research on climate change, including new evidence that human activities are causing climate change and that its impacts were already being felt.

New research has yielded a better understanding of three additional effects of climate change: the radiative properties of aerosols, the decrease in albedo—the reflectivity of the Earth's surface—caused by the melting of snow and ice, and the release of more carbon in the atmosphere from terrestrial sources such as fires and organic matter.

'Although much uncertainty still surrounds the timing, rate and magnitude of these effects, they all operate to amplify the initial greenhouse warming. Thus, there is now perceived to be a greater risk that the upper end of the well known *International Panel on Climate Change Third Assessment Report* estimate of a 1.4 to 5.8°C rise will be reached or exceeded by 2100,' states the report.

www.greenhouse.gov.au/science/index.html

Greenhouse reduction is affordable and achievable

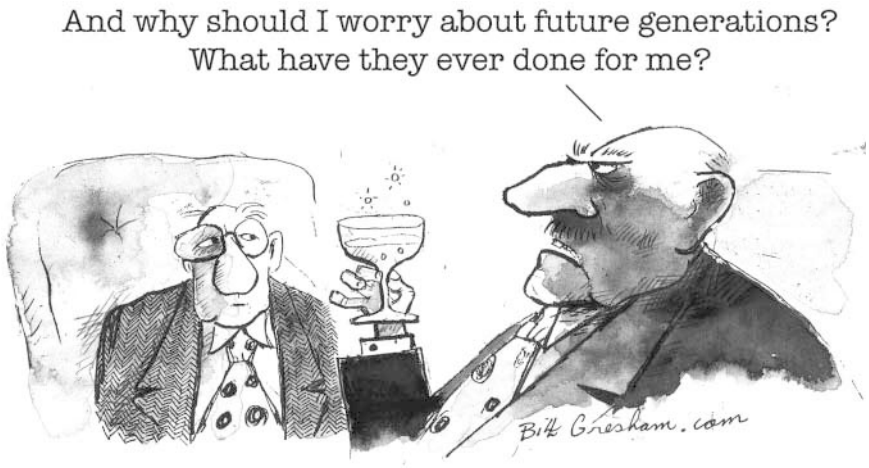
Australians could pay as little as $250 each to achieve a 40% reduction in greenhouse gas emissions from the country's electricity generation industry by 2030, according to a new study.

The World Wide Fund for Nature, AGL and Frontier Economics study has modelled the cost to Australian society of using low and zero greenhouse gas emission electricity generating technology to achieve a realistic target by 2030, consistent with the greenhouse gas reductions advocated by climate scientists.

The study, *Options for Moving to a Lower Emission Future*, found the electricity generating sector's greenhouse gas emissions could be reduced from current levels of nearly 200 million tonnes to 120 million tonnes by 2030 while still meeting growing electricity demand from industries and households.

'It is important that policy makers establish long-term emission reduction targets and the course for meeting those targets. This will allow businesses to invest in new technological solutions to minimise the cost of reducing emissions,' said AGL's General Manager of Merchant Power, Jeff Dimery.

www.wwf.org.au



Australians less concerned about the environment

Over the past 15 years, Australians have become less concerned about the environment and more materialistic and wasteful according to the *State of the Environment Report* being prepared for the Federal Government. Australian's have a growing appetite for dwindling resources and on average drive 8000km by car, use 115,000 litres of water and generate one tonne of waste a year.

Dr Peter Newton, a CSIRO scientist and one of the authors of the report, told *The Age* that he was disturbed by the findings.

'I've never seen such a large gap developing…it sends a strong wake-up call about how our behaviours are mirroring our attitudes.'

The report is expected to be released later this year.

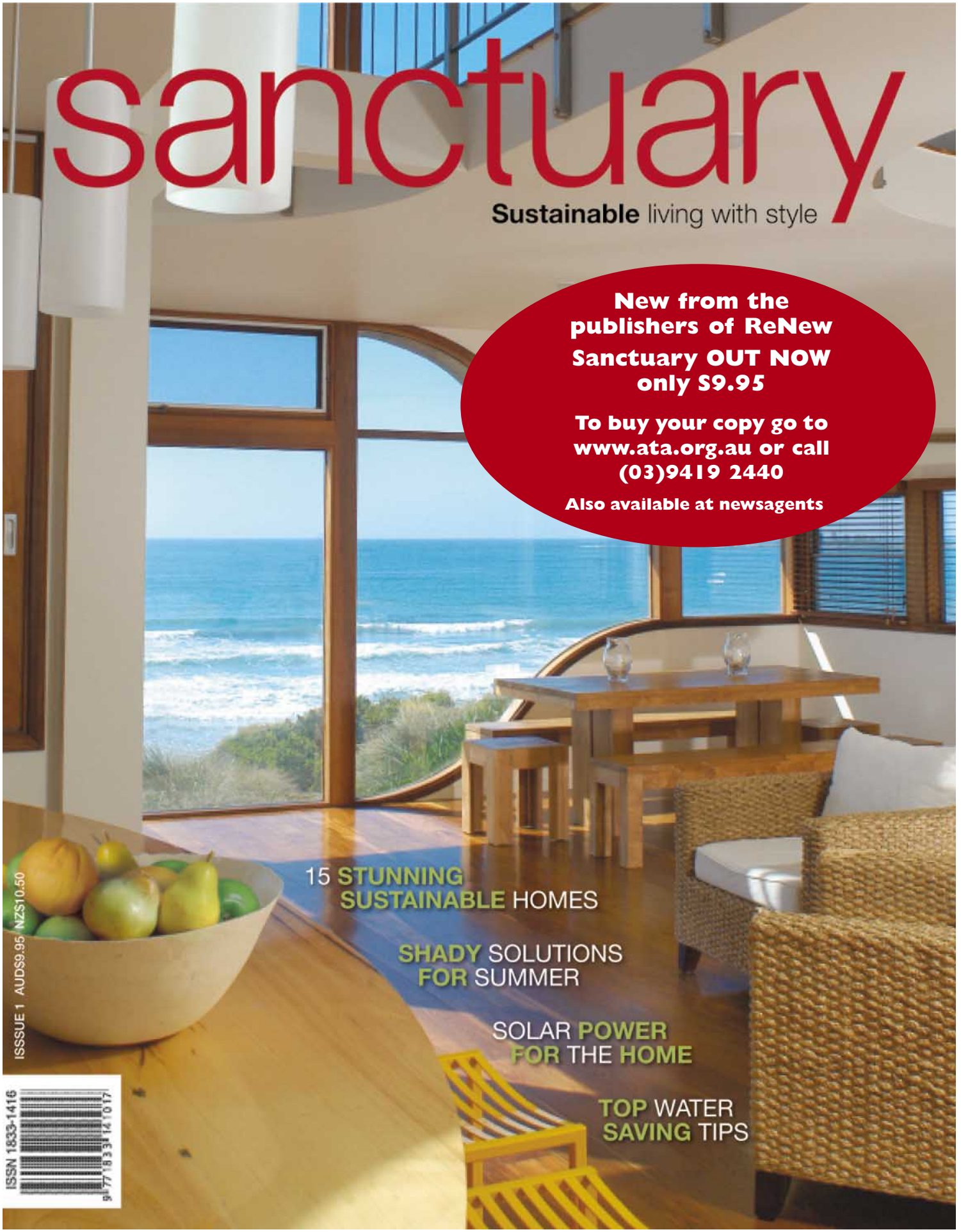
Australia should do more says World Bank

Australia should be doing more to reduce greenhouse gas emissions according to the World Bank chief economist for East Asia and Pacific, Homi Kharas. The East Asia and Pacific region is among the most vulnerable to natural disasters, the intensity of which could be affected by climate change, and is the subject of the World Bank East Asia Regional Report special focus section.

While the region is still largely rural, most of the gross domestic producers and large cities are in coastal areas and at risk from both rising sea levels and weather-related disasters. Some Pacific Island nations could even disappear.

'Countries across the region need to do more to step up to the plate with reducing greenhouse gas emissions,' said Mr Kharas.

'Australia is a country which might be small but it is the second biggest country in terms of greenhouse gas emissions.'



ISSUE 1 AUD$9.95 NZ$10.50
ISSN 1833-1416

Corporate leaders call for climate change action

Climate change is real and Australia needs to act to reduce greenhouse gas emissions, according to six of Australia's leading companies. The Australian Roundtable on Climate Change—which includes CEOs from BP Australia, Insurance Australia Group, Origin Energy, Swiss Re, Visy Industries, Westpac and the Australian Conservation Foundation—used its public launch in April to urge governments and business to not delay action on climate change.

The roundtable says that a 60% reduction in greenhouse gas emissions by 2050 can be achieved at an affordable cost to the Australian economy.

'What is required is a clear act of leadership', said Keith Scott, Swiss Re's Australian chief. 'Unless we act, everybody is going to suffer.'

The roundtable is calling for action on three fronts: designing a long, loud and legal framework to establish a carbon price signal; encouraging innovation and investment in emerging and breakthrough technologies; and building national resilience to impacts of climate change.

www.businessroundtable.com.au

More biodiesel plants

Queensland's first commercial biodiesel production facility was officially opened in May. The Eco Tech Biodiesel Plant at Narangba will have a production capacity of 30 million litres of biodiesel per annum, growing to 75 million litres at full production.

Eco Tech Bio Diesel is a joint venture between Western Australian-based Gull Petroleum and a group of independent businessmen. Besides its new plant at Narangba, Gull Petroleum also recently announced plans to develop a biodiesel facility in Western Australia.

The Narangba plant will not be alone, with the Australian Biodiesel Group opening a larger $9 million facility nearby in June.

In Victoria, Axiom Energy has announced plans to establish a 150 million litre biodiesel facility in Geelong. The facility at Toll Geelong Port will be the first commercial-scale production plant for biodiesel in Victoria. The plant is expected to be fully operational by mid-2007.

Meanwhile in New Zealand, Aquaflow Bionomic has produced its first sample of biodiesel made from algae sourced from sewerage ponds. The company claims it is the world's first commercial production of biodiesel from algae outside of the laboratory and without specially selected and grown algae crops.

The production of biodiesel could not only provide a cleaner source of fuel but also produce clean water.

Green goals scored at World Cup

Germany aims to make the 2006 World Cup the world's first-ever climate neutral major sports event with its *Green Goal* initiatives. The aim of *Green Goal* is to offset the estimated 100,000 tonnes of carbon dioxide generated within Germany by construction of the stadiums, transportation and the presence of an expected 3.2 million spectators.

Initiatives include free public transport for all ticket holders, drinks sold in reusable cups, solar panels on stadium roofs, harvesting of rainwater and both the German and Brazilian teams will use trains to travel around the country.

ReNew/Working Water greywater prize winner

Paul Spencer of Seacombe Heights in South Australia is the lucky winner of the *ReNew*/Working Water subscriber competition. Paul is the proud owner of the Working Water greywater system valued at $2475.

To go into the running to win one of two prize packs of a pair of Kyocera solar panels and a Morningstar regulator valued over $2000 each, join up or renew your Alternative Technology Association (ATA, publishers of *ReNew*) membership or *ReNew* subscription. More prize details are on page 5.

Win a selection of LED products valued at over $100

We are looking for good build-it-yourself style articles, and will award a package of LEDs and/or LED products (of our choice) to the author of the best article we receive.

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. Entries must describe completed working projects.

Send your ideas to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, email: renew@ata.org.au. Competition closes Friday 17 November 2006.

A unique take on solar concentrators

Concentrating sunlight to get more energy out of solar panels is not a new idea, but concentration systems usually use lenses or mirrors to focus the light onto a small PV cell at the focal point of the reflector. The Prism solar panels from Prism Solar Technologies Inc take a totally different approach. They use strips of PV cells embedded inside glass which contains a holographic image layer. This layer is designed to reflect selected wavelengths of light internally, directing it onto the PV strip.

The advantage with such a system is its versatility. The panels generate electricity while letting some of the light through, so they can be used in place of windows, skylights and other architectural components. The result is that you get more energy from the same quantity of solar cells—the manufacturers claim that the panels can reduce the amount of silicon cells required by up to 85%.

While the panels are not yet commercially available, they are expected to go into production in the next 12 months. Let's hope they do!

www.prismsolar.com

Prism solar panels: Generate electricity as well as letting the light in.

Sustainable seafood guide to help shoppers

Seafood that Australians love to eat, such as deep sea perch, silver trevally and broadbill swordfish are being pushed to the edge of extinction by increasing consumer demand and destructive fishing methods, the authors of the second national Sustainable Seafood Guide have found.

The Australian Marine Conservation Society recently launched its second, expanded edition of Australia's Sustainable Seafood Guide and urged Australians to think twice about the fish and seafood they buy.

'More than 30 new species have been added to the Guide as a result of pressure on fish and seafood stocks from increasing consumer demand and unsustainable fishing methods,' said Craig Bohm, AMCS National Fisheries Campaigner said.

In the 1990s seafood consumption in Australia increased by 13 per cent and this trend has continued into 2006 with Australians now eating an average of 21kg of seafood per person a year.

www.amcs.org.au/SeafoodGuide

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- Or fill in the form on page 81

ATA

Special ReNew offer

Join up as a new member by July 31st and receive a **free copy of ReNewROM2 RRP $65**.
If you are already a member get a friend to take out a membership and you both receive a free ReNewROM.

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ReNewROM 2 is the latest fully searchable CD ROM that includes all 19 issues of ReNew from 71 to 89.

From rural Australia to rural Namibia; on your bike for BEN

Inspired by the article on BEN Namibia in *ReNew 94*, year nine students from Wesley College raised nearly $6000—seventy bikes—to help break the cycle of poverty in Africa. Teacher, Steve Schneider, shares their story

Fate has played a significant part in the life of the Clunes Campus of Wesley College in Victoria recently. The Commonwealth Games had forced a two-week break, six weeks into an eight week program for Year 9 students. Like many teachers we were left wondering what to do. It was then that staff were asked to devise a three-day group challenge for the students to return to.

As we mused over what to do, the hand of fate delivered *ReNew 94* into our laps containing the inspiring article about BEN Namibia. The seeds of an idea began to form.

Break the cycle

Readers may remember the article by former *ReNew* editor, Michael Linke. It described the work of the Bicycling Empowerment Network (BEN) in Namibia, a non-profit organisation set up in May 2005 with the aim of empowering disadvantaged Namibians by providing affordable transport—the humble bicycle. This allows villagers greater access to health care, education, work and water, and gives health workers access to villages.

On reading about this organisation and seeing their need for help, we developed 'Break the Cycle', a project designed to help break the cycle of poverty and AIDS in Africa by raising money for BEN Namibia, and to see just what a group of year nine students working together was capable of.

The challenge was to cycle a 150km circuit from our campus in Clunes to Castlemaine over two days, and eighteen students committed themselves to the task. The students established a weekly training regime in order to learn how to cycle safely and efficiently as a group, and to improve levels of fitness. Student leaders were elected to manage their cycle effort, and to help coordinate fundraising.

With the help of a fundraising information kit stating the aims of the ride and explaining the BEN Namibia cause, students and staff used their two-week holiday to gain pledges totalling over $5800! This equated to over $320 per student, and more importantly, at $75 per bike, this would enable the purchase of over seventy bicycles for Namibian community groups. All that was left to do was to succeed on the ride.

Easy riders

After a day's preparation, honing riding skills, preparing bikes, packs and people, sixteen students—with two staff—rode off on their seemingly impossible quest. A 93km ride along the footsteps of Mt. Tarrengower was completed with an impressively up-beat attitude, and the strong support and determination of all involved.

Our two-student support team had

established camp in Castlemaine where relieved and weary riders arrived late in the afternoon. Despite some tired legs and sore 'seats', everyone was in great spirits and determined that the shorter second day wouldn't pose too many problems. This was indeed the case, and despite some agony on the final climb to Clunes, the group arrived back invigorated and overwhelmingly satisfied with what they had achieved.

From local to global

Despite the personal satisfaction of completing such a huge challenge, the real sense of pride came from knowing the number of bikes that would be given to Namibians in need. To have achieved a global result with local action, and to make a difference to someone they would probably never meet, was the greatest reward for the students.

Carlos Gantner, one of the student riders, summed it up. 'I believe that this was my greatest achievement at Clunes. I think it's great that I not only have completed a thing I thought was impossible, but collectively we changed the lives of over seventy people in Namibia through fundraising.'

BEN Namibia was equally excited and amazed. On hearing the amount raised, Director Michael Linke exclaimed, 'This is absolutely the best news I've heard in my whole time in Namibia! This is the biggest single sponsorship of bikes we've had, and totally unexpected. I'll have to check with the groups to see whether they have enough volunteers to ride the bikes!'

Michael has now been able to deliver the first twenty bikes to two local community groups who feed and educate local orphaned children. The delivery occurred just in time. The following day a child fell seriously ill but was able to be rushed to hospital. Project Manager Elizabeth Hilger, from Theresia's Orphans and Vulnerable Children Foundation, explained how useful the bikes would be.

'...it's great that not only have I completed a thing I thought was impossible, but collectively we changed the lives of over seventy people in Namibia...'

'The bicycles will help our women to fetch water, go the 14km to town to buy food for the children, and to take the children to hospital if they are sick. This happened the very next day after delivering the bicycles—one child got sick and was rushed to the hospital,' she said.

The future

After the success of the inaugural 'Break the Cycle' ride, the project will be offered to the next group of Wesley students arriving in Clunes for term two. We hope that the enthusiasm and dedication of the inaugural group will establish the project as a permanent feature of the Wesley at Clunes curriculum.

Of greater significance is a potential quarterly sponsorship scheme for BEN Namibia helping more and more Namibian villagers and workers.

But not content with what has been achieved, we hope that other schools, students and groups can begin their own 'Break the Cycle' style campaigns. We are so proud of what our first group achieved. It exceeded everyone's expectations. But the potential is there to help so many more people and organisations.

Michael is aware of more groups that need help. He sees the continuing need. We see a reasonably easy, workable solution. We urge as many people as possible to contact us and Michael to help the cause.

'Break the Cycle' is living proof of the positive results that arise from taking action when fate arouses your conscience.

For more information please contact Steve Schneider on steve.schneider @clunes.wesleycollege.net or Michael Linke at michael@benbikes.org.za

Tired but up-beat, the cyclists set up camp after the first day of cycling.

Solar surplus 10 years in a row

In 1996, Stuart McQuire and Wendy Orams switched their house to solar power. Stuart tells us how the solar has performed

Ten years ago we were the first house in Victoria and the second in Australia to have grid-connected solar power. With increasing concern about fossil fuels leading to global warming, and with some corporate and government interests pursuing a nuclear future, we're keen to share our experience of solar electricity.

It works! Each year, for 10 years in a row, our house has generated more electricity from solar power than it has used. It's put an end to us paying for electricity and we receive credit for putting electricity back into the grid.

Getting started

Over time we have given our 1929 Californian Bungalow style weatherboard house a 'green makeover' without needing to renovate or rebuild.

We first heard about grid-connected solar electricity in the early 1990s when *ReNew* reported on systems being installed overseas. Not far from where we lived, the council-owned Brunswick Electricity Supply Department (ESD) had set up grid-connected solar electricity as part of its Aurora Project.

Residents could buy a solar panel, or part of a panel, and receive a solar credit on their electricity bill. The solar panels were placed on the electricity supply office building and on frames erected at CERES Environmental Park in East Brunswick, adjacent to the office building.

In 1994 we were excited to read that the Brunswick ESD planned to extend the Aurora project to local houses, factories and community buildings. We immediately contacted them and, after discussions, agreed to pay $5000, half the cost of a 1 kilowatt grid-connected system.

However, restructuring of the electricity industry in Victoria saw the Brunswick ESD compulsorily acquired and privatised to become part of the newly created electricity retailer CitiPower. It became uncertain whether CitiPower would proceed with the Aurora project. But the door was open,

with us on one side and some of the former staff from Brunswick ESD at CitiPower on the other (led by Roger Lamb and Peter Zwack), and both sides pushing for residential grid-connected solar electricity.

Eventually CitiPower agreed to install a 2 kilowatt grid-connected solar system on our house. The panels were installed around September 1995 (by the late Ross Horman, a past president of the Alternative Technology Association (ATA), publishers of *ReNew*). Because there was no Australian standard for grid-connected solar, the panels sat on the roof through the first summer without being connected. Finally, on 4 April 1996, the system became operational.

The solar system

The 24 x 83 watt panels sit on the north-facing roof at an angle of 29 degrees, and cover an area of just 18m^2.

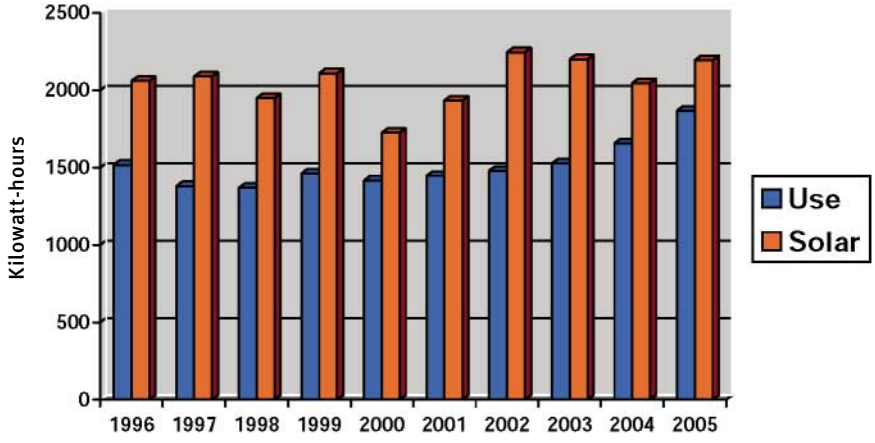
When the sun shines, the solar panels generate electricity in the form of direct current (DC), which is fed into an inverter, converting the electricity to the household standard alternating current (AC) at 240 volts.

There are no batteries or need for special wiring or appliances in the house. Meters record the flow of electricity into the grid when the sun's shining, or from the grid at night or when it's overcast.

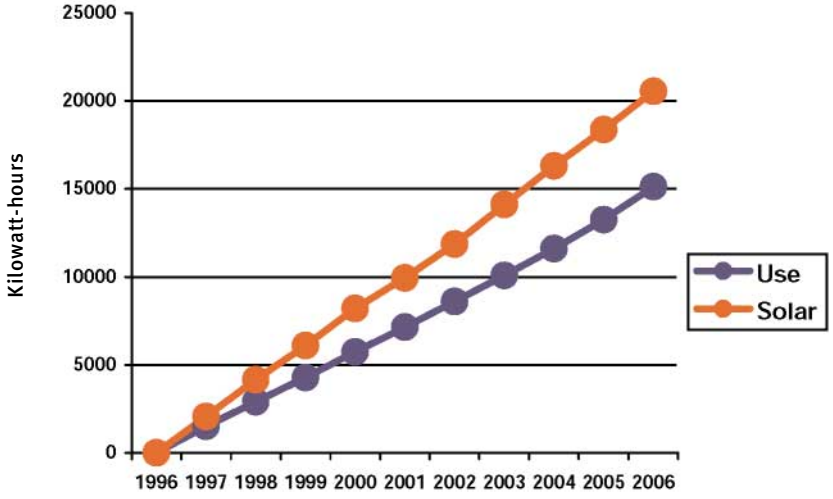
Performance

Solar electricity generation has exceeded our household consumption every year for the last 10 years. The solar panels generate around 2000 kilowatt-hours (kWh) per year, compared to household consumption of around 1500 kilowatt-hours per year.

Using less electricity has been a big part of generating a solar surplus. In some ways we use more electricity than a typical house because I work full time from a home office and the installation of new rainwater systems has



Graph 1. Annual electricity consumption and generation.



Graph 2. Accumulative total electricity consumption and generation.

increased electricity use by around 1kWh per day. We also have the normal range of electrical appliances and equipment, along with gas for cooking, heating and boosting the solar hot water. But, we have cut consumption in a number of ways including fitting compact fluorescent lights, using a medium-size fridge (rather than a large one), switching off appliances when not in use, washing clothes on the cold water cycle, and using a solar clothes dryer (clothes line).

Over the 10 years a surplus or credit of over 5000 kilowatt-hours has built up, with the household using just under three quarters of the solar electricity that was generated. In theory, this shows that we could have used a smaller system (around 1.5 kilowatts) to meet our needs.

The billing works by crediting us at the retail rate for any surplus electricity, reducing the supply or connection charge that we pay each quarter.

Greenhouse emissions

In terms of household greenhouse emissions we have cut our emissions from electricity and gas by over 90%, from 10 tonnes per year in 1994 to less than 1

tonne per year now. This has been through a combination of reduced consumption, solar hot water and solar electricity.

Grid-connected solar today

Today grid-connected solar electricity systems are priced from around $5000, while one that generates about the same as our system would cost around $15,000 (after a $4000 rebate from the federal government). A system that generated a similar amount to our average electricity consumption would cost less than $12,000 after rebate.

It's expensive, but in the greater scheme of things may not be out of reach for a lot of people. The capital cost of borrowing or using $12,000 is around $840 per year (at a 7% interest rate). This is equivalent to $2.30 per day, or less than the price of a cup of coffee at a cafe. For that you can have a solar power station on your roof, generating the premium green power and cutting your electricity bill.

The benefits of solar go beyond free electricity. Solar power is the premium green power because it is renewable, abundant and non-polluting. Unlike electricity from coal, there's no smoke and no greenhouse gases. Unlike electricity from nuclear power there's no radioactive legacy.

A further benefit of grid-connected solar electricity systems is that they generate electricity right at the time (and place) of peak demand: on hot days in summer. Little or no maintenance is required and the solar panels are designed to last at least 20 years.

Ideally a premium rate would be paid for the buy-back of solar electricity that is put back into the grid. The most successful schemes overseas have used such incentives to encourage the installation of solar electricity. Japan and Germany have led the way, and in 2005 Germany installed over half of all the solar photovoltaic panels installed worldwide, the equivalent of over 400,000 systems of the size we use.

Switching to the sun

Solar energy is abundant in Australia. I remember hearing Professor Ian Lowe at a conference several years ago, where he pointed out that the amount of solar energy falling on Australia in one day is equivalent to all the energy used by all the people in the world in one year.

The sun is the Earth's great source of energy. Why not use it? ✳

If you would like to learn more about Stuart's and Wendy's home go to www.greenmakeover.com.au

DIY solar porch light

You don't have to spend lots of money to get into solar energy. Anthony Dunk shows us his simple porch light system that cost less than $300

I have long been interested in solar electricity but the cost of a complete setup and my lack of experience with the technology has put me off installing panels on my house. However, after reading a number of issues of *ReNew* magazine and learning about the many people out there who are using this technology, I decided to experiment with a cheap, small-scale solar system.

To run your entire household off solar requires an investment of tens of thousands of dollars, but I decided to see if I could get something up and running for under $300.

My motivation for building a solar porch light was that when I come home in the dark it is hard to see my keys to unlock the front door. A small light above the front door with an external switch seemed like an ideal solution. Rather than calling in an electrician to wire up a 240 volt light, I decided to try installing a 12 volt solar system myself.

The switch (bottom left) used to turn on the LED porch light (top right)

I already had a medium-sized sealed lead-acid battery, so all I needed was a solar panel and a light. I picked up a 4.5 watt solar panel, a solar charge regulator and a 20 LED downlight from Jaycar Electronics.

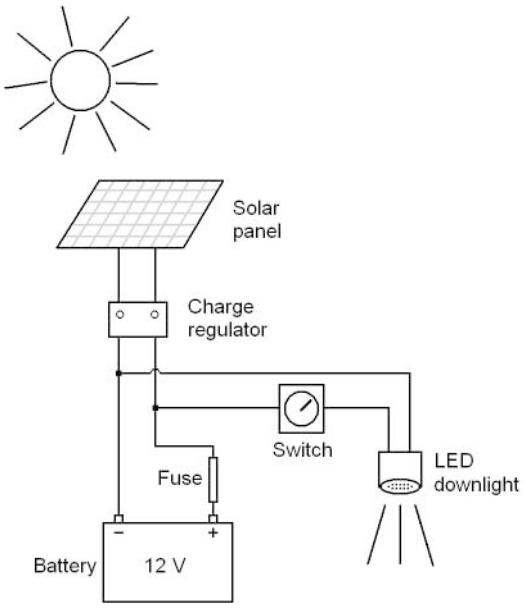
The solar panel, mounted next to the box holding the battery and charge regulator.

I decided to install the battery under my eaves so that it wouldn't need to be in the ceiling cavity where it could be a fire hazard. I found a sheet-metal letter box at my local hardware store which would do a fine job as a battery box as it was robust and fire resistant.

Assembling the system

I screwed the battery box and solar panel to the north-east end of my house. This meant the solar panel would get a few good hours of sunlight during the morning and the electronics would be kept reasonably dry and protected from southerly weather.

Next I installed the LED downlight above the front door and ran 10 metres of extra-low-voltage wire through the ceiling cavity to the battery box. Finally I installed a standard mains external



The schematic of the simple solar porch light system. As you can see, it is similar to many other small solar systems, with very few components needed to make a working system. The fuse is very important for fire protection, even on such a small system, as even small lead-acid batteries can produce a great deal of current if shorted.

switch (it's not connected to the mains, of course) next to the front door, and wired it all up. While AC switches are generally not recommended for DC systems, the tiny current used by the LED lamp means this won't be a problem.

The total cost for the project came to about $250 (see Table 1). It's unlikely that I will ever recoup this cost in electricity savings, but it has been a great way to get a feel for solar technology and battery charging.

How it performed

Using a multimeter I took daily readings of the battery charge before and after running the light each night. I found that running the light for about three hours each night was sustainable, with the solar panel able to restore the battery to full charge the following day. If I had placed the solar panel on the roof where it would get more hours of sunlight the charging capacity would have been greater, but it was just easier to mount it under the eaves with the battery.

My experience with solar electricity has been a very positive one. The components are easy to use, readily available and not overly expensive. I am already considering installing one or two more lights in this system, and if we ever build a new house I would be very keen to make solar energy an integral part of it.

Table 1: Parts list for the solar porch light system.

Component	Supplier	Cost	Notes
4.5 watt solar panel	Jaycar	$99.95	18 volt maximum. Comes with stand
Solar charge regulator	Jaycar	$22.95	
20 LED lamp	Jaycar	$29.95	1.5 watt
Downlight holder	Jaycar	$5.99	
Sealed lead-acid battery	Jaycar	$36.50	7.2 amp-hour, 12 volt
Fuse and in-line holder		$4.00	
240V external switch	Hardware store	$10.00	For switching 12 volt light
Rectangular letter box	Hardware store	$30.00	For use as battery box
Extra-low-voltage wire		$6.00	10 metre roll
Screws for mounting		$5.00	
Total:		**$250.34**	

Using alternative sources of water is the answer

Robin Merrick tells us why we need to use alternative sources of water in our cities and what regulations apply in each state and territory

Australians are increasingly aware that water is a scarce resource and that our current use of freshwater is unsustainable. Population growth, climate change and the social, economic and environmental costs associated with creating new freshwater supplies make it clear that we need to reconsider the way we currently use water.

Our first priorities are to reduce the volume of water we use per person (see *ReNew 94* for ATA's Top 10 Water Saving Tips) and to reduce the quantities of wastewater and polluted stormwater we discard into our waterways. We also need to increase our use of alternative water supplies, such as locally collected rainwater, stormwater, greywater, treated sewage and aquifer water to further reduce mains water consumption.

Why is it important?

Residential use of some alternative water sources, such as rainwater, stormwater and greywater, offer multiple benefits. Not only does it reduce a household's total mains water consumption—freeing up water for critical uses such as environmental flows—it also lessens the load on our sewerage and stormwater systems.

Use of these alternative supplies challenges the linear 'capture-use-discard' model to which many of us have become accustomed, by adopting a more natural, cyclical system in which wastewater becomes source-water for a second or third use. In the case of greywater and stormwater, pollutants that would otherwise enter our waterways may be used as nutrients in the garden.

The reduction in mains water consumption that can be achieved by using alternative water supplies is significant. In inner city Sydney, Michael Mobbs has achieved total independence from the mains water system. Similarly, Stuart McQuire in Melbourne's Brunswick West has reduced his mains water use to 25 litres a day (see *ReNew 94*).

State regulations vary

However, use of alternative water supplies is not without its hazards, many of which are managed by state-based regulatory frameworks. Approaches differ considerably, with each state and territory responding to its own unique social, environmental and political climates.

Different alternative water sources carry different levels of risk. The extent to which the use of each source is controlled therefore varies in accordance with the source, and with the purpose for which that source will be used.

For example, the capture and use of rainwater for non-drinking purposes is generally considered to be low risk in terms of environmental and human health, and is therefore endorsed without regulation in most states and territories. However, almost all authorities discourage the use of rainwater for drinking if mains water is supplied to the home.

Reuse of greywater, on the other hand, is generally regulated in accordance with the level of risk associated with the system design. For example, systems that store water for a period in excess of 24 hours are heavily regulated to manage potential health issues.

State governments have also responded to their own unique circumstances by determining which alternative water supplies consumers should be encouraged to use. The drilling of bores on residential blocks is unregulated in Western Australia, where drinking water supplies are failing to meet the state's demand. Use of bore water has therefore become common practice (more than 30% of Perth households currently use bore water for garden watering).

In comparison, any resident wishing to install a bore in South Australia needs permission from the Department of Water, Land and Biodiversity Conservation, and permission varies according to the where you live. This more rigorous approval regime has been designed to ensure long-term protection of South Australia's groundwater system.

What are the risks?

Responsible use of alternative water supplies in urban areas of Australia is an effective and valuable way for individual residents to help reduce demand for treated, reticulated urban freshwater. However, the potential human health and environmental risks require careful management.

Key risks include:

Rainwater

Capture of rainwater will only be envi-

	Rainwater	Greywater	Stormwater	Aquifer Water	Contacts
Australian Capital Territory	Planning and plumbing approval (and building approval in some cases) required. See ACT Health's *Rainwater Tanks Guidelines for residential properties in Canberra.*	Not regulated. See ACT Health's *Greywater Use Guidelines for residential properties in Canberra.*	Not regulated.	A licence is required from Environment ACT and extraction charges apply.	**Environment ACT** www.environment.act.gov.au **ACT Health** www.health.act.gov.au
New South Wales	Not regulated. Guidance for the use of rainwater is provided in NSW Health's *Rainwater Tanks* and the National Environmental Health Forum's *Guidance on the use of rainwater tanks*.	All systems require the formal approval of numerous authorities as outlined in NSW Health's *Greywater Reuse in Sewered Single Domestic Premises*.	Requires planning approval in most local council areas. Systems are generally assessed on a case by case basis.	Bores are permited in some, but not all, regions. Approval from Department of Natural Resources, and bores must be drilled by a licensed driller.	**NSW Health** www.health.nsw.gov.au
Northern Territory	Not regulated, however compliance with mosquito prevention requirements stipulated in *Public Health General Sanitation, Mosquito Prevention and Rat Exclusion and Prevention Regulations* is required.	Approval of Department of Health and Community Services (DHCS) is required and systems must be of a type approved by the department. See DHCS's *Greywater Reuse in Single Domestic Premises*.	Currently unregulated as long as the area of water capture is less than 5km^2.	If a bore is deeper than 3m or more than 1m wide, the landowner requires a permit to construct and to drill. Contact Department of Planning and Infrastructure.	**Department of Health and Community Services** www.health.nt.gov.au **Department of Planning and Infrastructure** www.ipe.nt.gov.au
Queensland	Generally, rainwater tanks for outdoor use only will not require any approvals, however this rule varies by council. Tanks for indoor use will need local council approval. All tanks must comply with the *Mosquito Prevention and Destruction* health regulation.	Greywater can be used to water gardens in most local council areas without a permit. More sophisticated systems require local council approval.	Not regulated at state level, however local councils may apply regulations.	A licence to take water, and a development permit to construct a bore are required in most areas. Bores must be drilled by a Queensand-licenced driller. Contact Department of Natural Resources, Mines and Water.	**Department of Local Government, Planning, Sport and Recreation** www.lgp.qld.gov.au **EPA Queensland** www.epa.qld.gov.au **Department of Natural Resources, Mines and Water** www.nrm.qld.gov.au
South Australia	Not regulated. Rainwater tanks will shortly become mandatory for new homes and major renovations.	Approval from the Department of Health is required and must include a soil report, underfloor plumbing and location plan. System type needs to be approved by Department of Health.	Formal approval may be required in some areas. Contact the Department of Water, Land and Biodiversity Conservation.	Rules vary for different areas.	**Dept. of Water, Land and Biodiversity Conservation** www.dwlbc.sa.gov.au **Department of Health** www.health.sa.gov.au
Tasmania	Plumbing approval from your local council is required.	Reuse of greywater is not permitted within sewered areas.	Not regulated. Any modifications to drainage systems or mains water supply systems would require local council plumbing approval.	Not regulated. No driller licence required.	**Department of Infrastructure, Energy and Resources** www.dier.tas.gov.au
Victora	Generally not regulated however some local councils apply planning controls.	Greywater diversions are permitted as a temporary measure during dry spells, and are not regulated. Treatment systems require EPA approval and local council permission to install.	Not regulated.	A licence to construct a bore must be obtained from Southern Rural Water, and all bores must be drilled by a Victorian-licensed driller.	**Environment Protection Authority** www.epa.vic.gov.au **Southern Rural Water** www.srw.com.au
Western Australia	Not regulated.	Must use a greywater system approved by Department of Health and obtain local council permission to install.	Not regulated.	Not regulated.	**Department of Health** www.health.wa.gov.au

ronmentally and economically beneficial if tanks are designed to match their climate and roof catchment areas, and if rainwater is used for an appropriate purpose. For example, summer use of rainwater for watering the garden will quickly empty most water tanks. Use of the same water for toilet-flushing may be more appropriate.

Guidelines for safe and appropriate use of rainwater are provided by most state and territory governments.

Greywater

Careful use of greywater can reduce mains water consumption by up to 30%. However, reuse of greywater can be a high-risk activity and should be carried out only with a full understanding of these risks (download the *Using Grey Water* guide produced by the ATA and Victorian Department of Sustainability and Environment at www.ata.org.au).

Treatment of greywater is energy-intensive and this energy consumption is usually not appropriate for residential use. Untreated greywater is therefore preferable, particularly for use in gardens or flushing the toilet.

Stormwater

Captured stormwater runoff from pavement surfaces within site boundaries is another water source. However, within single residential blocks, impermeable surfaces are best kept to a minimum. By keeping the top 400mm of ground surfaces high in organic matter, water will be retained on site and will help keep the garden healthy.

Aquifer water

Unregulated use of bore water provides little incentive for residents to use water efficiently, and may cause harm to groundwater systems. Aquifer water should be used only in locations where the groundwater system is well-understood and the impacts of such use have been carefully considered.

Think water, think energy

Whilst population growth and inefficient water consumption are placing pressure on Australia's urban freshwater supplies, climate-change induced drought is considered to be the main contributor to Australia's water crisis. Measures for better managing our urban water supplies must not, therefore, exacerbate this problem by generating greenhouse gases. Coal-generated electricity, car use and energy-intensive lifestyles are the major causes of water-scarcity, and require as much or more attention as the search for alternative water supplies.

Robin Merrick is the Alternative Technology Association's Water Conservation Specialist.

For more information on alternative water supplies go to www.ata.org.au

A curvy character

Located in the mountain foothills of Melbourne's green wedge, Trish and Andrew Ebert's passive solar house has a somewhat curvy character

We'd always dreamt of building an 'environmentally friendly' house. Specifically, we wanted a practical, energy-efficient dwelling that minimised our environmental footprint, maximised the view and was aesthetically pleasing from all angles.

After we'd found our perfect block, all we had to do was create 'our perfect house'. With help from architect Gavin Macdonald, after four years of planning and nine months of building we finally achieved that dream.

A view for every room

We live on 17 acres in the foothills of the Kinglake Ranges—about 40 kilometres northeast of Melbourne. The property is north facing and was previously used to graze cattle but still retains a scattering of mature eucalypts. We chose the house site to maximise both the views to the local ranges and exposure to the sun.

The house itself is a long arc, predominantly one-room thick with only the entry foyer, main bathroom, toilet and laundry on the 'south side.' The house is clad with a variety of materials including fibro cement sheeting and colorbond steel. The roof is colorbond steel.

The layout plan was designed entirely by the architect, although the room type and number were stipulated in our design brief. As most rooms are on the 'northern side' we needed to make no decisions regarding the compass orientation of each—only the sequence in which they were to be placed. A pleasant consequence of this design is that each room has a slightly different perspective over the property.

The house is designed with three zones: the master bedroom (with en suite) and study/library are at the eastern end of the house; the lounge, dining, kitchen and living areas are central; while the three remaining bedrooms and a small sunroom (currently used as a sewing room) are at the western end. Sliding doors allow us to block off the kitchen and living room into a separate area.

Ceilings throughout the house are generally raked with the roof line, but to provide some architectural aspect this has been varied with lower flat ceilings in the dining room and kitchen.

Large windows on the 'northern side', designed so we can enjoy as much of the magical view as possible, let in an enormous amount of light—so much in fact that we don't need to turn on the light switches in any room (except the internal walk-in pantry) until it is just about dark outside, whatever the season.

On the 'south side' the laundry includes a drying room with a 750 watt Siemens convection heater, for drying clothes on the coldest of winter days.

Fittings and finishes

Because our architect specialises in commercial design, the majority of the fittings and finishes in our house are of commercial grade and style.

The floor coverings consist of floating floorboards in the dining, kitchen and living areas, vinyl in the en suite and bathroom areas, ceramic tiles in the entry foyer and carpet throughout the remainder of the house.

Compact fluorescent downlights are installed in the bedrooms and the main

living area. Low-voltage halogen downlights are used as task lighting over benches in the laundry, kitchen and bathroom as well as dimmer adjustable lights in the dining room and study. The recessed downlights do not affect the integrity of the insulation because the thermal batts are installed on the outer shell of the house .

Compromises

In the kitchen we have not gone completely modern. We do not have a dishwasher even though one was originally drawn into the design. Momentarily appealing as some dishwashers use very little water these days, when it came to dishwashing powders and rise-aids we found, at the time, that most washing products weren't completely biodegradable and all rinse-aids were caustic.

Our waste system is a worm farm and although they will take a little bit of abuse, we didn't wish to subject the worms to any chemicals at all if we could help it. We are however very happy with the two pot drawers that have ended up in the place where the dishwasher was to go.

Thermal efficiency

The key principle of the design of the house is to allow the sun to penetrate into and warm up all major rooms in winter while restricting sun penetration in mid summer. The walls are lined with R3 batts and the ceiling with R3.5 batts.

Great care was taken to ensure there are no gaps in the insulation barrier, including special attention given to window surrounds and where the wall and ceiling insulation meet. To further ensure the thermal efficiency of the house all windows are strip-sealed Stegbar western red cedar double-glazed units consisting of 4mm glass and a 6mm thermal spacing. All external doors have retractable door seals.

Even though we currently only have blinds on the south-side windows, the internal evening temperature in winter is quite acceptable—usually around 15 to 18°. This temperature can drop slightly overnight but remains reasonably constant, unless it has been really cold for a few nights in a row and we haven't lit the wood heater.

We expect heat retention to be improved further once we have all curtains installed (we survived winter 2004 without curtains and the radiant wood heater was lit only six times).

Due to the modern style of the house we consciously compromised on the window coverings and decided to install Roman blinds. They are backed with 3-pass lining but there are still gaps around them. Despite this, the presence of the blinds on the south side of the lounge room during winter 2005 made a noticeable difference to the heat retention in the area. If, in the future, we do decide we need more heating, predrilled holes in the concrete slab are ready for the installation of hydronic heating panels.

In summer, the house heats up when closed up over long periods of time but windows designed for cross ventilation

The stand-alone solar power system provides all the power needs of the house.

allow the house to cool relatively quickly—usually within 40 minutes. The worst countdown time was 1.5 hours during an exceptionally hot day in the mid-40s. Two windows in the living room at a height of around 3.6 metres also help facilitate the dissipation of hot air. These high windows are openable by winders at shoulder level.

The house is positioned in a quite windy location. As a result, although the thermometer may read 30-plus degrees outside, breezes around the house can be considerably cooler.

When this is the case, windows are opened up and the breeze allowed to circulate throughout the house—so much breeze gets in at times you get the pleasant feeling of being in a wind tunnel.

Heating

The radiant Nectre wood heater in the lounge room is our only active source of heating and is rarely used. A fan can be used to circulate warm air from this area through ducts in the bulkhead along the corridor into the study, master bedroom and living area, and each vent can be shut off individually so excess heat is not wasted.

Construction

Where most houses are built on stumps or a concrete slab, our house sits on concrete columns and is raised up to three metres off the ground. This approach was deemed necessary due to both the slope of the land and our future plans to add additional rooms under the house. This construction method also means our house is extremely stable in the windy conditions and the thermal mass of the concrete is an advantage both in summer, when the temperature under the house is generally significantly cooler than upstairs, and in the winter when the concrete acts as a heat sink and retains and re-radiates the sun's warmth.

Above the concrete base, the house is constructed by standard methods but the design offered the builders additional challenges as the curved shape required almost all materials to be cut and tailored to fit (building products are generally designed and manufactured for square houses). Unfortunately, at the time this did not particularly endear the architect to the tradesmen.

RAPS solar system

We had two options for our electrical supply: mains power or RAPS solar power. When we investigated the mains power option we found that the power supply infrastructure in our area is a single wire system dating back in some parts to the 1930s. it experiences regular brownouts and occasional blackouts.

The cost of connection to the grid also took us by surprise and added to our dilemma. As we were the last in the run (no other properties needed to share the cost from our line) it was going to cost us about the same to connect to the grid (an unreliable system) as it was to purchase a RAPS.

Environmentally oriented, we opted for the RAPS. The system is designed so we can live comfortably without being paranoid about our power usage. The system is located on the roof of the shed skillion and consists of 16 x 140 watt BP Solar photovoltaic panels feeding into a 1600 amp-hour 48 volt Exide battery bank which runs through a 3.6kVA Selectronic SA42 inverter.

The system was designed and installed by Brendan Balk of Solar Alternatives and cost us around $38,000 (after the government rebate). We have found that with this system we can now live a normal (city) lifestyle quite comfortably; we even run the spa on the odd occasion (although that activity also needs to factor in water conservation).

The only 'utility' service we require is LPG to run the stove and oven and as a backup for our solar hot water system.

Electricity issues

Experience is always the best teacher. Early on, despite our battery capacity,

we actually ran the power down well below the recommended 60% of battery capacity (it's too embarrassing to say how far).

That situation can be attributed to our ignorance of both the consumption of our appliances compared with the inverter's capacity, and our need to monitor the weather and the remaining charge in the batteries. We now log the battery capacity each night and we are constantly aware of the weather—sunny days are good for power and overcast days are sometimes good for rain. We're just satisfied if there is a happy medium.

Waste for the worms

At the very beginning of the planning process the idea of composting toilets appealed to us, but as the design grew for the chosen site we realised that only one toilet (of two) would have the appropriate drop. The other issue we needed to consider was greywater.

Even if we'd installed composting toilets we would still have needed to install a greywater system. The solution to cover both issues is a worm farm, which processes both the blackwater, greywater as well as our daily food composting scraps.

Our worm farm is an OnZite Worm Farm provided by Environment Equipment. Waste from the kitchen, laundry and bathroom is piped to the worm farm chamber where the solids are separated from the liquids. The liquids are filtered as they drain through the organic biomass and drain out of the chamber and through trenches on the property for dispersal.

All the solids including the added vegetable scraps are broken down on a suspended bed of organic material. The resident worms and any other organisms that may have found their way in there, turm the waste into castings. The worm castings then join the filtered liquid waste and get dissipated across the property through a series of trenches. So far our worms have been wonderfully efficient and the unit has performed very well.

The worm farm takes all the household food scraps, as well as the greywater and blackwater waste

This last minute decision to include the worm farm meant we had to change the house specifications to accommodate it and we were fortunate we had the land available for the stipulated length of trenches.

Water collection

There are two 22,750 litre water tanks under the house which collect rain from approximately 240 square metres of the house roofline. The only disadvantage of this location is that every time the tap is turned on, power is used to pump the water up to the house.

However the capacity is more than adequate and being under the house means the tanks are protected from the summer heat—our cold water is nearly always cool in summer, but it's freezing in winter!

Solar hot water

Our hot water comes from a twin-panel solar hot water system (Solar Edwards 305LX-3 Titan) that is mounted on the roof above the living room. We have found however, as others have, that being this exposed to the hot sun all day does cause the copper in the pipes to leach, and a thin green slime has to be cleaned regularly from the shower recess.

A happy house

The building of our 'green' house has encouraged us to become even more aware of the planet's resource and pollution issues. If we were to build again we'd go even further toward minimising our impact on the earth by stipulating in the design brief recycled materials, natural paints and non-plastic fittings. We have now lived in our house for two years and all in all, we are very happy. Our house (and the way it operates) has turned out just the way we imagined it would.

Happy chooks everywhere

With so many great entries it was tough for our judges, but we are happy to announce the winners of the Alternative Technology Association's (ATA, publishers of *ReNew)* Contented Chook Awards. Looking at the wonderful entries, the real winners are some very happy chooks!

Urban: Western Port Secondary College, Victoria

The chook house at Western Port Secondary College on the Mornington Peninsula, Victoria, is such a lap of luxury that it is called the 'Hilton Hen House'. Designed and built by year 11 and 12 students under guidance from their teacher Jenny Montgomery and Kitchen Garden Coordinator, John Eldridge, the chook house is suitably impressive.

The octagonal chook compound has three sections: the inner hen house, surrounded by a straw yard, which is then surrounded by vegetable garden beds divided into eight sections that can be individually opened and closed. Chooks have permanent access to the straw yard via a high opening in the house wall, while access to a selection of eight vegetable beds is manually controlled.

The hen house is built from recycled materials: corrugated iron, wire and hessian. The roof is made of ferrocement, with a ferrous sulphate colouring. To provide protection from predators the corrugated iron walls continue below ground and are concreted at ground level. The straw yard is enclosed with netting that is buried 300mm into the ground. A second 1.8m fence encloses the vegetable beds.

Water is collected from the roof and stored in a 1000 litre recycled container that supplies the chooks with water through an automatic waterer. Any water run off is quickly absorbed by the surrounding vegetable garden or drains to the nearby frog pond. North facing wire openings on the house wall and a central skylight provide light as well as ventilation.

Top: A small door provides the chooks access to one of the eight surrounding garden beds. Bottom: The inner octagonal chook house is made from recycled materials and decorated with some leftover paint.

Rural: Paul and Di Bott, New South Wales

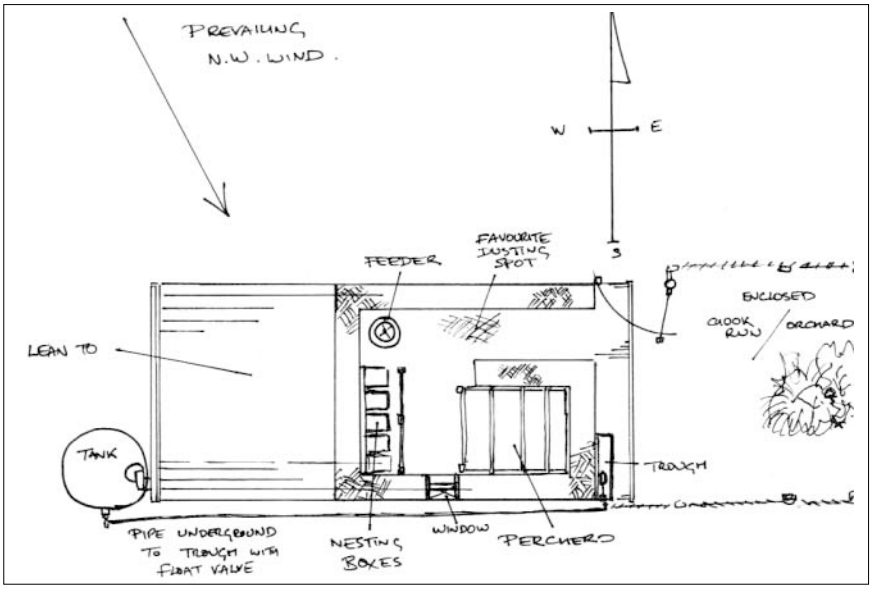
Self-proclaimed chook-a-holics, Paul and Di Bott, have created a wonderful passive-solar chook house to keep their girls happy at Mongarlowe in the Southern Ranges, New South Wales.

The rammed-earth, 400mm thick square chook house was made from earth sourced from their property and recycled materials: hardwood (preserved with old gear box oil), trimdeck roofing material, sisalation for insulation, guttering and piping and a small frosted glass window. The nesting boxes are 20 litre oil drums—very good at deterring mites because of a lack of hiding spots!

The chook house and enclosed run is situated on a slope with trees on the lower north-west side acting as a windbreak. The rammed-earth chook house has an east-facing entrance which allows sunlight onto the nesting box and feeder, and provides a favourite dry spot for the chooks to have a dust bath when it is too cold or wet outside. The entrance remains open to allow chooks access to the adjoining run that contains an orchard, sealed to protect the chooks from any predators.

The window on the south wall, near the nesting boxes, can be opened to allow in the cool south-east coastal breeze in summer. There are also two small permanent vents under the west roofline. The outside eastern wall catches the morning sun and gives the girls a nice spot to sit and enjoy the sunshine on winter mornings. A return wall in the chook house protects the perches from prevailing wind and rain as well as deterring flies; a design feature inspired by circular toilets Paul and Di saw in Central Australia. A low lean-to at the rear of the chook house helps protect the western wall of the house from wind and rain as well as providing space to store straw and food.

Top: The self-contained chook house allows the owners to go away for a few days knowing the chooks will be okay. Above left: Recycled oil drums make great nesting boxes. Above right: The perches are protected from the rain and wind by a return wall.



A water tank situated under the lean-to collects water from the roof of the chook house and automatically gravity feeds a trough located on the outside eastern wall. Shade cloth attached to the eastern wall helps keep the water in the trough cool in summer.

The chook house has performed extremely well, with the internal temperature five degrees warmer in winter and five degrees cooler in summer. The self-contained design also allows Paul and Di to go away for a few days knowing the chooks will be well fed and safe.

Design: Kate McLean, New South Wales

Kate McLean, from Boolambayte New South Wales, found her inspiration for a chook house design from permaculture principals and Bill Mollison's combined chook house and greenhouse. Kate has designed a passive solar chook house with mudbrick south, east and west-facing walls to provide thermal mass and help control internal temperatures.

A door on the western wall of the chook house gives the chooks access to the external run which contains an orchard and vegie garden. Nesting boxes are located on the southern wall. An internal mesh wall separates the chook house from the greenhouse and a door allows the chooks access when required.

The sloped, insulated roof and large northern eaves block out the sun in summer but allow the warming sun in during winter. High, openable vents provide good cross ventilation and can be opened in summer to let out the hot air.

Rain is collected from the roof and stored in a water tank that automatically feeds water to the chooks, and can also be used in the greenhouse and the orchard. Recycled windows, doors, roofing materials and bottles provide construction materials as well as earth sourced on site.

For Kate, the design is a win-win situation with the chooks supplying fertiliser for the plants, and both the chooks and plants keeping warm in winter and cool in summer.

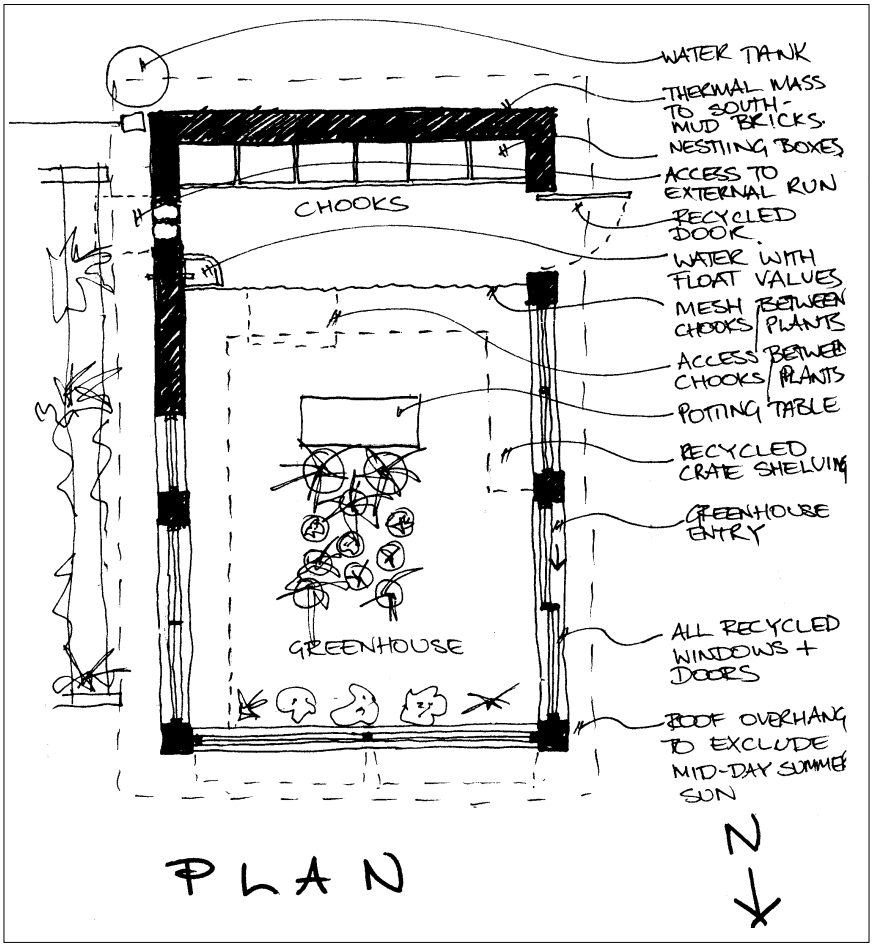
Hens like the high-rise lifestyle

Chooks are originally south-east Asian jungle animals. So if you want happy chooks you need to give them a nice jungle feeling—dappled light from above, somewhere to scratch, and a good high spot to perch on.

Happy chooks MUST be able to establish a pecking order when they perch—the 'top chook' at the top, and the more humble members of the flock lower down. Even if there is only one chook per perch, try to have at least four (preferably more) perches, or you may find the poor lowly chooks sitting on laying boxes or squatting on the floor.

My ideal sleeping house for chooks is shaped like a dunny—lots of vertical perching space, with the added advantage that it takes up less garden room!

Contented Chook judge Jackie French
Author of (among other wonderful titles) *The Chook Book*



Special mention

We would also like to give St Francis of Assisi Primary School, Australian Capital Territory, a special mention. Working within a number of constraints: space, school holidays, health and aesthetic considerations, the school has designed a chook house that incorporates a number of innovative technologies for water and lighting. Made out of recycled materials the school has made the chook house as self-sufficient as possible.

Thank you

A big thank you to all the people who sent in their chook designs. The high quality of the entries made it a difficult decision for our judges to make. Also a big thank you to Frith Kennedy and our judges for all their time and effort in making the tough decisions. ✲

A list of all the runners-up is available on the ATA website: www.ata.org.au

Solar towers, troughs, turbines and bottled sunshine!

An Australian-first solar showcase opens at CSIRO's National Energy Centre in Newcastle. John Davis reports

While the Federal Government talks up the benefits of expensive, polluting and dangerous forms of energy production such as nuclear or so-called clean coal, the CSIRO has been busy working out ways to ease the economic transition from dirty to clean production methods for energy producers.

Solar power is Australia's most abundant energy resource, with the island continent subjected to more solar radiation than anywhere else in the world, about 1700 kWh/m²/yr. An ambitious attempt to harness this energy was officially launched recently with the opening of the National Solar Energy Centre, (NSEC), in Newcastle, New South Wales.

Part of the CSIRO's National Energy Centre (featured in *ReNew 87*), it is described as a 'showcase for solar thermal technologies and a centrepiece for promoting Australian and international research collaboration', and is the only facility of its kind in Australia, one of only ten such sites in the world.

The centre comprises three main projects—a solar turbine using a linear solar array of parabolic mirrors; an innovative communications and control system and viewing platform; a high concentration array consisting of 200 heliostat mounted mirrors directed at a solar tower.

The 26 metre high solar tower that houses the solar concentrator is reflected in one of the 200 mirrors that help generate more than 500kW of power.

The solar turbine project

The turbine project is an attempt to develop a short-term thermal storage technology, particularly for use in remote areas where power is generally supplied by Remote Area Power Supplies (RAPS), and to demonstrate a working prototype of an Organic Rankine Cycle (ORC) technology powered by solar thermal heat.

ORC is a process whereby an organic fluid is pumped into a boiler where it is heated by thermal oil. The gas then passes through an expander where the expansion of the gas drives a turbine. The gas is then condensed back to liquid form where it begins the cycle all over again.

The oil itself is heated by the reflected solar thermal energy from a linear array of parabolic mirrors in the form of a trough. The tube containing the thermal oil runs along the length of the focal axis of the mirrors. This, combined with the low operating temperature of the ORC, optimises efficiency of the unit. Such a technique can be used for

direct heating applications, or, as is the case in the NSEC model, for the turbine generation of electricity.

Solar Tower

While the turbine project presents a unique approach to power generation, particularly in rural areas, the solar tower is perhaps the flagship project of the centre offering great potential for solar research with very exciting potential applications.

A solar field of 200 heliostat mounted mirrors with 900m² of surface area concentrates solar energy onto a tower mounted receiver. The concave shape of each mirror improves the concentration of solar energy on the receiver. In addition, each mirror is positioned to prevent shadowing of surrounding mirrors, regardless of the season. This allows, the CSIRO claims, the closest packing of heliostats in the world. They also point out that such an arrangement significantly reduces the footprint of the array, increasing suitability for use in areas where space may be limited.

It is also possible for two receivers to be mounted on the one tower allowing two experiments to be conducted at the same time.

The high efficiency of the array allows generation of temperatures of over 1000°C, controllable by changing the number of mirrors directed toward the focal point. This means the unit can be used for a variety of applications, such as water splitting, desalination and thermochemical processes, and it is the latter that has energy industry groups so excited.

SolarGas—bottled sunshine

When I was a child, bottled sunshine referred to a particularly bright, additive-laden fruit drink. But for today's energy producers it signifies a substantial opportunity to begin the transition to solar energy while weaning themselves from more polluting sources, notably natural gas. A mixture of natural gas (CH_4) and water (H_2O), passes through the solar tower. The high temperatures generated by the solar array cause the compounds to react, producing a combination of carbon monoxide and hydrogen ($3H_2+CO$).

This product, known as SolarGas, and wittily referred to as bottled sunshine by the CSIRO media team, is said to be 26% more energy efficient than the original natural gas.

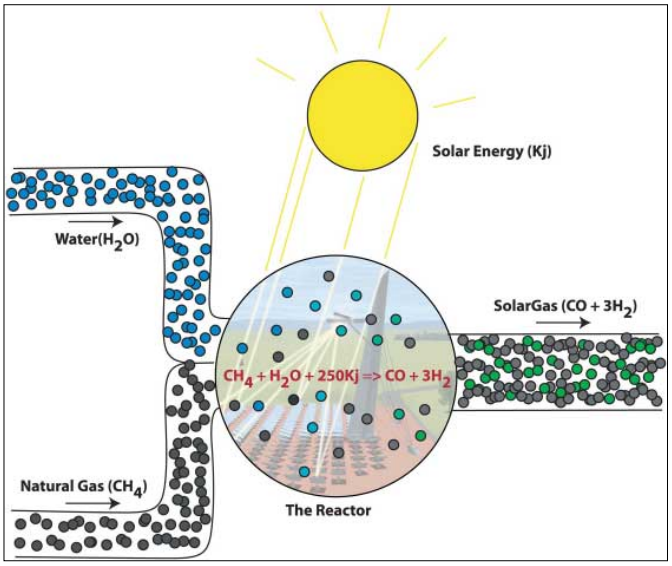
Alternatively, the hydrogen can be separated from the mixture and used in applications such as fuel cells and gas turbines.

While not carbon neutral, such a product offers the natural gas industry a substantial stepping stone into the renewables market, a stepping stone that has been sorely missing until now.

The CSIRO claims that harnessing two of Australia's most abundant energy sources is a necessary step along the path to a renewable energy future and the beginning of the end of our unsustainable dependence on non-renewables.

I for one hope they are right.

www.csiro.org/solarcentre



A reactor on the solar tower uses the heat created by the concentrated solar energy to produce a chemical reaction between water and natural gas that creates SolarGas.

Lose weight, get healthy, save money and help save the planet

Six months of self-sufficiency and zero emissions! Linda Cockburn tells us about her family experiment

My theory that sustainability needs to be 'sexy' in order to be taken up by the masses is a good one. A quick look at the top ten best selling books confirmed that. Only it's something I'm genetically unsuited to. Everyone wants to be slim; they want to eat good food and they want to be rich. Which is fine; I aspire to the first two and would be content to know I can always pay the bills, too. But how does that relate to sustainability? In a roundabout way.

I was driving along, wondering how much greenhouse gas I was emitting each year (not personally you understand), why with both my partner Trevor and I working full time we never had any money, why we were both getting fat (something to do with living off junk food because there just wasn't the time left in the day to cook anything better), and what I could do for our young son Caleb, who was doing time in day care and was very unhappy about it. We wanted something to change in our lives; it would need to be drastic and it would need to address all these issues.

So I came up with a good TV dinner (pizza) conversation solution.

'How about we try go six months without spending a dollar on food, power, water or transport?'

Blank looks.

'We could grow our own food, we've got a big backyard.'

No response.

'We could bike around instead of using the cars. I worked it out; we're creating about eight tonnes of CO_2 between us. Mostly it's me producing it. But, hey, you'd get to lose some weight.'

After six months, Linda, Trevor and Caleb not only made substantial environmental savings, but are healthier and saved 44% of Trevor's income.

I watch him take a slug of his beer.

'You'd have to make your own alcohol.'

A suspicious sideways look.

'We could get solar panels for the roof. I also worked out we're producing another eight tonnes of CO_2 a year through our current power use. That's just crazy.'

The remote control gets a work out as Trev frowns at the TV.

'You'd have to stop using that too—ghost power usage. Did you know 7% of the average household power is used when things like TV are on standby?'

'One of us would have to stop working and stay at home. Cal could stay at

home too. I think it should be me. You're the career man.'

'We'd have to source our own water, too. We'll need a couple of rainwater tanks.'

I'm not sure he hears me; he's at the fridge getting another beer. When he walks back in I add:

'To lower our water use and to deal with our own waste, we should have a composting loo. The average family flushes up to 70,000 litres of water down the toilet per year.'

He's picking at the last bits of cheese on the pizza box.

'And we'd have a goat, you know, cheese, yoghurt, milk.'

'We've already got chooks, we could barter our produce for things like oil, flour, sugar, rice.'

'We'd save money.' There's a note of desperation in my voice.

'I'll think about it'. He concedes.

He can't help thinking about it. I've a jaw like a rusty hinge. But eventually I infect him with some of my enthusiasm. I'm not sure what his response would have been if he could have seen into the future and discovered our six months would be very low in alcohol, that the grow your own tobacco scene was virtually nicotine free, and that he'd have to bike 17km each day (against the wind both ways if you listen to him), past KFC and numerous award winning pie shops and have to resign himself to providing his own protein in the form of garden snails.

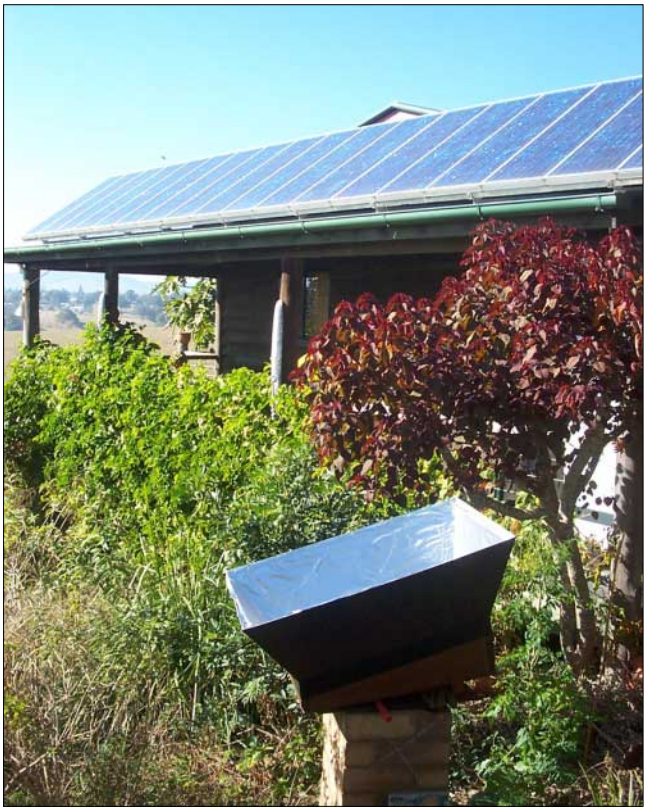
Getting ready: reduce energy and water use

It took us several years to establish the infrastructure, and learn how to reduce our daily power usage from 22kWh a day to between four and six, and water usage from 900 litres a day to less than 200. We also spent many hours in the garden ploughing up dirt and extracting large amounts of rock, establishing gardens that would provide both fruit and vegies.

I needed to learn how to ride a bike again; supposedly you never forget, but I grew up on the Canterbury plains in New Zealand and learning to ride a bike around Gympie, basically a series of large mullock heaps, was a challenge. You can add to that the challenge of whizzing down steep hills with six year old Caleb sitting on the back of my rusty—retrieved from the dump for $2—bike, large neighbourhood dogs snapping at my heels, and 80km/h traffic not too keen on sharing the road.

The experiment begins

We started our 'experiment' in January 2005. We pasted up a calendar on the side of the fridge. It was Caleb's job to cross off each day. We nearly wore the numbers off with our eyeballs as we contemplated how huge a task we'd set ourselves.



Linda's household was able to reduce their transport emissions by 94%, mains water usage by 94% and reduced their coal-fired power usage by 92%.

This was especially true of the six months we chose to do it. We had the worst drought in 135 years and were forced to compromise the moneyless aspect, buying animal food three months in. We continued to pay the mortgage, rates, insurances, phone bills, and medical expenses if they arose. Plus, we fell off the wagon a couple of times (we called them lapses) and while we would love to have avoided paying tax, the Australian Tax Office just weren't into it.

Trev was the intrepid recycler and managed such masterpieces as resoling his thongs and creating Caleb seats for the bikes out of old swing sets. He also did his bit by picking up useful stuff off the roadside; 'Hey, would you look at that, who'd dream of throwing that—insert screwdriver, unopened bag of cotton balls, porno mag, teatowel—away!'

We missed things. We're adherents of popular culture and were into consuming dark, caffeine impregnated fizzy drinks; alcohol; coffee; meat (for Trev); Bionicles (for Caleb); chocolate (for me).

The positives? We lost weight, lots of weight; we became healthier; our iron levels prior to the experiment were low and yet, after six months of near meatlessness, they were 75%

higher, the result of lots of fresh, organic fruit and veggies; our cholesterol and blood pressure were lower; our kidney and liver functions higher.

And we saved money! 44% of Trev's income!

But it was the environmental results that were most gratifying.

We managed to reduce our transport related emissions by 94%. We did use the car, driving 469km during the six months, but all up this amounts to about 6% of the average Australian vehicle use. However most of this distance was a 300km round trip to take Caleb to a heart specialist, an unexpected and, at the time, worrying trip. Total use created 156kg of vehicle emissions compared to the average 2.6 tonnes, and 86% of our total transportation requirements were made on the back of a bike.

We reduced our reliance on mains water by 94%; the drought denied us the 100% we had strived for, and had achieved prior to the six months. Without the extensive garden, we would have got away with it. It was the one thing we would have done differently—concentrated the garden over a smaller area rather than spread ourselves too thinly over the entire block. We didn't have a hope of watering it all.

We reduced our coal-fired power usage by 92%. This was a disappointment as again we were going for gold. But a hotter than average year resulted in reduced solar panel efficiency (roughly 0.5% decrease for every degree over 25), and we used more power as the fridge struggled with the high temperatures. In autumn and winter we generally make up for the summer blow out, but it was unusually overcast and resulted in more hot water boosting than we had needed in years and, of course, reduced PV output.

Overall we shouldn't grizzle. It's not everyone who gets to skite about growing their own toilet paper.

Homemade goat cheese and bounty from the garden.

The next challenge

Once the experiment came to a close and we'd done our best to stretch our stomachs and shrink our wallets and had settled back into what had become a normal lifestyle, Caleb asked us what the next adventure was. It got me thinking.

'Hey Trev. How about we go somewhere they don't have fruit fly. Somewhere cooler, and where it rains. You know, not where you go five months without rain and then get 200mm in an hour?'

He gets up, turns the TV on without using a remote, and looks at me sideways and with great suspicion.

'How about Tasmania? We could build a house ourselves.'

He fidgets in his seat and casts longing looks at the door.

'Strawbale. Great insulation. No concrete either. Did you know 7-10% of the worlds CO_2 is created by cement production?'

He's not looking at me now; he's looking at the ceiling. I can see he's thinking…

'I'm not keen on PVC either,' I add hopefully, 'too toxic. And we could make our own paints.'

'And use sustainable timber' he comments, 'solar passive design.'

He meets my eye and grins.

Linda Cockburn wrote *Living The Good Life*, published by Hardie Grant Books about their six-month adventure in domestic sustainability.

www.lintrezza.com

Where to find good wood?

Claire O'Rourke gives us the low-down on how to find wood that is environmentally and socially responsible

When you consider building a timber deck, renovating your home or buying a piece of furniture, have you ever thought about where the wood comes from?

The way the timber was harvested could have made devastating impacts on the world's ancient forests and the people who depend upon them for their survival. In fact, almost one-tenth of the timber imported to Australia is illegally felled from forests in neighbouring countries.

The way around this is to get your hands on some guaranteed 'good wood' or ecotimber. But what exactly is good wood? How can you ensure that the wood you are buying really is better for the environment? And what does it mean for your bottom line?

The good, bad and the ugly

According to a report prepared last year for the federal Department of Agriculture, Fisheries and Forestry, $400 million or 9% of Australia's imported timber products are illegally harvested from forests close to home. Over 80% of Indonesian's timber is illegally logged, according to its own government. In Papua New Guinea, illegal logging is linked to corruption, environmental destruction and human rights abuses. This timber, and what it is made into, is sold throughout Australia.

This is why architects, builders, DIY renovators and furniture makers are becoming motivated to use good wood.

Furniture designer and craftsman Roy Schack has been working in good wood for the past eight years, mainly using PNG Rosewood that has been legally harvested.

Photo: Greenpeace/Natalie Behring

'It's been just as good as the stuff I buy from the local timber yard, and the beauty of it is that it's not necessarily any more expensive.'

Schack wants to see ecotimber become an industry standard, rather than a fashionable flirtation with sustainable materials. 'Clients love it—they love the fact that they are a part of a bigger picture,' he says.

Ecotimber, or good wood, is harvested from well-managed forestry practices—whether it is from plantation or native forests. The good news is that it's readily available in Australia.

Greenpeace is a key supporter of ecoforestry projects in Papua New Guinea and the Solomon Islands, which aim to ensure the long-term survival of the Paradise Forests—one of the last stretches of ancient tropical forest on the planet.

Villages use portable sawmills to selectively log their own sections of forest, and are monitored to meet strict international ecoforestry standards. These small projects, such as those at Lake Murray in PNG, mean that traditional tribes can maintain their lifestyle and guarantee their financial future. The resulting good wood is sent to Australia where demand is increasing.

When is wood good?

Choosing good wood is easier when it comes to products such as plantation pine, but when it comes to hardwoods the picture can get murky, especially when cheap imported timber might seem like a hassle-free option.

But there are labels you can rely on which guarantee timber has been sustainably harvested. Forest Stewardship Council (FSC) certification is fast becoming the international standard that guarantees timber comes from well-managed sources. The FSC accredits bodies which in turn certify forestry projects that adhere to stringent environmental, economic and social standards. FSC also provides chain-of-

custody certificates so you are guaranteed to get what you pay for from suppliers and manufacturers.

FSC is relatively new in Australia, but already around 500,000 hectares of locally-produced plantation timber has been certified, says Michael Spencer, FSC's interim CEO in Australia.

Spencer cites the Netherlands as a prime example of the international push to FSC wood. Up to 15% of the timber trade in the Netherlands is FSC-certified after five years of the system operating there, he says.

Other good wood products, such as some of the Greenpeace-supported projects in PNG and the Solomons, are known as 'community-based timber', which often means the projects are in the process of getting certified.

Chris Taylor, a PhD student in forest certification and timber specification working in architectural practice at RMIT University's Centre for Design, says architects want to avoid the stigma attached to tropical timbers but are confused about the best system to guarantee good wood.

'At this point in time the Forest Stewardship Council has provided the best means of providing assurance and it enjoys broad stakeholder support,' he says.

Scott Coppin, director of third generation joinery business Hampton and Larsson, in Lismore, New South Wales, made a decisive move to use ecotimber in the windows and doors they make. He hopes to replace all his timber with good wood within a decade.

Luke Petersen is building his home in Western Australia, using as much FSC timber as possible.

The company is the first joinery manufacturer in Australia to gain FSC certification. The price of the timber, Coppin says, is on a par with illegally harvested products.

'If you give people the choice of certified or non-certified timber, the decision is easy.'

Only one small hardwood project of Australian native forest timber has been FSC certified so far, which means you'll need to buy imported hardwoods to have the same stringent guarantees.

Luke Petersen, who is building his family home at Karridale in Western Australia, isn't shy about his passion for good wood. In fact, he's spending a sizeable chunk of the budget for his new home on ecotimber. 'My main goal was to get as much FSC timber in the house as possible within my budget constraints,' he says.

Petersen paid an extra 10-20% on top of what you might pay for illegally logged timbers, significantly lower than his expected 50% premium. He used Australian plantation radiata pine and imported tropical hardwoods including kwila (merbau) and malas. Around $60,000 of his $260,000 home budget will be spent on good wood.

Petersen is aware of the environmental implications of transporting timber that has been harvested overseas, but thinks his support of the emerging supply chain for FSC tropical hardwood will help raise awareness of good wood.

'If this helps promote FSC timber and make it widely available, maybe that's a better thing to do.'

Good wood

Forestry Stewardship Council (FSC) certified plantation, certified secondary or semi-natural forest
From secondary non-threatened forests
FSC certified tropical timber
Community based tropical timber, especially from PNG or Indonesia

Wood to avoid

Australian native old growth or rainforest
Uncertified plantation, cleared from native forest in the past 10 years
Uncertified tropical hardwoods

Greenpeace Australia Pacific has recently launched an online Good Wood Guide. The guide lists species of imported timber that are likely to be illegally logged and environmentally safe alternatives, as well as information on 'good wood' timber and furniture suppliers and retailers.

Greenpeace Good Wood Guide
www.greenpeace.org.au/goodwoodguide

Forest Stewardship Council
www.fsc.org

Forest Certification Resource Centre
www.certifiedwood.org

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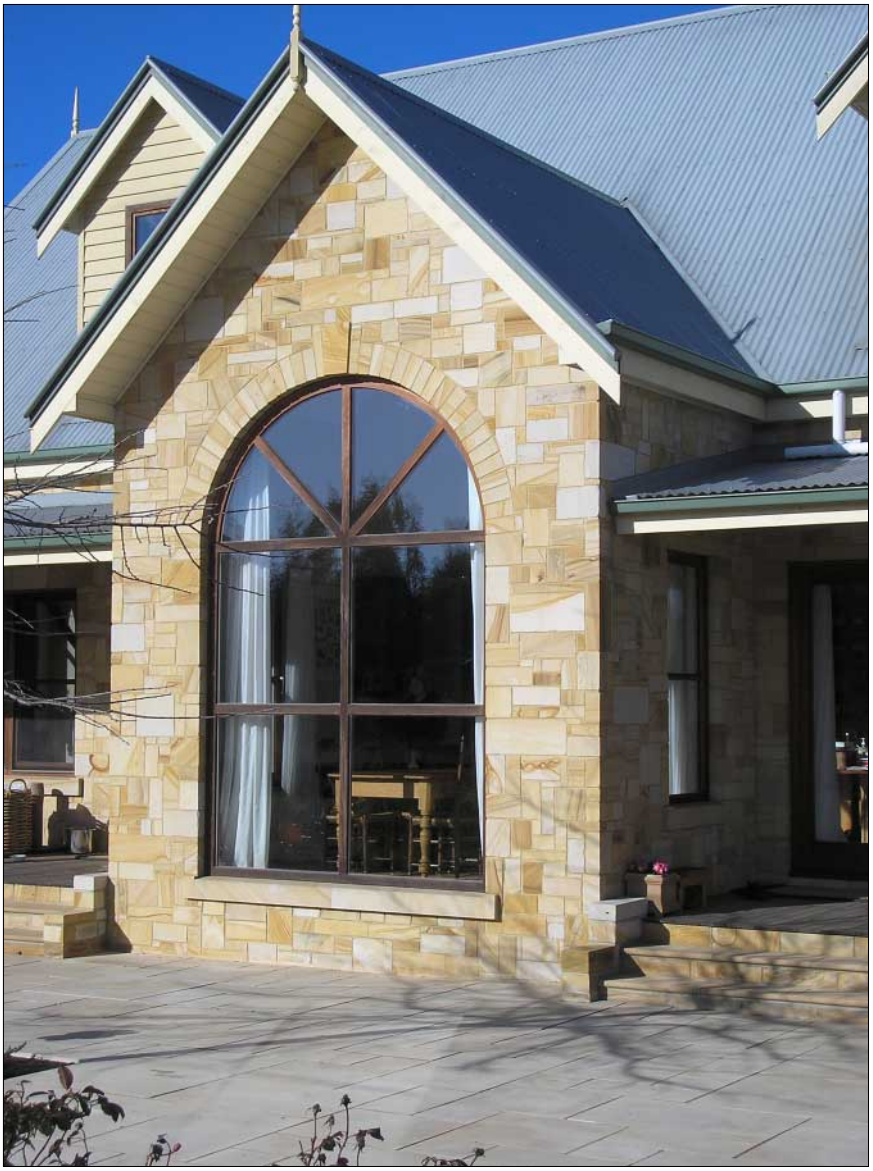
Double glazing buyers' guide

There's not much point in insulating your ceiling and walls if your windows and doors let too much heat in or out. We take a look at window and door glass insulating options

The importance of reducing heat flows through windows and doors should not be overlooked. A great deal of heat can flow through single pane glass, and an otherwise well-insulated house can suffer considerable heat transfer. In fact, a single pane plain glass window is not much better than a hole in the wall when it comes to its insulating ability.

There are two main problems. Firstly, heat is lost by direct radiation—warm objects inside the room radiate heat, which passes straight through the window glass to the outside.

Secondly, warm air is rapidly cooled against the glass, falling to the floor to be replaced by more warm air. This is called a convective current and it can literally suck heat out of a room as fast as you can add it. For example, if you have ducted heating, the outlets are often directly under or above the windows—this dramatically increases heat loss by increasing the temperature differential and breaking up the air layer on the inside of the window. Installing deflectors on the heating vents, (around $10 each), deflects the hot air away from the window, saving up to 20% on heating costs.



Double glazed windows don't have to be square, as these Paarhammer windows show.

It's curtains for heat loss

Windows can be insulated in a number of ways. Covering them with thick curtains or using roller or vertical blinds is a good place to start, but they must have pelmets at the top to prevent convective currents circulating, otherwise they will do very little. However, this means that the windows are only insulated when you can't see out of them, so you can have a well-insulated house, or enjoy your view, but not both. If you find pelmets ugly or impractical, then you may be able to fit a strip of wood or other suitable material between the top of the window frame and the curtain rail or track.

Pleated blinds (such as the double layered Luxaflex Duettes,) can seal well at the top because they can be mounted against the window frame.

External roller shutters are an alternative to curtains or blinds, but they also have the problem that once in place,

they let in no light.

The ideal solution is to improve the insulating properties of the glass itself.

Raise your glass

You can install double or triple glazing, where sheets of glass are separated by a small, sealed airspace. This space may contain air, or it might be filled with an inert gas such as argon. Because the airspace is so narrow, there is not enough room for convection currents to circulate, so the layer of gas between the sheets of glass acts as an insulator, much like the tiny pockets of trapped air in bulk fill insulation.

Another alternative is to use a single sheet of glass that has a special coating or is designed to resist the transfer of heat while still allowing the majority of visible light to pass through.

You can even have a combination of the two methods, with double or triple glazing that is made using low-E glass—this glass allows visible light to pass through into the house, while preventing heat (infrared) from escaping—or another type of insulating glass. This will give greater heat transfer reduction, but is also more expensive.

Glass types

Firstly, let's look at the types of glass available. There are a great many variations, including tinted or 'toned' glass, which absorbs some of the light passing through the glass, thus reducing the heat ingress in summer. Some types of toned glass are also low-E.

Then there is reflective glass, which reflects some of the incoming heat back in the direction it came from. This type of glass works best in summer on unshaded windows.

Some types of glass are spectrally selective—they will allow visible light to pass through while reflecting UV and infrared wavelengths.

Low-E glass is ideal for cooler climates where heat loss in winter needs to be reduced. However, low-E glass can also be used in hot climates provided it is shaded from direct sun—or if it is integrated into double glazing with an outer 'toned' pane. This is known as 'cool glazing' in the US.

It should be noted that shading double glazing is even more important than shading single pane windows, as double glazing will trap solar heat in summer if exposed to the sun.

Frames

Window frames are often overlooked, but they are an important part of the heat transfer equation.

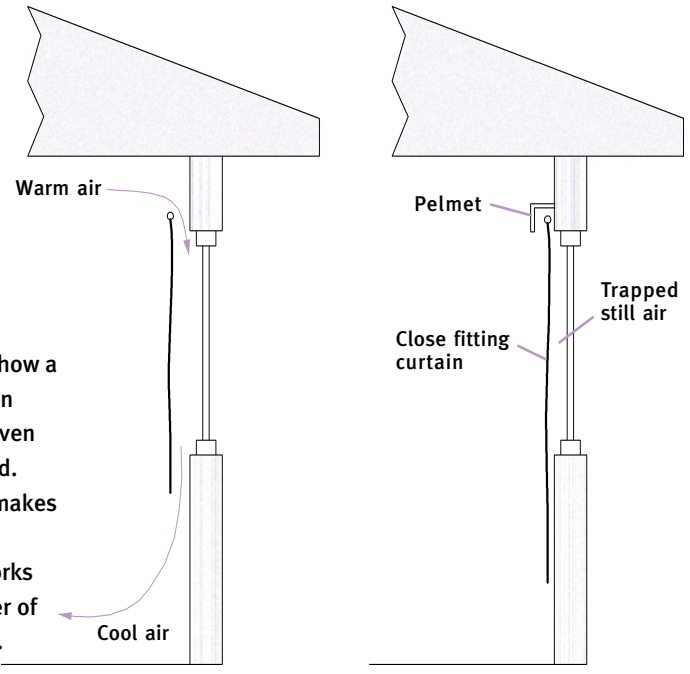
The most popular type of frame is the all-aluminium frame, but aluminium is a great conductor of heat and so provides no insulating properties.

This can be solved by using different materials or a combination of materials. You might prefer the look of aluminium frames, but want them to behave in a more civilised manner. This can be achieved by introducing a thermal break inside the frame. This consists of a section of frame between the inner and outer frames that is made from an insulating material such as timber or plastic.

A number of manufacturers now make 'improved aluminium' frames, basically aluminium frames with timber covering the inside of the frame—effectively creating a thermal break and making them look like timber windows on the inside. Rylock is one manufacturer who makes this type of frame.

Other framing materials might be your preferred choice, and these include timber (make sure it is sustainably sourced), uPVC plastic (unplasticised polyvinyl chloride), and even fibre-reinforced plastic (fibreglass).

When shopping for windows, ask the supplier where they get the material for the frames, and in the case of timber, whether it is sustainably sourced. Materials such as uPVC and fibreglass are quite toxic to manufacture and do not readily break down in landfill. Aluminium is fully recyclable, but takes a great deal of energy to manufacture initially, so you have to weigh the positives and negatives of each material when making a decision.



Here you can see how a thermal current can start circulating, even with curtains fitted. Adding a pelmet makes all the difference. Double glazing works by trapping a layer of air, much like this.

A few technical terms

There are two values commonly used to describe the insulating properties of materials, especially windows. The first is the R-value. This describes the material's resistance to heat transfer. Be careful not to confuse the R-values used in the US with the international units used in Australia. An international R-rating of 1 is equivalent to a US rating of 5.7! So make sure you confirm with the manufacturer which R-values are being used.

The second is the U-value. This measures how easily heat is transferred through the material, the opposite (or inverse) of the R-value. A material with an R-value of, say, 2.4, will have a U-value of 1/2.4 = 0.42. So, with R-values, the higher the number, the better the insulating properties, but with U-values, the lower the number, the better.

The Solar Heat Gain Coefficient (SHGCw) or 'Shading Coefficient' measures the window's ability to control heat gain. It is the amount of solar radiation admitted through a window (directly, and absorbed and transmitted) as a proportion of the total amount falling on the window. The coefficient is expressed as a number between 0 and 1—the lower the number, the less solar heat the window transmits.

In mixed and cool climates or for westerly orientations, windows with a low solar heat gain coefficient are desirable.

The WERS rating defines how well a window performs thermally. Look for windows that have WERS certification.

Reducing the 'pane' of costs

If you're smart you can minimise the cost of double glazing. If the panes of glass are not too big, thinner glass can be used, saving cost and weight. Doors have to be glazed with safety glass (which costs more, multiplied by two with double glazing), and windows set down low that are larger than a certain size also have to be safety glass. Raising sill heights to 500mm above floor level can eliminate the requirement for safety glass (as covered by Australian Standard AS1288) and save a lot of money.

With the introduction of energy regulations from May 1 this year, efficient glazing is one way you can quickly upgrade a building's energy performance. Studies by the Australian Glass and Glazing Association on the homes of one of Victoria's biggest home builders showed an average cost payback of just over five years.

Weather seals

It is also important to remember that a window allowing airflow around it, will be a poor insulator, no matter what its materials and construction. Windows that have moving sections should have good seals between the moving frame and the window frame. Most modern commercially-made windows have a reasonable seal, but their effectiveness depends on how well the window is designed and manufactured. The amount of air that passes through an area of window under a given pressure is known as the infiltration rating—the lower the value, the better.

Another thing to remember is the installation itself. When the window frame is fitted, it must be sealed to prevent any air leaks. It is not uncommon to see windows with considerable gaps, and sometimes you can feel air currents between the frame and the wall.

Add-on double glazing

So far we have looked at commercially available double-glazed windows, but this is not the only way to install double glazing. There are several aftermarket double-glazing products designed to be attached to the inside of window frames as a second layer of glazing material.

For example, Clear Comfort consists of a flexible clear film that is held in place with double-sided adhesive tape. The film is then shrunk with a hair dryer to make it taut so that it isn't noticable. Although a permanent installation it can also be fitted to removable 'fly screen' frames or home-made frames.

Magnetite is a removable add-on system consisting of clear acrylic glazing sheets attached to frames that magnetically clip on to thin metal strips attached to the window frame. This allows easy removal of the inner glazing sheet.

You can even make your own home-made double glazing using similar principles—the options are varied and limited only by your window frames but we won't go into more detail on the DIY option here. Check out *ReNew 84* for an example of adding your own double glazing.

Doors

Generally, much that applies to windows also applies to doors containing glass.

Glass doors are available with many of the same features as windows, including double glazing and the various types of heat flow reducing glass.

Sealing around doors can be more

difficult than windows, but is equally important and should not be overlooked.

Standards and ratings

Windows and sliding doors made to Australian Standards AS2047 or AS1288 will carry a certifying label. These standards cover things such as safety, water resistance, air infiltration and other important features. Some windows are fully imported and conform to stringent overseas standards. If a window is supplied to you without any certification, you should not use it.

Some Australian-made windows don't need to comply with AS2047, such as replacement windows for heritage homes.

Some manufacturers will supply windows that are tested and come with a Window Energy Rating Scheme (WERS) rating, which defines the energy performance of the window.

In conclusion

Double glazing can be expensive, although it may be as little as 1% of the total cost of building a home and can reduce energy loss through windows by 40% or more, so it is a very worthwhile investment. It is important that you get quotes from at least three suppliers, and talk to them about what is right for your home. Remember, what applies in colder climates doesn't necessarily apply in warmer climes.

Note: we have only included a selection of what is available, check your local yellow pages for other suppliers. ✳

More information on glazing can be found in the Your Home Technical Manual (available from the ATA) or go to www.yourhome.gov.au, and the Australian Window Association, www.awa.org.au. For information on the window energy rating scheme, see www.wers.net

Table 1. Doors.

Brand/manufacturer	Made in	Model	Type	Frame material	Type of glass	Size (H x W)	U-value	SHGCw	Surface treatment	Price	Availability	Comments
CertainTeed 359 Warrigal Rd Cheltenham VIC 3192 Ph:(03) 9584 5388 sales@certainteed.com.au www.certainteed.com.au	Australia	Devon	Sliding and French doors	uPVC	You will be advised of most suitable acoustic and thermal configurations	Custom made to your requirements	Leading brand thermal and acoustic performance		100% uPVC needs no treatment or painting	Dependent upon type, size, glass configuration, colonial or plain, gas or no gas etc	Australia wide, all states and territories	Must be installed by CertainTeed or your builder/carpenter
Everglaze 402 Heidelberg Rd Fairfield VIC 3078 Ph:(03) 9486 1422 enquiries@everglaze.com.au www.everglaze.com.au	Australia	Winsa	Sliding, French and Bifold Doors	uPVC	All combinations	Max. height 2400mm	Depends on glass selection	Depends on glass selection	No treatment required	On request	Melbourne	Installation by Everglaze or with written instructions. Site glazing by Everglaze
Fairoak Timber Windows Ph:(03) 9748 4200 Mob:0425 816 799 cled.ftw@optusnet.com.au www.fairoak.com.au	Australia	Timber and timber clad	Single and double opening	European Redwood	24mm double glazing with a 16mm air gap	All sizes	1.9		Fully finished with a three coat spray system	On request	Fairoak Timber Windows	Installation available
Marvin and Integrity doors ASH Building Products ACT/NSW Ph:(02) 9531 1831 VIC Ph:(03) 9317 2555 windows@ashbp.com www.marvin.com	USA	Integrity	Swinging French	Timber/aluminium	All glass supplied by Cardinal. Over 30 different glazing options	Over 12,000 standard sizes			Raw, primed	Varies	Direct from ASH Building Products	
			Archtop swinging French	Timber/timber								
			Sliding patio									
			Sliding French									
		Marvin	Sliding French	Timber/fibreglass	All glass supplied by Cardinal. Tempered low-e II with argon gas (std). Tempered Obsecure low-e II with argon gas (option)	Approximately 800 standard sizes (for all Wood-Ultrex series)			Raw, primed, white finish			
			Sliding patio									
			Inswing French									
Miglas Australia 57-59 Canterbury Rd Montrose VIC 3765 Ph:(03) 9728 3999 sales@miglas.com www.miglas.com.au	Australia	Miglas Timber Miglas Ali-Clad	French door, sliding door, bifold door	Hardwood timber, timber/aluminium clad	All combinations of double glazed units to suit the application. Pilkington and PPG glasses	Custom made to client requirements	>1.8 depending on glass unit selection	>0.27 depending on glass unit selection	Timber envelope dipped. Timber/aluminium powder coated in a range of architectural colours	Varies according to size, shape, timber, finish and glass	Miglas Direct	High performance window and door systems require skilled fitting. Installation and flashing instructions available
Paarhammer Pty Ltd 11 Smallmans Rd Ballan VIC 3342 VIC ph:(03) 5368 1999 Australia wide ph:1300 655 920 info@paarhammer.com.au www.paarhammer.com.au	Australia	Portal	Sliding	Various timbers	Wide range of double glazed units (16mm gap) and triple glazed (2 x 12mm gap), optional argon gas, low-e etc	Custom made up to 3m high	From 0.9	From 0.3	Raw, primed, oiled or stained	Varies according to timber, size, finish and glass	Paarhammer Pty Ltd	Professional installation available
			Bifold			Custom made up to 10m wide						
			French			Custom made						Easy to install
Rylock Windows and Doors 45-47 Shearson Cres, Mentone VIC Ph:(03) 9583 9222 2/17 Hope St, Brunswick VIC Ph:(03) 9381 4822 Home Ideas Centre 1686 Princes Hwy, Clayton VIC Ph:(03) 9543 6311 rylock@rylock.com www.rylock.com	Melbourne and Adelaide	Architectural	Sliding door	Aluminium	All products are capable of being single or double glazed with industry available clear, laminated, toughened, toned, low-e and decorative glass	Custom fabricated to size	Various combinations are WERS rated	Various combinations are WERS rated	All aluminium is powder coated in one of 20 standard colours (special colours available on request). All select grade timber is left natural for painting or staining	Dependent on suite, size, glass and configuration	Sold and distributed throughout Victoria, Tasmania, ACT, New South Wales and South Australia	Install using standard carpentry skills/techniques
			Stacker door									
			Hinged door									
			Bifold door									
		Timber and aluminium composite (TAC)	Sliding door	Aluminium and timber								
			Hinged door									
Stolar Joinery VIC Ph:(03) 9547 6511 info@stolar.com.au www.stolar.com.au	Melbourne	Timber	Glazed door	Victorian Ash, Cedar	Single and double glazing				Raw or Protim treated		South-east Australia	
			Bifold door									
			Sliding door									
Titane Windows & Doors 82 Mayne St Launceston TAS 7250 Ph:(03) 6326 8217 sales@titane.com.au www.titane.com.au	Tasmania	Eurodur 3S	Hinged	'Kommerling' uPVC	Double glazed using 16mm cavity low-e, hi-performance glasses. Argon thermal gas. SF6 acoustic gas	2100 x 900	2.7			$1,400	Tasmania	Easily installed
		Eurodur 3S	French			2100 x 1800				$2,500		
		SF2	Sliding			2100 x 1800				$1,800		
		Eurodur 3S	Bifold			2100 x 3600				$7,000		
		PremiDoor	Lift and slide			2100 x 3600				$6,000		
Vue Systems P/L 15 Chetwynd St Loganholme QLD 4129 Ph:(07) 3806 4566 daniel.joli@vuesystems.com.au www.vuesystems.com.au	Australia	SF2	Sliding	uPVC	All types	All sizes	1.8	Depending on glass chosen	Satin or timber finish (Golden Oak)	On request	QLD factory	No special fitting required
		Gold Systems	Tilt and slide, lift and slide, single French opening, double French opening									

Table 2. Windows.

Brand/manufacturer	Made in	Model	Type	Frame material	Type of glass	Size (H x W)	U-value	SHGCw	Shapes available	Surface treatment	Price	Availability	Comments
CertainTeed 359 Warrigal Rd Cheltenham VIC 3192 Ph:(03) 9584 5388 sales@certainteed.com.au www.certainteed.com.au	Australia	Devon	Double hung, sliding, awning, casement, fixed, bay windows	uPVC	You will be advised of most suitable acoustic and thermal configurations	Custom made to your requirements	Leading brand thermal and acoustic performance		Custom made, angles and curves	100% uPVC needs no treatment or painting	Dependent upon type, size, glass configuration, colonial or plain, gas or no gas etc	Australia wide, all states and territories	Must be installed by CertainTeed or your builder/carpenter
ClearComfort Intelligent Insulation PO Box 773 Jamison Centre ACT 2614 Ph:(02) 6161 3570 info@clearcomfort.com.au	Australia	Small	MiniKit	Polyethylene membrane and double-sided tape	Transparent plastic membrane	120cm x 82cm	3.6 (when applied to a plain clear single-glazed window)	Nil	Cut to size with scissors	Not applicable	$19.30 (includes GST and delivery)	Mail order	A very simple do-it-yourself method for adding the benefits of double glazing to any single-glazed window, door or skylight. Requires no special tools, equipment or skills—just scissors, a teaspoon and a hairdryer
		Large	SuperKit			10m x 1.6m					$180.50 (includes GST and delivery)		
Everglaze 402 Heidelberg Rd Fairfield VIC 3078 Ph:(03) 9486 1422 enquiries@everglaze.com.au www.everglaze.com.au	Australia	Winsa	Tilt and turn casement window (awning and sliders also available)	uPVC	4mm clear/16mm space/4mm clear	Up to 2400mm high x 900mm wide (larger if fixed)	2.074	0.528 (for 4/16/4 clear glass)	Rectangle, square. Round, arches, curved or shaped if window is fixed.		On request	Melbourne	Installation by Everglaze or with written instructions—site glazing by Everglaze
					4mm green tint/16mm space/4mm clear		2.118	0.38 (for 4 green tint /16/4)					
Fairoak Timber Windows Ph:(03) 9748 4200 Mob:0425 816 799 cled.ftw@optusnet.com.au www.fairoak.com.au	Australia	Timber and timber clad	Casement, awning, fully reversable, pseudo double hung and fixed glass	European Redwood	Double and triple glazing to any glazing specification	All sizes available	1.9	Depends on the glass	Made to any size	All windows and doors are delivered fully finished with a three coat spray system in any colour	On request	We manufacture in Victoria but can deliver anywhere in Australia	Installed by a qualified carpenter
Magnetite Australia Ph:1300 304 082 info@magnetite.com.au www.magnetite.com.au	Australia		Magnetically attached secondary glazing system. Glazing panel is attached to a secondary frame. Used to retrofit windows and doors	Mainly PVC plastics with some aluminium	Optical grade acrylic in 3mm, 4.5mm and 10mm thicknesses	Fits onto any window	2	0.34	Any shape	Framework: major window colours and can also be painted to suit any colour. Optical grade acrylic: clear, tinted and frosted	$300 per m² for 3mm OGA $350 per m² for 4.5mm OGA $450 per m² for 10mm OGA	Most states of Australia	System has a very low air infiltration making the window almost airtight. Installation can only be done by trained professionals. Prices are approximate and include installation and GST
Marvin and Integrity windows ASH Building Products ACT/NSW Ph:(02) 9531 1831 VIC Ph:(03) 9317 2555 windows@ashbp.com www.marvin.com	USA	Marvin	Double hung	Timber/aluminium	All glass supplied by Cardinal. Over 30 different glazing options	Over 12,000 standard sizes			Limitless custom options made to order	Raw, Primed	Varies	ASH Building Products	
			Magnum double hung	Timber/timber									
			Insert double hung										
			Casement										
			Awning										
			Bay/bow										
			Round top										
			Polygon and special shape										
			Tilt and turn (European window)										
			Hopper										
			Sliding										
		Integrity	Awning	Timber/fibreglass	All glass supplied by Cardinal. Low-e II with argon gas (std). Tempered low-e II with argon gas (option). Tempered Obsecure low-e II with argon gas (option)	Approximately 800 standard sizes			Spec sizes only	Bare wood	Varies		
			Casement						Square and rectangle, polygons, round tops	White finish			
			Bay / Bow										
			Double Hung										
			Glider										
			Polygon										
			Round Top										
			Single Hung	Fibreglass/ fibreglass									
			Polygon										
Miglas Australia 57-59 Canterbury Rd Montrose VIC 3765 Ph:(03) 9728 3999 sales@miglas.com www.miglas.com.au	Australia	Miglas Timber Miglas Ali-Clad	Fixed, casement, awning	Hardwood timber, timber/aluminium clad	All combinations of double glazed units to suit the application. Pilkington and PPG glasses	Custom made to client requirements	>1.8 depending on glass unit selection	>0.27 depending on glass unit selection	Custom made to architect/client requirements	Timber envelope dipped. Timber/aluminium powder coated in a range of architectural colours	Varies according to size, shape, timber, finish and glass	Miglas direct	High performance window and door systems require skilled fitting. Installation and flashing instructions available
Paarhammer Pty Ltd 11 Smallmans Rd Ballan VIC 3342 VIC Ph:(03) 5368 1999 Australia wide Ph:1300 655 920 info@paarhammer.com.au www.paarhammer.com.au	Australia		Tilt and turn (European style)	Various timbers	Wide range of double glazed units (16mm gap) and triple glazed (2 x 12mm gap), option argon gas, low-E etc	Custom made to any size	From 0.9	From 0.3	Custom made to any shape	Raw, primed, oiled or stained	Varies according to size, shape, timber, finish and glass	Paarhammer Pty Ltd	Easy to install
Rylock Windows and Doors 45-47 Shearson Cres, Mentone VIC Ph:(03) 9583 9222 2/17 Hope St, Brunswick VIC Ph:(03) 9381 4822 Home Ideas Centre 1686 Princes Hwy, Clayton VIC Ph:(03) 9543 6311 rylock@rylock.com www.rylock.com	Melbourne and Adelaide	Architectural	Fixed Lites	Aluminium	All products are capable of being single or double glazed with industry available clear, laminated, toughened, toned, low-e and decorative glass	Custom fabricated to size and where applicable, shape	Various combinations are WERS rated	Various combinations are WERS rated	Custom sizes and shapes	All aluminium is powder coated in one of 20 standard colours (special colours available on request). All select grade timber is left natural for painting or staining	Dependent on suite, size, shape, glass and configuration	Sold and distributed throughout Victoria, Tasmania, ACT, New South Wales and South Australia	Install using standard carpentry skills/techniques
			Awning										
			Casement										
			Sashless double hung										
			Sliding										
			Bay										
			Curved										
		Timber and aluminium composite (TAC)	Fixed Lites	Aluminium and timber									
			Awning										
			Casement										
			Sashless Double Hung										
			Sliding										
			Bay										
			Sliding Door										
			Hinged Door										
Stolar Joinery VIC Ph:(03) 9547 6511 info@stolar.com.au www.stolar.com.au	Melbourne	Timber	Windows	Victorian Ash, Cedar	Single and double glazing				Made-to-order	Raw or Protim treated	On request	South-east Australia	Installed by a qualified tradesperson
Thermosound PO Box 3073 Tamarama NSW 2026 Ph:(02) 9369 3018 www.thermosound.com.au	Australia			Wood and aluminium	All combinations	Custom made to any shape	0.588				On request	Thermosound	Installed by a qualified carpenter
Titane Windows & Doors 82 Mayne St Launceston TAS 7250 Ph:(03) 6326 8217 sales@titane.com.au www.titane.com.au	Tasmania	'Kommerling' SF3	Sliding	Kommerling' uPVC	Double glazed using 16mm cavity low-e, high performance glasses. Argon thermal gas SF6 acoustic gas	1200 x 1800	2.7		Square, rectangle		$1,400	Tasmania	Easily installed
		'Kommerling' Eurodur 3S	Awning			1200 x 1200					$1,000		
			Casement			1200 x 1200					$1,000		
			Tilt and turn			1200 x 700					$800		
			Fixed			1000 x 1000			Square, rectangle, round, shape		$600		
Vue Systems P/L 15 Chetwynd St Loganholme QLD 4129 Ph:(07) 3806 4566 daniel.joli@vuesystems.com.au www.vuesystems.com.au	Australia	Gold Systems	Casement	uPVC	All types depending on customer's request	All sizes available	1.8	Depending on type of glass	All shapes made to size	Satin	On request	QLD factory	Can be supplied with timber reveals. Instructions provided
		SF3	Awning										
		Kommerling products	Sliding, bi-fold, tilt and turn, tilt and slide										

A DIY solar panel tracker controller

Want to build a solar tracker but not sure where to start? Lance Turner describes a simple microcontroller based tracker controller that can be programmed to work how you want

As outlined in the last issue of *ReNew*, solar trackers can increase the output of solar panels by a considerable amount. However, most trackers, and even just tracker controllers, are quite expensive, and repairing them can be pretty daunting.

With this in mind, I decided to design a simple solar tracker that can be used on any type of tracking frame and with any frame actuator that runs on DC.

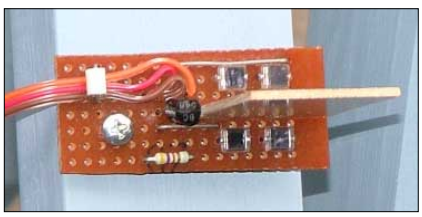
The solar tracker test frame used to develop the tracker controller.

The basic concept

This tracker controller uses a tiny eight-pin microcontroller to do the hard work. It evaluates the voltages at three inputs and operates the tracking motor accordingly.

The three inputs are connected to the sun position sensor, the limit switches and the manual tracking switches. The two outputs of the microcontroller are used to drive a pair of relays that allow the actuator motor to be driven in both directions.

There is also a set of secondary limit switches that are connected in series with the actuator motor as a backup should the controller get confused and not shut the motor down when needed. This could happen if the controller is damaged by a lightning strike or some other event, so the secondary limit switches are cheap insurance.



The sun position sensor. Note the pairs of photodiodes.

The tracker controller circuit is powered by any 12 or 24 volt DC power source: either a small dedicated battery, or the main system battery.

To test the controller I built a small frame and actuator out of pine, some brackets and screws, and a small geared motor. The motor was used to drive a length of threaded rod. As the rod rotates, it pushes and pulls a nut which is attached to the pivoting array frame by a bolt, causing the frame to be pushed up and down, thus rotating the frame from left to right. You can see how this works in the photos. This design is not meant to be a practical tracker frame, it was built to test the tracker controller.

The circuit in detail

The heart of the system is the microcontroller. In this circuit I used a Picaxe 08M micro, for several reasons. Firstly, they are cheap, at less than $5 each.

Secondly, they are very simple to program. The programming software is free and you just need a simple serial cable to connect them to your PC.

Thirdly, the 08M has three pins that can act not only as digital inputs (ie, the inputs are either high or low) but also as analogue inputs (they can read the

input voltage as a number between 0 and 255). This allows us to connect more than one switch to each input. You can see how the limit switches and the manual tracking switches were connected to their respective inputs in the circuit diagram.

By connecting a resistive ladder across from V+ to ground and connecting the input to the approximate midway point of the ladder, the voltage at the input with no switches activated is around half of V+, or 2.5 volts. It is in fact a little lower than that as the resistive ladder contains not two, but three resistors.

Aside from the two 10k resistors used to divide the V+ supply voltage, there is also a 1k resistor in the high side of the ladder (R6 and R10 in our circuit). These are necessary in case both switches are pressed at the same time. If this were to happen there would be a dead short of the V+ supply to ground—that would be a bad thing.

Each switch is connected across one of the 10k resistors, so when you press the switch it shorts out its accompanying resistor. This has the effect of pulling the input of the microcontroller to either ground or V+ (about 91% of V+ actually, but close enough as far as the micro is concerned).

The change in voltage is read into the analogue-to-digital converter on the input of the micro and converted to a representative number which the micro can use to decide what to do next.

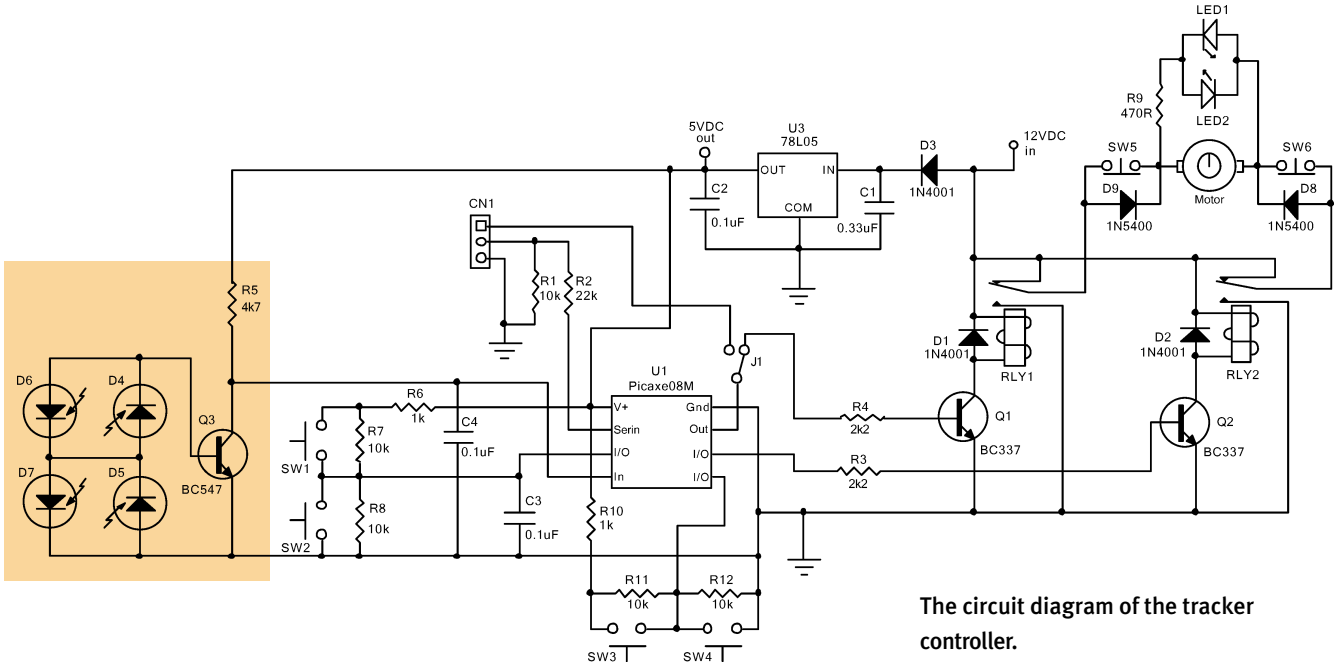
This all sounds complex, but in fact it is simple to implement, you just issue a 'readadc' command and the micro reads the voltage on the specified pin.

The sun position sensor

You might think that the sun position sensor would also need to be connected to an analogue input, but in fact this isn't necessary. The sun only ever moves from east to west, so why bother making a tracker that can track the sun back the other way? Cloudy days can mean the tracker might move a little too far sometimes as the brightest spot in the sky might appear slightly west of the sun's real position, but being a few degrees off while the sun catches up to the tracker's position will have little effect on the output of the solar array.

So, the sensor only needs to tell the controller when to move the array to catch up to the sun. This is easily done using the quite common system of a pair of light sensors separated by a gnomon (a vertical separator that casts a shadow

This simple system turns the rotational motion of the motor into the push-pull motion needed to drive the tracker. It is similar to how linear actuators work, without the cost (but without the sealed drive and motor too!)



The circuit diagram of the tracker controller.

as the sun moves). As the sun moves, the shadow falls across the east-most sensor, causing it to change resistance, voltage output, or whatever, depending on the type of light sensor it is.

For this project I shied away from the commonly used LDR (light dependent resistor) sensors as they have a habit of degrading over time with UV light and heat exposure. Instead I decided to use silicon photocells, which are basically large area photodiodes. So why are these more rugged? Well, they are made from the same material as solar cells—indeed, this is exactly what they are, tiny solar cells in a small encapsulated package. We know that solar cells last for 20 years or more with minimal degradation, so the photodiodes should last a similar amount of time.

You can see the sensor part of the circuit in the circuit diagram, in the coloured box. D4 and D5 in series provide enough voltage to turn on a small transistor, Q3, when light shines on them. The two photodiodes are effectively just one single sensor.

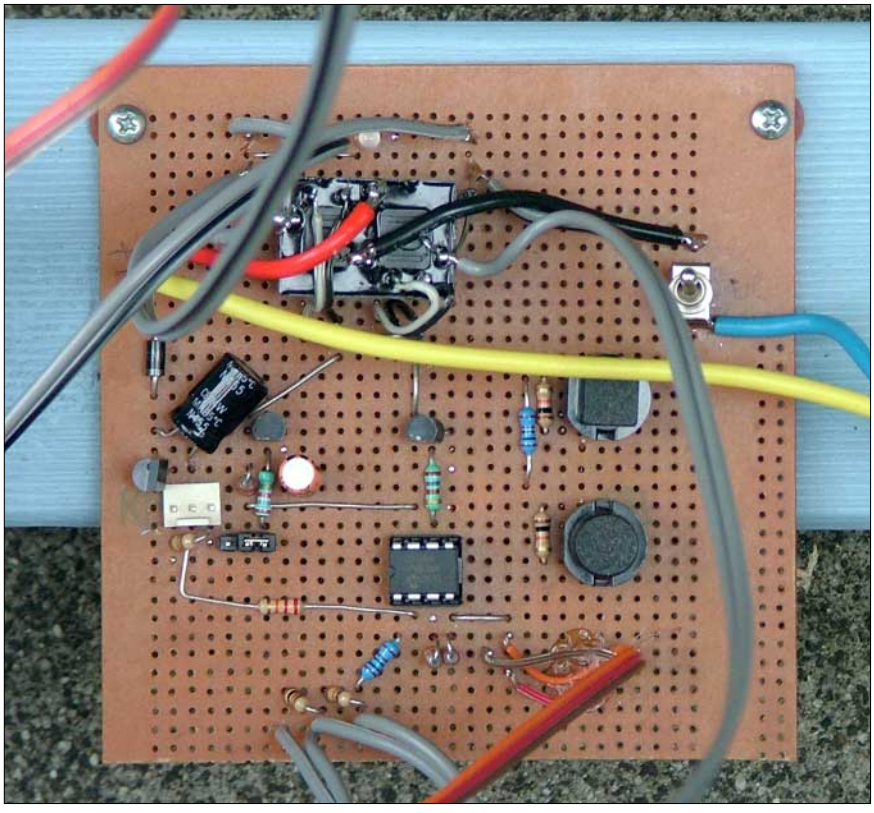
When Q3 turns on it pulls the voltage on the bottom end of resistor R5 down, so the voltage at that point swings from V+ down to just above ground.

Obviously, this is of little use if Q3 is always turned on, as the output voltage will always be down around ground. This is where D6 and D7, the other two photodiodes, come into play. When a similar level of light shines on them as compared to D4 and D5, they are producing enough voltage in the reverse direction to D4 and D5 to stop the transistor being turned on (Q3 needs to have around 0.65 volts at its base to turn on). However, when D6 and D7 are even slightly shaded, they can't compete with the output of D4 and D5, so Q3 turns on and the output voltage of the sensor swings from high (V+) to low (ground). The microcontroller sees this and treats it as an indication that it should move the array a bit to the west until the input signal goes back high.

So, let's have a look at the inputs so far. We have a sun position sensor connected to pin four of the micro. We have manual tracking switches connected to pin five of the micro, and primary limit switches connected to pin three. This is all we need to make a working tracker—the other two pins of the micro are used as outputs to drive a pair of relays to send power to the motor in the appropriate direction.

You will also have noticed diodes D8 and D9, and the switches that appear to short them out. These are the secondary limit switches, and are there to prevent damage to the motor and/or tracker frame in case the microcontroller stops responding.

If the tracker is driven past the point where the primary limit switches should have stopped it, the secondary switch on that side will open, thus cutting power to the motor. However, you need to be able to track the array back the other way, which is what the diodes are for. Each one allows the motor to run in the opposite direction to when it tripped the limit switch. This means that the frame can only be tracked away from the limit switch.



The controller. The micro is the little eight-pin device at lower-centre of the board. The dual relay is the black block at the top.

Driving the motor

As mentioned earlier, the motor is controlled by two of the output pins from the micro. However, one of those pins, pin 7, is also used when programming the micro, so you need to have a jumper or switch (marked J1 on the circuit) to connect the micro's pin to the appropriate point—the programming connector when programming, or R4 when the tracker is operating.

The outputs of the micro operate the relays (or in our case, a single relay with

dual coils and contact sets designed specifically for motor control) via transistors Q1 and Q2. The diodes connected in reverse polarity across the relay coils are there to absorb the energy from the coil when it turns off, preventing large voltage spikes from occurring.

Before we look at the software, just a short word on pin designations. When we talk about pin 3, pin 7 et cetera, we are talking about the physical standard IC pinout designations. The Picaxe software and documentation makes things a bit confusing as it numbers the pins according to function, so pin 0 is actually the physical pin 7, pin 1 is physical pin 6 et cetera. More information on this can be found in the Picaxe documentation available from the Picaxe website at www.picaxe.co.uk.

Software

Of course, the microcontroller won't do anything without suitable software. The program written for the prototype can be seen on the next page. As you can see, it isn't very long, and once loaded into the Picaxe, it only takes around half the available memory space of 256 bytes (yes, bytes), so there is plenty of space for customisation.

If you look through the program you should get an idea of how the controller functions. The main loop keeps polling the manual track and limit switches to see if they have been triggered. If the manual tracking switches are pressed and the limit switches haven't been triggered, the program jumps to the manual tracking routines. If the sun position sensor is triggered (ie if pin 3=0) and the limit switches haven't been tripped, then the program jumps to the west tracking routine.

When in this routine and the west limit switch is tripped, the controller knows that the array frame has tracked all of the way west and it is the end of the day, so it jumps to the sunset routine. This routine makes the controller wait for about four hours and then it tracks back east until the east limit switch is tripped or the time limit is reached. The sample program has this limited to 20 seconds, although this should be set to whatever is appropriate for your design. Give the controller enough time to drive the array all the way east twice. Time how long it takes to track from west to east and then double this figure. The timeout is required to protect the motor in case something becomes jammed in the mechanism and the array frame never makes it back all the way to the east.

The limit switches. The primary reed switch is on the right, the 10 amp secondary microswitch is on the left. The reed switch is triggered by a small magnet attached to the moving array frame.

Building it

We built the prototype on veroboard. It isn't pretty and the layout isn't optimal, but it works. You could take this approach, or design your own circuit board if so inclined.

Once you have it built and tested, there are a few things to be aware of when connecting it all up to your array frame and motor. I found that the electrical noise from the motor would cause the microcontroller to lock up all the time, and it took a bit of experimentation to eliminate the problem. I first started by connecting a 180nF polyester capacitor directly across the motor's terminals. This did the trick when testing, but when the whole rig was assembled the problem came back to some degree. I added a 680pF capacitor, followed by an inductor in the motor's power leads (I wrapped the leads around a ferrite core a few times) but this didn't fix it. What did was adding a 1uF bipolar electrolytic capacitor across the terminals. Obviously I needed a bigger cap to absorb all the energy of the spikes coming off the motor. I could probably have removed the other capacitors, but left them in place. After all, if it works, don't mess with it!

How much of a problem electrical noise will be with your tracker will depend on the design and layout. As can be seen in the photos, the controller board on the prototype was pretty close to the motor, so this was part of the problem, as was mounting the limit switch diodes on the PCB rather than at the motor.

Fitting the controller inside a sealed metal box (you need to fit it inside a sealed box for weather protection anyway, so it may as well be a metal one) and using shielded leads on the sensor and reed switch leads would help too. When building this design you will have very few problems if you follow the basic preventative measures outlined above. *

The ATA is considering producing a kit of this design if there is enough interest. If you would like to buy a kit (price is expected to be below $50) then email lance@ata.org.au to register your interest.

Solar tracker program for Picaxe o8M

```
symbol limit = b0
symbol manualtrack = b1
symbol loop = w1

main:
low 0
low 1
readadc 2,manualtrack                          ' Check to see if manual tracking buttons have been pushed
readadc 4,limit                                ' Check to see if limit switches have been triggered
if manualtrack>160 and limit<160 then manualtrackwest
if manualtrack<50 and limit>50 then manualtrackeast
If pin3 = 0  and limit<160 then trackwest      ' Check light sensor and if needs to track, then do so if limit
switch is not triggered.
goto main


trackwest:
for loop = 1 to 1000                           ' Provides a time delay so that relay doesn't jitter.
readadc 4,limit
if limit>160 then sunset                       ' If west limit switch triggered, go to sunset routine
high 0
low 1
next loop
goto main


sunset:
low 0
low 1
for loop = 1 to 14400                          ' Cycle 14400 times - 4 hour delay after sunset.
readadc 2,manualtrack
if manualtrack<50 then manualtrackeast
wait 1                                         ‘ Wait 1 second in each loop - 14400 seconds is 4 hour delay
next loop
goto trackeast
goto main


trackeast:                                     ' Track back east for next day routine
for loop=1 to 7700                             ' 20 second timeout. Approx 385 counts per second
high 1
low 0
readadc 4,limit                                ' Stop when east limit switch triggered
if limit<50 then main
next loop
goto main


manualtrackwest:
high 0
low 1
readadc 2,manualtrack
readadc 4,limit
if limit>160 or manualtrack<160 then main      ' If limit switch triggered or button released, stop and reset
goto manualtrackwest

manualtrackeast:
high 1
low 0
readadc 2,manualtrack
readadc 4,limit
if limit<50 or manualtrack>50 then main        ' If limit switch triggered or button released, stop and reset
goto manualtrackeast
```

The national picture

ReNew's regular policy columnist Alan Pears says that nuclear power is not the climate change silver bullet

The past year has brought a dramatic revival of nuclear power and uranium mine lobbying. For a comprehensive review of costs, waste management issues, risks of terrorism and nuclear proliferation, I recommend the website of the UK's Sustainable Development Commission: www.sd-commission.org.uk

The key new arguments from the nuclear lobby are based on its potential to help address climate change. Indeed, according to uranium advocates, Australia has a moral responsibility to provide its uranium to China and India to support global responses to climate change.

They also claim that environmentalists are now split, with some prepared to treat nuclear energy as the lesser of two evils, given the potentially devastating impacts of climate change. Pointing to divisions in the green movement is a powerful strategy that makes politicians feel more comfortable when taking a controversial decision—even if it's exaggerated.

In response to those concerned about nuclear proliferation, they claim it's too late to put the genie back into the bottle. Instead, if we sell more uranium we can supposedly have a say on how it's managed. Unfortunately, both major political parties seem likely to support uranium mining: the ALP is seemingly seduced by the possibility of a (very) few jobs and the potential to help our balance of payments problems.

To me, every extra kilogram of nuclear material in circulation is one too many. I don't want my children to face a world like the one I grew up in, when most young people wondered whether humanity had any real future because of the risk of nuclear holocaust.

Can today's politicians really have the naivety to believe that all future leaders will act responsibly on nuclear weapons, or that no-one working in a nuclear power station will ever make a silly mistake? Or that terrorists won't at some point want to make a really big statement?

The argument that energy efficiency and renewable energy can make nuclear power unnecessary has so far failed to gain traction: Peter Harvey on *60 Minutes* in April dismissed this vision as absurd, and he is not alone. We still face an enormous challenge to change this mindset. Renewables are painted as erratic and inadequate in scale. And few leaders can conceive that energy efficiency can slash our need for energy, despite examples such as new fridges using two-thirds less energy than those of the mid 1980s.

It seems obvious to many politicians (prompted by the uranium lobby) that we need a power source that produces lots of base load electricity. But much of our demand for overnight electricity is artificial: off peak hot water was promoted to find a use for excess coal-fired electricity. Cheap off-peak power has encouraged businesses to sloppily leave equipment on overnight and on weekends. In contrast, solar energy peaks on the hottest days, when conventional energy systems struggle to cope. A mix of renewable energy sources combined with smart management of demand can easily satisfy the energy service requirements of an energy-efficient society.

Politicians should also ask just what proportion of our energy needs could nuclear replace, as electricity provides only a fifth of Australia's (and most modern economies') energy. Do we want to risk our future on an option that won't even solve our energy problems?

I have worked on numerous projects that have painted visions of enjoyable and economically attractive futures based on sustainable energy. We have done computer modeling that shows it's possible and economic. Many *ReNew* readers live with these solutions and find them quite workable.

Yet it seems many politicians and business leaders simply cannot believe society can progress without massive quantities of subsidised electricity from coal or uranium. It's a worry.

Six big businesses break ranks

In early April, six major businesses—BP, IAG, Origin Energy, Swiss Re, Visy and Westpac—went public to argue that

we had to get serious about climate change. They presented economic modeling that showed acting now would be cheaper and less disruptive than waiting till later. This was a powerful statement from some of Australia's most successful businesses.

The response from the Herald Sun's financial writer Terry McCrann (11 April) illustrated the strategies used by powerful vested interests to block serious greenhouse response. First, ridicule them as naive and gullible victims of the Australian Conservation Foundation's propaganda. Then attack the economic modeling—done by the same people whose work is happily accepted when it produces the 'right' answers.

Thirdly, accuse CSIRO of bias. And finish off by suggesting that they are all acting in their own narrow interests—unlike the industry opponents of climate change response who are, of course, acting in the community's interests by protecting them from the draconian outcomes of doing something about climate change.

This kind of material is so obviously manipulative yet a lot of people read and believe it. But at least some business people are now thinking independently and speaking out. And when it's recognised that they are some of Australia's most successful businesses, maybe some will take what they say seriously.

Compact fluorescent lamps (CFL): what to regulate?

Recently we have seen the first steps towards regulating the energy efficiency of lighting in new homes. In New South Wales, BASIX allows points towards the required energy target to be scored by installing fluorescent lighting. In Queensland, 40% of the area of new homes must be lit by energy efficient lighting. This is exciting progress. But the two states have taken slightly different approaches. In NSW, fluorescent lamps must have permanently wired-in ballasts to qualify. In Queensland, CFLs plugged into standard bayonet fittings comply.

The NSW argument seems to be that if permanent fittings aren't installed, the efficient lamps will just be replaced by incandescent lamps when they fail. The Queensland argument is that plug-in CFLs are now widely available and cheap so they are likely to be replaced by new CFLs, while the range of permanently wired-in ballast light fittings available is very limited and often expensive.

I don't know which approach is preferable. In theory, if permanently ballasted CFLs were widely available, the NSW approach would seem better, as it locks-in ongoing use. Maybe the existence of the NSW regulations will drive market transformation, so they do become more widely available. The NSW government could even use other mechanisms such as its Energy Saving Fund to encourage such a shift.

But I can certainly understand the Queensland perspective, which responds to what is available, and its approach would work even better if it banned incandescent globes, or placed a substantial levy on them and used it to subsidise CFLs!

Both approaches are tackling an important lighting issue—avoiding installation of low-voltage halogen lights, which are driving household energy growth and greenhouse gas emissions.

We also need some way of overcoming a hidden problem associated with all types of recessed lighting: the removal of insulation around these lights by electricians for fire safety. Inspections of new homes have identified a common practice of removal of insulation batts around halogen downlights—effectively reducing the R value of the ceiling insulation from R4 to R2!

So halogens are undermining building thermal performance as well as wasting lighting energy and cooking people under their heat.

www.arkive.org

There is an amazing array of life on planet Earth, but with the ever expanding human population, many other species face extinction. You might not realise just how many species are in trouble, but a visit to this website is a real eye-opener.

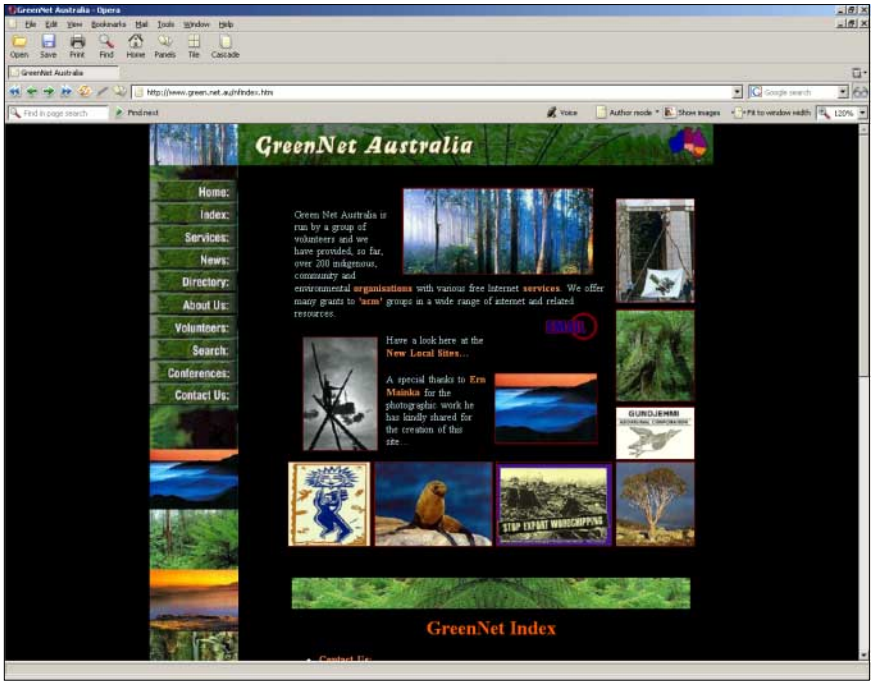
The site is basically a photo and video archive of many of the Earth's endangered species. They are categorised into groups such as mammals, birds, amphibians, invertebrates, plants and fungi, with each section alphabetically sorted.

The listing for each creature has information on the species status and where they are found, as well as a general description of the animals. Clicking on the 'more information' link takes you to a detailed page with additional information on their range, habitat, details on biology, the threats they face, and the conservation efforts made to help protect them to date.

This is a great site, both for children looking for information for school projects, and for adults who may have forgotten just how many species exist on this planet that need our help.

www.green.net.au

As you might suspect from the URL, this is a site dealing with environmental issues. Run by a group of volunteers, green.net.au offers internet services to other environmental organisations and groups. As a result, their website is a great place to start browsing when looking for environment and social justice groups.



Clicking on the environmental directory link takes you to an alphabetical list of group categories, including alternative energy and technology, educational and research sites, environmental policy, festivals, Australian flora and fauna, industry, trade and government, indigenous culture, wilderness, and many other categories.

A community forum allows anyone to post messages, and the site hosts a large number of online conferences from a range of organisations. The site also hosts the Australian Community Directory and the Australian Cultural Directory.

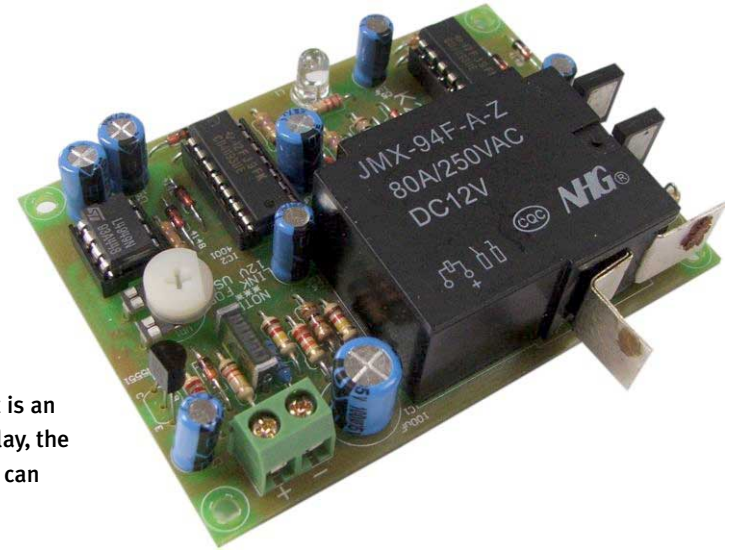
Green.net.au is a great place to start if you are looking to become more involved in environmental issues. For organisations looking for basic internet services such as a web page or email address, it's also worth having a browse.

Add a second battery to any power system

This dual battery adaptor kit from Oatley Electronics allows you to add a second battery to your vehicle or solar power system while preventing the main battery from being flattened. Branko Justic describes how it works

Many vehicles have dual battery systems—one battery is the main starting battery, while the other is often a deep cycle battery that stores extra energy for use with appliances and inverters.

This kit simply switches the auxiliary battery across the main battery when the main battery voltage exceeds a set voltage, say, 13.5 volts in a 12 volt system, or 27 volts in a 24 volt system. Typically, when the battery voltage reaches this level it means the battery is being charged by the vehicle's alternator, and so the auxiliary battery will be charged this way too. When the voltage drops, such as when the vehicle engine is stopped and is no longer providing charge, then the auxiliary battery is disconnected from the main battery so that the loads connected to the auxiliary battery don't flatten the main starting battery.



The heart of the kit is an 80 amp latching relay, the big black block you can see here.

How it works

When the auxiliary battery is first connected across the main battery, the combined paralleled battery voltage can drop to a lower figure for a short period of time. To prevent possible chattering of the relay during this time, a 30 second delay is included so that the auxiliary battery is not isolated unless the combined battery voltage is still below 13.5 volts after this period. We have tested this unit in a vehicle with a discharged auxiliary battery (flattened to around 10 volts). At the point when the auxiliary battery was connected, the peak current was around 15 amps. The battery voltage quickly rose to over 13.5 volts, at which point the charging current of the auxiliary battery reduced to around 5 amps.

The unit features a status indicator LED. With the LED disconnected the stand-by current of this unit is around 50uA. Adding the indicator LED increases the average stand-by current to 500uA (0.5 milliamp). A high current (80 amp) single coil latching relay is used for switching between the batteries. A latching relay only consumes power when it is being pulsed on or off, as internal magnets are used to keep the contacts in the selected state with no power applied to the coil.

The following more detailed explanation assumes that the 12 volt link is in place for use in a 12 volt system.

At the heart of the circuit is IC1 (an L4949) which is a monolithic integrated 5.0 volt voltage regulator with a very low dropout voltage and additional functions such as power-on reset and input voltage sense. In this circuit, only the voltage sensing comparator and the 5 volt regulator sections of this IC are used.

Pin 2 is the input pin for the battery sensor section of the IC. When the voltage at this pin falls to 1.24 volts, the open collector output on pin 7 is pulled internally to ground.

When the voltage at pin 2 rises to 1.34 volts the internal transistor at the output (pin 7) is turned off. With the 12 volt link in place and with the switch on, the output switches at 13.2 volts with the potentiometer in the maximum anticlockwise position, and 15.2 volts when in the maximum clockwise position. The transistor will turn on when the voltage drops to around 0.5 volt less than these figures.

The logic in detail

For the following sequence, assume that the main battery voltage has been low for a few hours. If you don't want to understand the circuit in this level of detail, then you might want to skip this section.

When the battery voltage is low, the transistor in IC1, whose open collector output is connected to pin 7, is switched on, so the output at pin 7 is at logic '0'. IC2A, IC2D, C6, R9, D2 and D3 form a monostable. The trigger input for this monostable is at the input of the inverter gate IC2A, and the output is at pin 11

Parts list

1 PCB coded K227
1 12 volt 80 amp latching relay
1 two-way PCB mount screw terminal block
1 8 pin IC socket
2 14 pin IC sockets
1 L4949 IC
1 4011 quad OR gate IC
1 4093 quad NAND gate IC
2 P239 N-channel MOSFET
1 2N5551 transistor
1 high intensity red LED
1 15 volt 400mW zener diode
9 IN4148 diode
1 22nF polyester
1 100uF 35 volt electrolytic
3 100uF 16 volt electrolytic
4 1uF 16 volt electrolytic
1 1K ¼ watt resistor
1 2K2 ¼ watt resistor
1 6K8 ¼ watt resistor
1 12K ¼ watt resistor
2 22K ¼ watt resistor
2 91K ¼ watt resistor (for low voltage cut-out)
2 100K ¼ watt resistor
2 120K ¼ watt resistor
5 470K ¼ watt resistor
2 22 ohm 1 watt resistor
1 2K horizontal trimpot

of IC2D. The input is pulled to '0' by R8 and the output is at '0' since the input to the inverter IC2D is pulled high by R9. Note that capacitor C6 is discharged since both of its sides are at logic '1'.

If either or both of the inputs of NOR gate IC2B are at '1', its output would be at '0'. Since both of its inputs are at '0' its output would be at '1', the output at IC2C is at '0' and the output of IC3A is at '1'. IC3B, R10, R11, D5, D6, and C7 make up a simple low-duty-cycle oscillator. This oscillator flashes LED L1 at about 4Hz via isolation diode D4. Since the input to this oscillator gate pin 5 is at '1', the oscillator is enabled and L1 would flash indicating that the battery voltage is low.

Note that capacitor C8 is discharged since both of its sides are held at logic '1'. Similarly, C9 is charged since the output of IC2C is at logic '0'.

Now we will look at a sequence for when the battery voltage is high.

When the voltage is high, the transistor in IC1, whose open collector output is connected to pin 7, is turned off, so the output at pin 7 is pulled to logic '1' by resistor R7. The input of the monostable is pulled to a '1' via D1, and the output of IC2A goes low. The input of IC2D is also pulled low by the discharged capacitor C6 and the output of IC2D is at logic '1'. The input to the monostable would be kept at logic '1' via the isolating diode D2 even if the battery voltage goes low. Capacitor C6 and resistor R7 determine the duration—around 30 seconds. Either or both of the inputs of IC2B are at '1' and its output is at '0', the output of IC2C is at '1', and the output of gate IC3A is at '0'. LED L1 would light continuously, deriving its current through R12 and the forward biased diode D7. This indicates that the auxiliary battery is being charged.

At the transition when the battery voltage goes high, the output of IC3A goes low. Since C8 was discharged the inputs of IC3C go low and its output

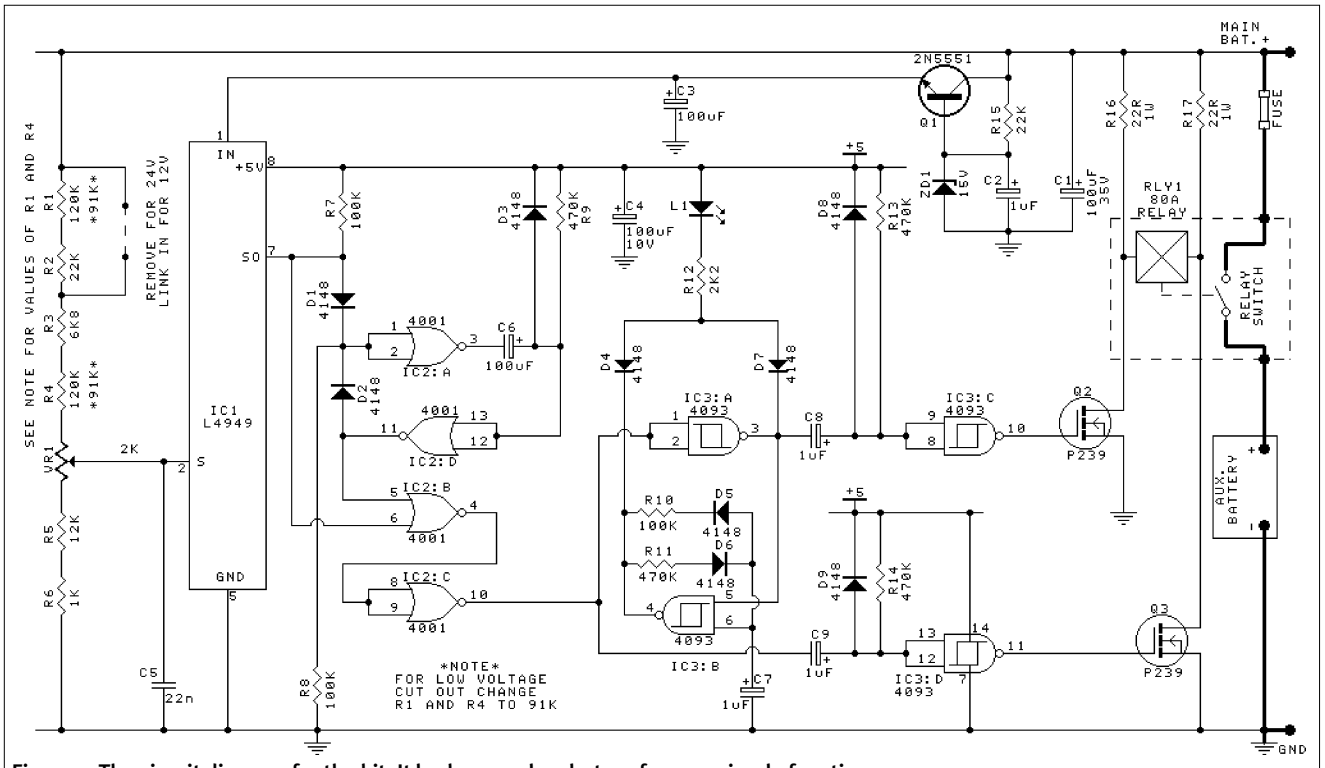


Figure 1. The circuit diagram for the kit. It looks complex, but performs a simple function.

goes high. MOSFET Q2 is turned on for a time determined by R13 and C8—around half a second. During this time a current is applied to the coil of the latching relay RLY1 via R17 and the contacts make. Similarly, at the transition when the battery voltage goes low, the output of IC2B goes low. Since C9 was discharged the inputs of IC3D go low and its output goes high. MOSFET Q3 is turned on for a time determined by R14 and C9—again, around half a second. During this time a current is applied to the coil of the latching relay via R16 and the contacts break.

And that's how it works! It is interesting that this project doubles up as a low voltage cut-out for a 12 or 24 volt battery. Simply by changing R1 and R4 to 91k instead of their existing value of 120k the cut-out voltage is adjustable between 10 and 11.7 volts. The drop-in voltage is about 0.6 volt above these figures.

This circuit is sold in kit form by Oatley Electronics in Sydney (kit K227), ph:(02) 9584 3563, www.oatleye.com.au. For notes on building and using this kit, see one reader's experiences as detailed in the following article.

ReNew reader Ross Dannecker shares his experience of using the kit with his solar energy system

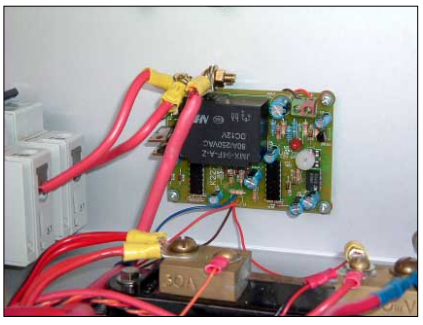
It is common practice in power systems incorporating a battery to include some means of automatically disconnecting the load when the battery terminal voltage falls below a preset value. This is principally done to save the battery from total discharge, which can be disastrous for lead-acid and some other battery types. Even if the battery is able to be recharged after a total discharge, it is for certain its lifetime will have been greatly reduced. 240 volt inverters often incorporate a low-voltage cut-out circuit, but any DC load connected directly to the battery will not usually include a low-voltage disconnect.

The solar power system at my weekender was typical. A simplified block diagram is seen in Figure 1. While the 240 volt AC inverter will shut down if the battery voltage falls below about 11.7 volts, the 12 volt DC load will continue to discharge the battery. I had thought about adding a low-voltage disconnect circuit but the options for a switch posed some problems:

- a relay with normally-closed contacts would consume power on disconnect that would continue to discharge the battery—high current relays normally have a higher current consumption themselves
- a relay with normally-open circuits would consume power under normal conditions
- an array of low-resistance FETs would be feasible, but my experience is that FETs make excellent (if expensive) fuse protectors
- a magnetic latching relay with high current contacts would solve these problems, but I couldn't economically source one with 50 amp contacts or greater.

In the end, I just added a low voltage detector to the metering to flash a LED and sound a beeper if the battery voltage fell below 11.7 volts. If I was present, I could then manually take appropriate action.

However, Oatley Electronics recently released a new kit designed to automatically switch an auxiliary battery in parallel with the main battery in a vehicle when the voltage of the main battery exceeded, say, 13.5 volts. The main thing that drew my attention was the device used for the switch in the kit—a 12 volt, 80 amp magnetic latching relay—and the price of the whole kit is $19!



The circuit board in Ross's system. We recommend mounting it inside an insulated enclosure if you can.

Well, if you can connect and disconnect an auxiliary battery, then you can use the same circuit to connect and disconnect a DC load instead. Oatley had realised this, and included a very simple modification for the kit to do this at a lower voltage. So I purchased a couple of kits to give it a try. The result so far? The kit is simple to build and works well.

The measured current consumption of the 12 volt unit is less than 0.5mA. It can be set for either 12 volt or 24 volt operation. Only two resistors need changing to make it a low-voltage disconnect circuit and these are included in the kit. The documentation included describes the circuit operation and has a circuit diagram and good component layout diagram. There are no notes on construction, so here are a few to aid the less experienced constructor. Note that the component numbers on the circuit board may not be correct but all the values are. Use the component layout drawing provided in the kit's instructions as it is correct.

Check the relay by applying 12 volts to the coil (the two pins on the underside close together) first one way then the other. The relay should click fairly

loudly and continue to do so with each reversal.

Construction

Insert and solder 1N4148 diodes noting polarity. I omitted D7, as I didn't want the red LED indicator to light continuously during normal battery voltage conditions. I felt this was a distraction and consumed current unnecessarily. The LED flashes in the low-voltage disconnect state.

Next, install the 15 volt zener and all resistors except the two 22 ohm. Use the two 91k resistors provided, not the two 120k resistors, for low-voltage disconnect operation. Leave enough clearance to later fit IC2 and IC3—bend R13 and R8 away a little from the IC outlines.

If the unit will be used for 12 volt operation, solder in the wire link. Then install VR1, IC1, IC2, IC3, Q1, M1, M2. In the past I have had more trouble with poor contacts in IC sockets than they are worth so I just solder the ICs directly (if you are inexperienced at soldering electronic circuits then use the sockets). Make sure IC2 and IC3 are properly seated before soldering.

Now, install the capacitors, noting the polarity. I replaced C5 with a 47uF, 6 volt tantalum capacitor to make the circuit more immune to any transient low voltage conditions. The positive end goes to VR1.

Now fit the remainder of the components, with the relay soldered in last.

Testing is quite simple—a variable voltage power supply will help but is not essential.

Rotate VR1 fully clockwise. This will give a low-voltage cut-out in the range 11.5 to 11.7 volts and a cut-in voltage about 0.5 volt greater. Use a variable voltage supply and an accurate digital voltmeter to set the cut-out point to 11.5 volts. Adjust the voltage in steps of 0.1 volt and wait 30 seconds for any response from the circuit. If you don't have a variable voltage supply, just leave VR1 in the fully clockwise position. You could check operation by carefully tapping off 10 volts from the battery bank. (Double all these values for 24 volt operation.)

If all is okay, then spray both sides of the circuit board with printed circuit board lacquer sealant. This is a very wise thing to do to any circuit board, particularly if you live in a hot and humid or seaside area.

The LED indicator is easily mounted external to the circuit board if required.

Connecting to the relay contacts is the most challenging bit. The relay comes with two short leads with lugs containing bolt holes and it may be possible to mount the board in a position to utilise at least one of these. Alternatively you could bolt leads with lugs to both and insulate them. I found it was quite possible to cut the short leads off the relay and solder directly to the relay lugs. I was careful not to overheat the relay while soldering.

The kit as supplied also includes two 150 ohm resistors. There is no explanation in the circuit description as to what they are for. I suspect they are to replace the two 22 ohm resistors used with the relay coil for 24 volt operation as the DC resistance of the relay coil is about 150 ohms.

I actually bought four kits and two spare relays as I had applications for three. I did discover a tolerance issue which is most probably in the relays. While I could get three kits to function, the fourth didn't want to pull in the relay reliably. I therefore tried the two spare relays. One functioned okay while the other didn't. All the relays worked with 12 volts directly applied to the coil. I then checked the relay driver circuit voltages with a CRO (cathode ray oscilloscope) and found that during the pulses there was about a 2 volt drop across each FET when it conducted. Add about 0.5 volt across the relevant 22 ohm resistor and that's only 9 volts across the coil at low-voltage disconnect and 9.5 volts at reconnect.

I replaced the FETs in one kit with 2SK2175 FETs I had on hand. These are logic gate level (5 volt) FETs. The result was that the CRO now showed less than a 0.3 volt drop across each FET when pulsing the relay and the two formerly suspect relays now worked quite reliably. I therefore retrofitted all four kits with 2SK2175 FETs. Unfortunately I couldn't find any datasheets on the P239 FETs supplied by Oatley, so I can't ascertain as to whether they are logic level FETs or not. Regular FETs need more than 5 volts on the gate to conduct fully (Oatley Electronics are now supplying the kit with 2SK700 FETs to fix this problem—Ed).

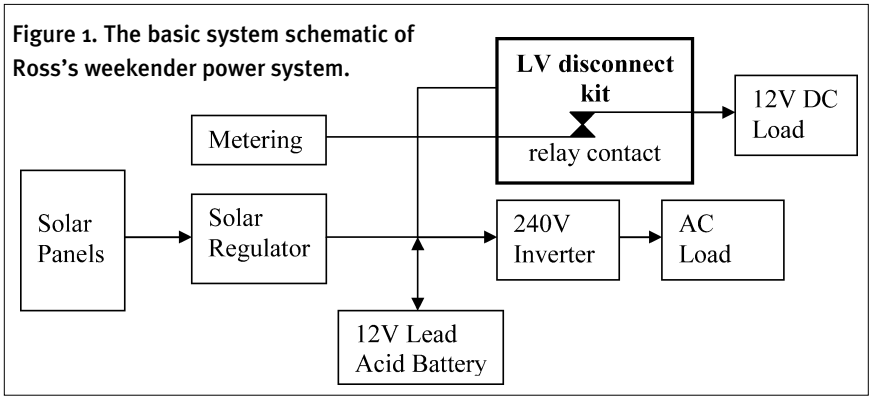


Figure 1. The basic system schematic of Ross's weekender power system.

AquaPak

Providing pathogen-free drinking water can be difficult, if not impossible, without some form of water treatment. The simplest method is to heat the water to a temperature that kills most bacteria, viruses and parasites, but often the fuel needed to do this isn't available.

The AquaPak, developed by Solar Solutions Laboratories in the USA, is made from low-cost polyethylene plastic (also used in food preparation boiling bags) with UV inhibitors added, and air-filled bubble wrap sheeting (originally developed for the packaging industry). The edges of the plastic layers are bonded using tapered seals so the AquaPak can pass a 10 foot (3 metre) drop test.

Using only sunlight, it can heat water to temperatures above 67°C, a temperature that will kill all waterborne pathogens. In independent tests on virus-contaminated water and bacterial pathogens, the AquaPak eradicated over 99.99% of pathogens.

Designed to be mass produced using labour in third world countries, the AquaPak can be manufactured for as little as US$1. The AquaPak employs a reusable sealed glass tube indicator—called a WAPI—filled with coloured wax at one end that melts when the required temperature is reached, indicating the start of the pasteurisation process. Depending on the availability of sunlight, an AquaPak can produce over 14 litres of water per day, enough safe drinking water for a family of four.

RRP: US$19.95

For more information contact Solar Solutions, 10080 Willow Creek Road, San Diego California 92131, ph:+1 858 695 3806, fax:+1 858 695 3807, email: contact@solarsolutions.info, www.solarsolutions.info

Dimmable compact fluoro

Compact fluoros are great for reducing your lighting energy consumption, but if you try to dim them, they usually die rather rapidly.

The Environment Shop now has two sizes of dimmable CFLs that actually work quite well. They can be dimmed down to just 25% of maximum output, and produce no flickering even when fully dimmed. They have spiral tubes for compactness and maximum light output in fittings where the lamps are mounted vertically, and are available in two wattages (13 and 20 watts), three colour temperatures (warm white, cool white, and daylight), and both BC22 and ES27 bases.

RRP: $29.95

Available from The Environment Shop, 221 High St, Northcote VIC 3070, ph:(03) 9489 4855, www.environmentshop.com.au

Solar panels from Oatley Electronics

These two new 12 volt solar panels from Oatley Electronics are ideal for many smaller solar power systems, such as weekenders, boats, small lighting systems and electric fences.

The SP20 is a 20 watt polycrystalline panel with an output current of 1.1 amps at maximum power, while the 10 watt SP10 has a rated output current of 0.57 amps. Oatley Electronics states that these ratings are very conservative as they have measured similar figures in late afternoon autumn sunlight.

The panels are waterproof, aluminium framed and covered with tempered glass. Connections are made to screw terminals inside a small box at the rear of the panel. The SP20 measures 610 x 290 x 25mm and weighs 2.3kg while the SP10 measures 330 x 290 x 25mm and weighs 1.3kg.

RRP: $219 for the SP20, $124 for the SP10.

Available from Oatley Electronics, PO Box 89, Oatley NSW 2223, ph:(02) 9584 3563, fax:(02) 9584 3561, email: sales@oatleyelectronics.com, www.oatleyelectronics.com

Ampair 300 finally arives

Conergy Pty Ltd is the exclusive importer of the new Ampair Pacific 300 wind turbine into Australia. The Ampair is available in 12 and 24 volt DC and 3-phase AC (for grid-connected systems) versions and is rated at 300 watts output at 12.6m/s wind speed. It has a 1.2 metre diameter glass-filled polypropylene rotor, diecast aluminium powder-coated body and weighs 11kg. It is ideal for battery charging in small and medium renewable energy systems, boat battery systems and even campervan and caravan systems.

The Pacific 300 features automatic blade 'pitch control' to help regulate output and all components are sealed to prevent corrosion. They are said to be smooth running, quiet and vibration free. They have been engineered primarily for marine applications and as such should be a robust and well-made turbine. The previous Ampair, the Pacific 100, has a reputation for reliability.

RRP: $2750 including GST, not including regulator and stop switch.

For further information, contact Conergy Pty Ltd, Suite 33, Jones Bay Wharf, 26-32 Pirrama Rd, Pyrmont NSW 2009, ph:(02) 8507 2207, fax:(02) 8507 2220, email: m.lambert@conergy.com.au, www.conergy.com.au. Also see www.ampair.com

Get the tank off the roof

Solar hot water systems with the tank on the roof can not only pose a weight problem for modern house construction, they can also look unsightly and may not be allowed by some councils.

EcoSmart solar water heaters are split level systems, with the solar collectors on the roof and the tanks at ground level, making for a nice looking installation. The systems are available with electric or gas boosting and there is even an instantaneous gas-boosted system for unlimited hot water.

The EcoSmart hot water system includes what the company calls 'HotLogic processor technology' which, according to the manufacturer, 'constantly searches for, and switches to the most cost-effective energy source available. It adapts water circulation to suit changing weather conditions so that the longevity and efficiency of the EcoSmart hot water system is maximised even in the depths of the winter season.'

RRP: from $3140 before rebates.

Manufactured by GWA. For more information call 133 326 or go to www.ecosmart.com.au

Versatile trolleys

There are bike trailers, and there are shopping trolleys, and then there is the Max trolley from My Smart Trolley, which is both.

The trolley can be used in shops and the basket can be easily detached with its shopping contents and stowed away in the boot of your car, so no shopping bags are required. Or, if you prefer to walk, the trolley converts to walking mode.

It can also be used as a bicycle trailer by attaching a drawbar to the trolley handle, which connects to a universal coupling on the back of your bike. This makes for a very flexible trolley—you are able to ride with your trolley to your local shopping centre, use it as your shopping cart, then attach it back onto your bike, pull over the flexible cover and you're away.

The trolley features an aluminium frame for lightness (it weighs 7kg), ball-race wheel bearings, and has a maximum allowable weight of 40kg. The Swiss-made Max trolley comes in four colours—ocean blue, light blue, grey and orange, and comes with a one year warranty.

RRP: $249 for the trolley, $54 for the drawbar and $15 for the universal coupling.

Available from My Smart Trolley, ph:0410 403 230, email: orders@mysmarttrolley.com.au, www.mysmarttrolley.com.au

Three-in-one gensets

Most gensets can supply AC or DC, very few being able to provide both, and most of the AC gensets that have a DC output can only slow-charge a battery, making them next to useless for charging large battery banks. The Combo genset from Wattagan can not only output both AC and DC, but can also be used as a welder!

The genset is available with 12, 24 or 48 volt DC outputs, with either petrol or diesel engines, the latter being ideal for use with commercial biodiesel (although this may void the engine warranty), with one small change to the engine (replacing the rubber fuel line). The DC output means you don't need to buy a separate battery charger for charging your batteries, and you can use the AC output for powering large loads that might strain your inverter, such as power tools.

Rated outputs are 4.2kW AC (with voltmeter and adjustable voltage with circuit breaker for protection), maximum DC of 100 amps at 24 volts (or 50 amps at 12 volts), and welding current of 80 to 200 amps. Note that the genset can't be used for AC power or welding while it is in battery charging mode, and it can't battery charge while supplying AC or welding current. However, it can still produce AC while welding.

The DC charging output features a charge controller to ensure full output and accurate charging, automatic stop when charging is complete, adjustable charging voltage to suit different battery types and applications, adjustable current limiting to avoid overcharging or overloading the engine, and adjustable absorption time. Other features include optional engine, alternator and battery temperature sensors, electric and manual start, wheels for moving the genset about, large capacity fuel tank, and a large and effective muffler. The unit weighs 90kg.

RRP: $2750. The 48 volt and diesel options are both $200 extra.

Available from Wattagan Innovations P/L, ph/fax:(02) 4998 8183, email: watin@bigpond.com, www.wattagan.com.au

Cleaner burning firelighters

A lot of firelighters use kerosene soaked into an absorbent medium, and they certainly smell like it when you burn them! Sureburn firelighters are made from plantation sawdust impregnated with vegetable wax. They are waterproof, clean to handle, and because they don't contain any petroleum products, don't leave an oily residue on hands or clothing.

According to the manufacturer, the firelighters don't give off fumes while burning (we would expect some fumes as they are based on wood after all) and are very quick to light. They are ideal for starting combustion heaters, barbeques and for camping.

RRP: None set, varies between retailers.

Available from selected outlets. For more information and a list of suppliers contact Sureburn Firelighters, ph:(03) 5152 4718, email: colin@sureburn.com.au or go to www.sureburn.com.au

Greenhouse neutral paint?

Dulux has recently introduced a new eco-friendly paint that they say is greenhouse neutral. It is a Greenhouse Friendly (an Australian Greenhouse Office program) certified product, as emissions from the production, use and disposal of the product have been balanced with reduced emissions in other areas by the Dulux greenhouse abatement program.

EnvirO2 is a range of interior paints, including preparation and topcoat products, that are low in VOCs (volatile organic compounds), washable and available in a large range of colours. The paints meet maximum VOC content compliance criteria in IEQ-11 of the Green Building Council.

Dulux also have a new water-based enamel, Aquanamel, which is designed to replace the toxic and very smelly oil-based enamels. Aquanamel is also greenhouse neutral.

Available from Dulux stockists. For more information go to www.dulux.com.au and search on Enviro2.

Rechargeable camping lantern

This camping lantern is a great little unit. It uses eight power LEDs (totalling around three watts) to produce more than enough light for most camping uses.

The lantern has five brightness levels, so that you can extend the runtime. If you do need to recharge the supplied 4.5Ah batteries (which are removeable standard sized D cells) you can use either mains power from the supplied plugpack, a 12 volt source such as a car, or the supplied 2.5 watt solar panel.

Not only that, but the lantern comes with a cable and lots of different adaptors for charging and running devices such as mobile phones (Nokia, Motorola, Samsung, Ericsson and Siemens), walkmans et cetera, making this a very versatile lantern. The top of the lantern even contains a compass, just in case!

The lantern measures 250mm high by 108mm diameter.

RRP: $99.

Available from ATA, level 1, 39 Little Collins St, Melbourne VIC 3000, ph:(03)9639 1500, email: orders@ata.org.au, shop.ata.org.au

A smarter pump

Most mains pressure pumps use a pressure switch to turn the pump on and off. This results in pressure fluctuations, as well as wear and tear on the pump, and regular cycling can waste precious energy from your battery-based energy system.

Shurflo has developed a new DC pressure pump that uses a smart controller and pressure sensor to eliminate the mechanical pressure switch. By continuously varying the speed of the pump motor, pressure is accurately controlled, while pump noise and vibration is reduced.

The pump uses a five-chamber diaphragm pump head and will provide a flow of up to 21 litres per minute. The pump is available in both 12 and 24 volt versions to suit many systems.

RRP: $396 for the 12 volt unit, $429 for the 24 volt unit.

Available from Choice Electric, ph:(07) 3868 1999, email: choice@choiceelectric.com.au, www.choiceelectric.com.au

Greener copy paper

Despite the 'recycled' moniker on many office copy papers, they usually contain no post-consumer waste paper at all, instead being made from trimmings from the paper production process, meaning they are all virgin fibre usually sourced from forests. However, there are alternatives, a number of which are available from SCRAP (school communities recycling all paper), an organisation set up to promote the recycling of waste paper from schools.

SCRAP have their own online shop where you can buy various truly recycled and alternative fibre papers, including Evolve (100% post-consumer recycled), Canefields (75% bagasse—sugar cane waste and 25% virgin plantation pine fibre, although it is chlorine bleached), Canon 100 (50% post-consumer), Canon Colours and Canon Parchment (plantation timber, 100% chlorine free and food colouring inks), Steinbis Vision colours (100% post-consumer, unbleached) and Denim Blues card (100% denim textile trimmings).

Prices are similar to virgin fibre papers, so there really is no reason to be using such ecologically damaging products. For example, A4 Evolve is $5.94 per ream (when buying five reams), Canefields is $6.95 (five ream price) and the coloured papers range from $8.80 upwards per ream (these are member prices which include a 15% discount). SCRAP also have toilet and facial tissues, exercise books and other products available.

Available from SCRAP, ph:(02) 9825 1062, fax:(02) 9825 6972, email: support@scrapltd.com.au, www.scrapltd.com.au

What can I do?

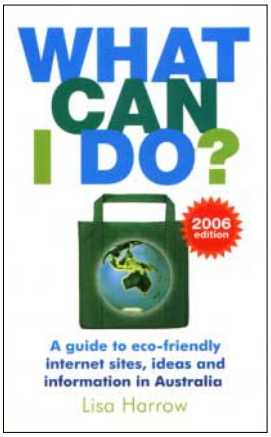
Lisa Harrow
RRP: $12.95
Published by Hodder Australia
ISBN: 0 7336 1995 9

What Can I Do? is a handy sized guidebook, listing eco-friendly internet sites covering a broad range of topics such as energy efficient lighting options, becoming a conscious consumer, joining a car share community, ethical investment opportunities, community supported agriculture and much more.

If you are going to use the index you may find that it takes time to become familiar with the classification system that has been used. ATA, for instance, is found under 'Building Green' and not in 'Action', where a number of environment groups are listed. You could instead choose to flick through the pages, discovering new sites at random.

Some sections, like 'Bicycles', look a bit bare and initiatives such as Deadly Treadlies (a bike rebuilding project for young people operating in Alice Springs) or organisations such as Brunswick Bicycle Users Group (a discarded bicycle recycler and bike repair shop) are missing. However, you can email the author with anything that you think needs to be included or updated in the next edition.

Scattered throughout the guide are short snapshots entitled 'People Who Did'—inspiring personal accounts of how some of the included internet sites began. These accounts, together with Margaret Mead's insightful quote in the postscript, 'Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed it is the only thing that ever has', may inspire you to implement your own eco initiative.



If you are looking for some positive action you can take to make a difference and help care for our environment, Lisa Harrow's *What Can I Do* is a guide that will enable you to get started with minimal effort. Even if you are already environmentally aware, you will still find this simple book incredibly useful for discovering organisations or initiatives that somehow you have never come across.

Reviewed by Wendy Clarke

Climate change: turning up the heat

Barrie Pittock
RRP $39.95
CSIRO Publishing
ISBN: 0 6430 6931 3

I had this review substantially written when less than halfway through the book—but I just had to read to the end out of interest.

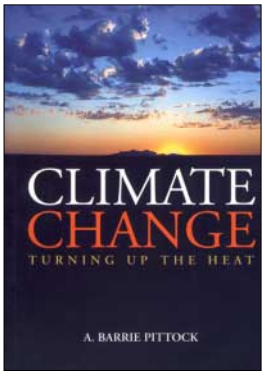
Unlike many other books on the topic, *Climate Change: Turning up the heat* is without hype or bias I could detect. It is a reasoned and reasonable examination of the evidence, with full consideration of how that evidence is generated.

This leads Dr Pittock to establish some well founded conclusions such as:

- The planet is warming up and such warming will accelerate
- It is possible that some of this warming is due to natural periodic variations. However, this is a minor factor, due to the unprecedented amount and rate of change in relation to data mapping over the last 10,000 years
- There are well-understood (and well-explained) mechanisms that tie various human activities to climate change
- Not only do we need to worry about gradual change, but also about sudden catastrophic changes as certain thresholds are exceeded.

Dr Pittock goes on to show that while adaptation (living with the changes) is necessary, it won't be enough. Mitigation (reducing future impact by current action) is also required. There are no surprises in his recommendations on how to go about this, but the book will provide plenty of motivation for governments, business and individuals to do everything possible, now.

However, this is not a doomsday book. If you are an environmental activist, read this book so that you can increase your understanding. If until now you have dismissed climate change as false, irrelevant to your life, or too expensive to do something about, then you owe it to yourself to find out the facts.



Climate Change: Turning up the heat is a serious work that would be an excellent tertiary-level introductory text for studying climatology. At the same time, the language and logic of presentation are clear enough to be understood by a high school science student, without minimising the complexity of the subject. I find this to be a remarkable achievement. Dr Pittock is not only a distinguished scientist, but also a champion communicator.

Reviewed by Dr Bob Rich, a multi award-winning writer, with 13 published books. www. bobswriting.com

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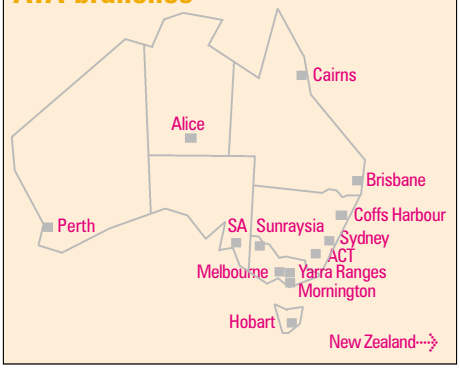
• Alternative Fuels 10% • Aqua Block 10% • Aqua Clarus 10% • Australian Correspondence Schools 5-15% • Biome Living 10% • BP Architects - free 'Green House Plans' book • B/W Solar 10% • CERES nursery 5-10% • Cycletrek Bunbury WA 5-10% • Design Habitat $200 off ResCode assessment • Earth Basics 10% • EcoSouth $250 off power systems • Environment Equipment 5-10% • Everglaze Industries 5% • F2 Design - free energy rating with design sketch • Federal Batteries 10% • Going Solar 10% • InSolar 10% • Metcalf Building Consultants 10% • Natural Paint 10% • NENSYS New Energy Systems 10% • Outback Energy Supply 10% • Pearcedale Conservation Park 10% • Permaculture Visions 10% • PV Solar Energy 10% • Sandford Electronics & Solar 10% • Sharpe & Jephcott 10% • Smartflo 10% • Sola-Kleen 10% • Solar Charge 10% • SolarTasmania 10% • Solartec Electrical Services 10% • Solazone 5-10% • Sustainable Impact 5%, plus 5% donation to ATA • The Environment Shop 10% • The Solar Shop $300 off complete home solar package • Tri Nature Greensborough (VIC) distributor 10% • Wattagan Innovations 10% • Wren Industries 20% • Yarra Energy 5%, plus 5% donation to ATA. NB: the ATA website has full details of member discounters outlets.

ATA branches



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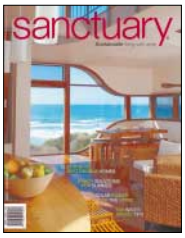
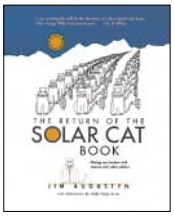


Sanctuary magazine

Price: $9.95 plus $2 postage

Sanctuary: sustainable living with style is an exciting new benchmark title for people looking to create or renovate a home which offers the latest in sustainable design. *Sanctuary* brings together 15 of Australia's leading sustainable architects and building designers.

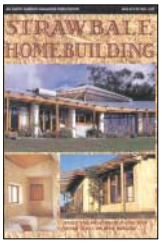


Solar Cat book

Price: $32.95 ($25.00 for ATA members).

Learn about renewable energy in a simple and lighthearted way with the solar cat book.

Item code: SCB



Strawbale Homebuilding

Price: $19.95, Paperback, 156 pp

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

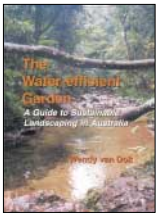
Item Code: SBH

The 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*



ATA Booklets series: Solar Hot Water

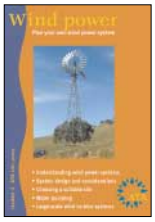
Price $10 each inc postage ($8 for ATA members)

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

ATA Booklets series: Wind Power

Price $10 each inc postage ($8 for ATA members)

This is our new wind power booklet. In it you will find all the information you need to get an understanding of wind power electrical and water pumping systems, how to size and install them correctly, how to look after them, safety requirements and a great deal of other information.



Your Home Technical Manual

Price: $49.50. NB: $10 postage on this item

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.

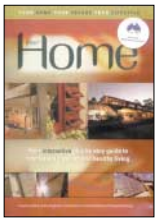
Contains over 60 fact sheets on sustainable solutions for designing and building your home. *Item code: YHTM*

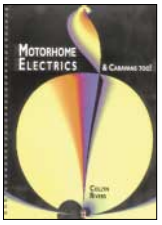
Your Home Technical Manual DVD

Price: $27.50

This DVD allows you to virtually visit some of the most beautiful, innovative and low-maintenance houses in the country. Be inspired as you take a visual tour of some of Australia's most comfortable and stylish homes, created by leading architects and designers.

Item code: YHTMDVD





Motorhome Electrics & Caravans Too!

Price: $35 ($33 for ATA members)

Running motorhome and caravan electrics from solar is neither difficult nor complicated. Planning is relatively simple, and anyone comfortable with basic tools can do it. This book is a down-to-earth guide to getting it right the first time.

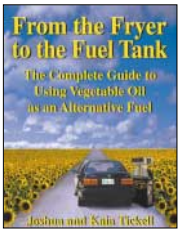
Item code: MECT

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*



The Composting Toilet System Book

Author: David Del Porto and Carol Steinfeld

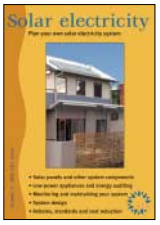
Price: $40.00, Paperback, 236pp

This book shows you how to choose, install and maintain a composting toilet system to meet your needs. *Item code: CTSB*

ATA Booklets series: Solar Electricity

Price $10 each inc postage ($8 for ATA members)

Covers all the basics you need to know when designing a solar power system. Includes panel types, batteries, controllers, inverters and many other aspects of solar energy systems.



Renewables on CD ROM

ReNewROM II

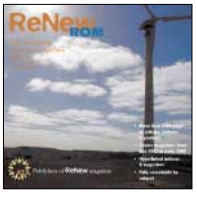
Price: $65 ($30 for ATA members) plus $4 postage

The third CD ROM in the series, and covers issues 71 to 89 of *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 19 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM2*

ReNewROM

Price: $65 ($30 for ATA members) plus $4 postage

The second CD ROM of the series, covering 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*



Cool new products

Computer connect wireless weather station

Price: $399 ($379 for ATA members)

We now have a new computer-connect weather station available that comes complete with display software which presents all the current weather data on one easy-to-read display on your computer. The weather station monitors indoor and outdoor temperature and humidity, rainfall, barometric pressure, wind speed and direction, wind chill, and dew point.
The software can store unlimited weather data on your computer and you can export the history file for further analysis or for generating graphs in a spreadsheet program. The external transmitter requires two AA batteries while the base station runs on a plugpack. *Item code: WIRELESSWEATHER-CC*

Solar LED camping lantern

Price: $99 ($95 for ATA members)

This is a well constructed super-bright white-LED lantern with a charging socket that also doubles as a power socket for charging external devices such as MP3/CD players and mobile phones. The lamp can be charged via mains power, car charger or solar panel, all of which are included.
The rotary switch provides five levels of illumination (to extend battery life). The lantern features eight power LEDs (totalling around 3 watts), a 2.5 watt crystalline solar panel in tough aluminium frame, charging lead and adaptors for various devices including Nokia, Motorola, Samsung, Ericsson and Siemens mobile phones. The lantern measures 250mm x 108 mm diameter. *Item code: SOLARLANTERN*

Three-stage solar regulator

$169.95 ($155 for ATA members)

The Powertech 12 volt regulator has a three-stage charging profile, with bulk, absorption and float charge stages, and is switchable between flooded cell and sealed battery programs, and has adjustable setpoints. It has a rated current of 20 amps continuous, and charging current is controlled using pulse-width modulation. Other features of the controller are dusk-to-dawn automatic on-off load control with 10 selectable on-off programs, five-state LED indication of system status, adjustable low-voltage disconnect, reverse battery connection protection, and an optional battery temperature sensor. The in-built LCD displays charge current, battery and solar panel voltage, solar charge energy in amp-hours for the last three days.
Item code: SOLARCHARGER

More cool products

Shake-powered calculator

Price: $14.90 ($13.90 for ATA members)

You will no longer have to buy replacement batteries for your calculator or put up with fading calculator screens. The battery free calculator is powered by shaking the calculator side to side.
Electricity is generated by a magnet passing through a coil of wire. If the screen starts to fade, just shake it again for power.
The calculator features an eight-digit screen and a clear plastic body so you can see the workings.
Item code: CALCULATOR

Power-Mate energy meter

Price: 10 amp version is $295 ($280 for ATA members); 10 amp heavy duty version is $345 ($330 for ATA members) and the 15 amp version is $405 ($390 for ATA members)

We have been selling the German-made SparOmeter energy meter for some time, but while it does a good job, we have been looking for a locally produced equivalent meter for general household use, and finally we have found it!
The Power-Mate has all the functions of the SparOmeter, as well as quite a few extras. The unit consists of a hand-held meter which can be connected to the appliance it is measuring via a simple piggyback plug and socket set. The meter features an LED display for easy reading and high visibility at all times.
The meter can tell you a variety of measurements including: power in watts, voltage and current. The meter can tell you the minimum, maximum as well as instantaneous readings.
The meter can also tell you: cost of running the appliance, how much energy the appliance used in kilowatt-hours and how many kilograms of greenhouse gas emissions it produced. All in hourly, yearly, quarterly and accumulated figures. *Item code: POWERMATE*
We also have a Power-Mate for hire for $50 a week!

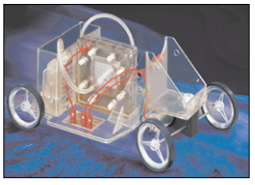
Power House kit

Price: $290 ($280 for ATA members)

Make a renewable energy powered model home!
The kit focuses on the heat and light energy from the sun, the energy from the wind, as well as with electrochemical and plant energy.
With the Power House kit you can build a model house complete with solar panels, windturbine, greenhouse and desalination system. You can build and operate an electric train, windmill, solar cooker, solar hot water tank, hygrometer, electric motor, power hoist, sail car, and more! Plant watercress, prepare sauerkraut, and make chewing gum. Learn how plants convert sunlight into energy for your body and your engines.
Over 20 different building projects in one kit, including Power House, wind-powered generator, solar collector, solar oven, solar power station, greenhouse, current indicator, oil press, sail car, hygrometer, refrigerator, thumbtack scale, electric motor, electric crane, electric train, lemon Battery, oil lamp, light telescope, rice cooker, electric switch experiments.
Includes a 96-page full colour manual. *Item code: POWERHOUSE*

Fuel cell car kit

Price: $290 ($280 for ATA members)



The Fuel Cell Car and Experiment Kit provides an introduction to the technology of fuel cells. With this unique kit, you can build your own experimental reversible fuel cell car to learn more about this energy source. With more than 30 experiments and demonstrations, users will learn how a reversible fuel cell works to perform electrolysis as well as to create energy. The electricity required to activate electrolysis is created by a solar panel included with the kit.
The 96-page, full colour Experiment Manual offers over 30 experiments, including: how to build a solar-powered car, effects of direct and indirect radiation, characteristics of a solar module, electrolysis and its effect on water, oxy-hydrogen test, how to construct and load a reversible fuel cell, decomposition of water in the fuel cell, qualitative and quantitative analysis of gas in a fuel cell, how efficient is electrolysis?, how light influences electrolysis, solar electrolysis, and making a fuel cell-powered car. *Item code: FUELCELLCAR*

Kits, LEDs and energy efficient devices

Universal NMH, nicad and alkaline charger

$59.95 ($56.95 for ATA members)

This charger will recharge four of either AA, AAA, C, or D cells or one 9V cell. Battery sizes may be mixed as the bays operate independently. It handles nicad, NMH or rechargeable alkaline batteries (such as Grandcells, not standard alkalines) via a switch setting. Battery types may not be mixed in one session.

For nicad batteries, the charger will discharge the battery first to prevent memory effect, followed by a quick charge and then a constant current trickle charge.

The charger features both LED and LCD displays, 1-2 hour charging time, and it runs from 12 volt DC via the supplied plugpack. It may also run directly from 12 volt DC systems, although we haven't tried it. *Item code: BATTCHARGERLARGE*

Miniature wind turbine kit

Price: $49.95 ($47.95 for ATA members)

This great little kit allows you to make a tiny wind turbine that is both educational, as well as a functioning turbine that can produce power. Maximum output is up to 10 watts, though we would rate it more like a watt or two realistically. *Item code: WINDKIT*

Low-power halogen replacement bulb

Price: $40 ($35 for ATA members)

This bulb can be plugged into almost any 50mm halogen downlight socket that uses an MR16 halogen lamp. It uses a 3 watt ProLight LED as the light source, which is available in either warm white or cool white. The LED is driven by an inbuilt switchmode power supply. Beam angle is around 30 degrees, suitable for task lighting or highlighting. The body is made of aluminium for good heat dissipation. Power consumption is around 4 watts, and the bulb will run from any power source of around 12 volts, either AC or DC, so can be plugged straight into a halogen socket without changing the transformer. *Item code: LEDHAL3W*

LED bike light

Price: $29.95 ($28.95 for ATA members)

This light has five white superbright LEDs and is powered by four AAA batteries. The light has two modes—continuously on and flashing—and is waterproof to 20 metres.

The light comes with a slide locking handlebar clamp to allow easy removal of the light from the bike to prevent theft. This means that the light can also be used as a general purpose torch and even a diving torch, providing you don't exceed the 20 me- tre rating. *Item code: BIKELIGHT5LED*

Dynamo torch

Price: $29.95 ($28 for ATA members).

This is a super-bright LED wind-up torch that will provide light anywhere, anytime, without requiring batteries or an external power source.

One minute of winding provides light for up to 30 minutes, and you can switch between one or all three LEDs. Ideal for emergency use. *Item code: TORCH_DYNAMO*

1-wire weather monitoring kit

Price: $200.

The 1-wire weather station connects to a PC to measure wind speed, wind direction and temperature. Use it to monitor the weather, or log a possible site for wind turbine suitability.

Item code: WEATHER-AAG

Nightstar kinetic torch

Price: $70 ($65 for ATA members)

This amazing torch uses no batteries and no incandescent globes, yet will provide light when you want it with total reliability. The Nightstar uses a high power rare-earth magnet passing through a wire coil to provide the electricity to charge a super capacitor that drives the white LED lamp. Around 30 to 60 seconds of gentle shaking gives 5 minutes of full light and a steadily reducing level for another 15 minutes. *Item code: NIGHTSTAR*

Aluminium 4 LED torch

Price: $8 ($6 for ATA members).

This machined black finished aluminium torch uses 3 AA-cell batteries (supplied) to drive four 5mm LEDs. Never be stuck with a blown bulb again! The torch is water resistant and very robust. What's more, a set of alkaline batteries should give at least 24 hours of usable light.

Windup radio torch

Price: $33.90 ($32.90 for ATA members)

This is an AM/FM radio which is compact, portable, splash proof and best of all it can operate without batteries! The radio can be powered three ways: built-in lithium battery (wind it up for 90 seconds for 20 minutes of use); two AAA batteries; or an optional DC adaptor

The unit also features an LED torch. The unit's casing is water resistant so it is ideal for use outdoors as well as in.

Item code: DYNAMORADIO

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

Solar powered flasher

Price: $24.95 ($23 for ATA members).

This multi-purpose solar-powered warning light has six high brightness red LEDs. Ideal for bicycle lights, emergency warning lights or personal emergency lights for walking or hiking. Comes with a magnetic stand, belt clip, elastic strap and clip and a bicycle mounting bracket. *Item code: SOLAR_FLASHER*

Aluminium 9 LED torch

($25 for ATA members).

This is a machined aluminium torch that uses 3 D-cell batteries to drive nine 5mm LEDs. Never be stuck with a blown bulb again! The torch is water resistant and very robust (we have drop tested it onto concrete!). What's more, a set of alkaline batteries should give at least 48 hours of usable light. Price: $30 **Note: Actual stock is silver in colour.**

12 volt, 1 amp switchmode plugpack

Price: $25 ($23 for ATA members)

This plugpack is ideal for running our LED halogen bulbs or LED halogen replacement kit. Use it to replace the inefficient transformer supplied with most halogen fittings, or wherever you need an efficient 12 volt plugpack.

Item code: SMPLUGPACK

Wireless weather station

Price: $249 ($239 for ATA members)

We now have a new wireless weather station that measures not only wind speed and direction, but indoor and outdoor temperature, humidity, barometric pressure, and even rainfall.

The data is collected by two sensor packs that are connected to a wireless transmitter. This sends the data back to the base station every minute or so, which then uses the information to give averages, accumulated totals, maximums, minimums and trends of the various data.

The transmitter requires two AA batteries while the base station is mains powered, with three AA batteries for data backup. The base station does not have the facility to connect to a PC, so you can't download data, but it does just about everything else. *Item code: WIRELESSWEATHER*

1 watt and 5 watt Luxeon LEDs

Each 1 watt Luxeon LED is equivalent to a dozen or more high-brightness 5mm LEDs in light output.

With over twice the current draw and twice the voltage of a 1 watt LED, each single 5 watt LED is equivalent to up to 50 or more high-brightness 5mm LEDs in light output. Available in blue, green, cyan and white (**Note: the 5 watt white LED has a rated life of 1000 hours**). For more information, prices and to order, go to the ATA's website at www.ata.org.au or call the ATA on (03)9419 2440.

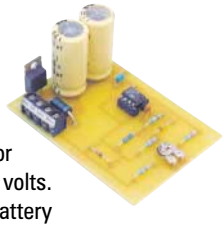
Now available: 3 watt LEDs and 1 watt warm white LEDs! See our webshop for details.

Luxeon optical collimators

Price: $10 each

This 25mm optic with holder solves the problem of how to attach the optics to the LEDs! Available in wide, medium and narrow versions.

Mini-maximiser kit



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. Note: not suitable for battery charging use! Price: $45 ($40 for ATA members). *Item code: MINIMAX*

30 amp speed controller kit

Price: $45 ($40 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.

We have tested it to over 30 amps without problems.

Item code: SPEEDCON

Hexagonal lens/holders for Luxeon LEDs

Price: $6

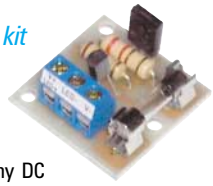
These assemblies consist of a 20mm diameter lens in a hexagonal holder which is designed to fit to 3 and 5 watt Luxeon star LEDs. They come in 6, 15 and 25 degree angles and the 4 x 25 degree line optic. *Item code: LED_OP6DEG, LED_OP15DEG, LED_OP25DEG, LED_OPLINE.*

Simple 1 amp rectifier kit

This very simple kit allows you to build a rectifier for use with polarised LED halogen lamps or for polarity protection of electronic equipment. Uses four Schottky diodes to reduce voltage drop and includes a 1 amp fuse. $5.

Item code: RECKIT

Constant current circuit kit



Price: $8

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 four sizes, 20mA, 50mA (for the Superflux LEDs), 300mA (for the 1 watt Luxeon LEDs) and 650mA (for the 5 watt Luxeon LEDs).

Please specify which current rating you need when ordering.

Item code: CCBOARDxxx where xxx is the current rating in mA (020, 050, 300 or 650).

Superflux LEDs

Price: Red and amber: $2 each, green, blue and cyan: $3 each

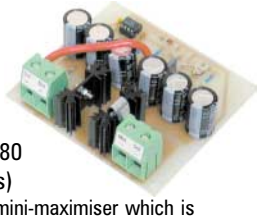
The Superflux LEDs are about the best value for money available in LEDs today. Each 8mm square Superflux LED has the equivalent light output of several of the best 5mm LEDs, for the same or less cost as a single 5mm device! Available in red, green, cyan, blue and amber.

Chinese Superflux LEDs

Price: Red and amber: $0.50 each, white, green, blue and cyan: $1 each

These are a cheaper Asian-sourced Superflux LED which are the same size and shape as the Lumileds Superflux, but not as expensive. Although they probably won't last as long as the Lumileds LEDs, they should be great for most uses.

Maxi-maximiser kit

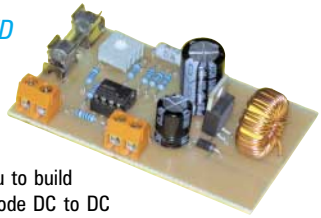


Price: 12 amp: $70 ($65 for ATA members), 20 amp: $80 ($75 for ATA members)

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. Note: not suitable for battery charging use!

Item code: MAXIMAX

Switchmode LED driver kit



Price: $30 ($25 for ATA members)

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

Kit includes circuit board, all components and instructions. No case is provided.

Item code: SWITCHMODE.

Expand your *ReNew* collection

All available back issues $8 inc. postage within Australia. 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 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, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94 and 95.

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❒ Other pubs ❒ Other.....

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96/06

Fifteen years of recycling fun

The *Noel's Treasures from Trash* column in *ReNew* has been a popular one with kids and adults alike. As Noel hangs up his scissors and pliers, we take a look at the man who turned the world of trash on its head

Way back in issue 40, when this magazine was known as *Soft Technology*, a long-time ATA supporter and contributor decided to do a regular column for the magazine. Noel Jeffery's column, *Noel's Treasures from Trash*, looked at taking everyday household items that would otherwise be discarded, and turning them into useful and fun devices, usually with a renewable energy or sustainability theme.

Over the years, Noel came up with some excellent and impressive ideas, including solar stills, solar cookers, electric motors, meters and generators, fuel cells, solar water heaters, syphons and pumps, windmills, waterwheels, even a model stirling engine made out of cans.

Noel's aim was to get kids into building things with their hands, to think about what they were making, to experiment, and to learn from doing so, not just reading about something in a book. He also intended that kids make the projects with the help of their parents or teachers so that it wasn't just the kids who were learning.

There were some interesting and funny results from many of the projects, such as the home-made electric motor. The column described how for one part of the motor you have to 'wind it with wire', and one parent reported how hard it was to convince his son that to make the motor work it had to be insulated wire, as he had just taken bare copper wire out of some cable.

About the only negative feedback Noel received on his projects was when he did a column on making 'animal seeds' when a reader worried that kids might swallow them and possibly choke. A valid concern of course, but one that reinforced the need for adults to be involved with the making of the projects.

For over 15 years Noel Jeffrey has turned discarded objects into useful objects—helping educate both kids and adults on sustainability.

Alternative Technology Association (ATA, publishers of *ReNew*) staff have thoroughly enjoyed working with Noel over the years, and his enthusiasm for the ideas he has produced over the last 15 years or so has been infectious. We had a lot of fun each issue when Noel delivered his contraptions, marvelling at their inventiveness and simplicity.

And a final word from Noel, who wants to thank all the staff of the ATA for their tolerance and patience, support and suggestions, and Mick Harris and Alan Hutchinson for their inspiration in the early days of the *Treasures from Trash* column.

Noel also wanted to thank former *ReNew* editor Kulja Coulston for her encouragement when he had doubts about continuing with the column.

Evaporative cooling

I am wondering how useful a ducted air, whole-of-house evaporative cooler would be. Please can you tell me how many degrees below the ambient temperature the flow of air can be expected to be?

If it is likely to be disappointing, is there a simple fan, that is very quiet, that could at least be used to draw in cool night air to replace the warm air in the house?

I suspect that an evaporative cooler might do the latter very well but not be worth much when the ambient temperature is 40 degrees and the house is creeping up over 28. Especially as you would have to open some windows after switching on the cooler.

We have had much improvement just with insulation so far.

Richard Stanford
ripen@tadaust.org.au

Evaporative cooling is a great possibility for predominantly dry climates. It is more effective than a fan and much cheaper to install and run than refrigerated coolers (air conditioning). I run a system in my home so I have a good feel for performance. In hot dry conditions I find it knocks about 10 degrees off the room temperature. So on a 35 degree day you can keep the house to around 25 degrees. If it gets over 40 degrees it generally keeps the temperature below 30 degrees.

However on humid days the performance is not as good and the temperature drop is generally less than five degrees. This may not sound so good but because evaporative cooling relies on a high air flow you still get significant cooling effect even when the temperature starts to get up.

The key to an effective system is getting the best air flow possible. Make sure an installer does not compromise this. Our system provides cool air to the upstairs bedrooms and an open plan downstairs living room/kitchen. None of the other downstairs rooms has a duct but we can make the other rooms more comfortable by opening the windows in a selected room so the exhaust air exits through that room. They won't be as cool as the living room but are much better than without cooling. I would suggest just cooling the main rooms and using the exhaust air to help cool other rooms.

Another feature I really like is that evaporative cooling also has the advantage of allowing you to flush hot air out of your home after a cool change or overnight. Just turn on the 'vent' function (you can leave the evaporative cooling off) and you are drawing in heaps of cool, fresh air.

You could go for a simple exhaust fan. It would be cheaper. But an evaporative system will be much more effective.

Mick Harris

Write to us!

We welcome questions on any subject, whether it be something you have read in ReNew, a problem you have experienced, or a great idea you have had. Please limit questions to 350 words. Send letters to: ReNew, Level 1, 39 Little Collins St, Melbourne VIC 3000, renew@ata.org.au

DC fridges

We are in the market for a new fridge and after searching the *ReNew* CD I found an article that said the DC fridges were much better from a power consumption viewpoint.

The only problem is I haven't been able to find anyone who sells them, and everyone I have spoken to recommends the AC Vestfrost fridge.

Could you steer me in the right direction to get some info on this please?

Being energy efficient is not as common as it should be, partly due to it being so difficult to get info (and then find the products).

Robert Duncan
the_shed@ozemail.com.au

DC fridges are best if you are on a 12 or 24 volt battery based RAPS system and have the battery bank relatively close to the house. Many people install AC fridges because they are cheap and readily available, but they always end up using more energy from the system (due to inverter losses, inefficiencies in the fridge compressor motors et cetera) so a DC fridge is the way to go if you can find one that is suitable. What's more, if your inverter should decide to die, you won't lose all the food in a DC fridge like you will in an AC unit. I don't recommend absorption fridges generally, as they are not overly efficient and don't always work so well in warmer climates.

The Vestfrost is a good fridge as far as AC fridges go, but it still suffers from the issues raised above. The ultimate DC fridges are the Sunfrost range from the US. Their large models only use around 500 watt-hours per day, but they are so expensive it is unrealistic to import them, unless you have a great deal of spare cash. See www.sunfrost.com for more information, and note the massive insulation thickness on their cabinets.

We wrote a RAPS fridge buyers guide in issue 79 of ReNew. This article is on ReNewROM II. There are some newer models and manufacturers around now, but this article should get you started. This back issue is no longer available, but we can supply a printed copy of this article for $5 including postage or for free if you are an ATA member.

Lance Turner

Ultra-simple wind generator

Does anyone have any advice on building a Savonius turbine (a type of vertical shaft turbine) out of plastic chemical drums, driving a Fisher and Paykel washing machine motor? I was thinking of cutting a drum from end to end to get two troughs, then in half again, so each piece has a closed and open end. Mount these onto a piece of 25mm ply, with clamps top and bottom to squeeze onto the motor shaft.

I'm considering leaving the motor's windings untouched, to keep the transmission voltage up to reduce copper

losses in the length of cable between the wind generator and the shed. I would connect three AT computer power supplies between the three phases to get the +5 volts at 20 amps, and connect the outputs of those in series to get 15 volts at 20 amps—nice for charging batteries. By using the power supplies, the cut-in voltage (where they start producing stable outputs) is approximately 80 volts, so the generator will start in gentler winds.

I'm not sure how I'd stop it flying to bits in strong winds, though. Electrical loading might govern the speed up to a point.

Nigel Weeks
nigel.weeks@gmail.com

Some years ago when we first started looking at these motors for use as generators, we ran an article looking at using switchmode power supplies. You only need one switchmode though, as you just rectify the output of the generator before feeding it to the switchmode. As nearly all switchmode power supplies immediately rectify the incoming AC into DC anyway, this works well.

The only things to look out for are that:

a) As the wind slows down, the switchmode will try to draw more current to keep up the output power levels, so will load up the turbine and eventually stall it, so the turbine will start and stop a lot in lower windspeeds.

b) Plastic drums are not the way to go, they flex outwards as the turbine picks up speed so you either have to reinforce the edges or use steel drums, which are usually rigid enough not to need reinforcing, as they generally have two pressed ridges around their circumference.

c) Each drum piece should have both a top and bottom end plate to make best use of the wind. If the air flows out of one end, drag is reduced a great deal, and this is not what you want as Savonius rotors work on drag.

The ATA has a booklet on building Savonius rotor wind turbines. It is available from the ATA office for $8 including postage.

Lance Turner

Solar cooker designs

My name is Jim Rebgetz from Numinbah Valley Environmental Education Centre—I spoke with Lance Turner a while back about getting a heliodon—we have given up on buying one and are now making one.

I am wanting advice on some other equipment for our educational trailer. Where can I buy a solar oven and a solar cooker (parabolic dish and frying pan type)? I have found some good solar ovens in the USA on the internet (such as at www.affordable-solar.com) but we are unable to purchase over the internet. Can you suggest an Australian supplier for such devices, or can you provide plans for a solar cooker so that we can get one made?

Jim Rebgetz,
rrebg1@eq.edu.au

The only person selling cookers of this type that we know of is Brett White, his website is at www.users.bigpond.com/solarbbq. For other designs, go to www.solarcookers.org and click the archive link, which takes you to a separate archive site with various designs and info.

We have featured several DIY solar cooker designs in previous issues of ReNew, including issues 85 and 86. Back issues are available for just the price of postage to educational organisations. See the box below for more information.

Lance Turner

Compressed air car

The web page www.gizmag.com.au/go/3523 describes a car that runs on compressed air which is safe, quiet, has a top speed of 110km/h and a range of 200km. I would imagine that there would also be many applications for stationary motors as well as vehicles. Does anyone know when it will be available in Australia, or have any further information?

Mark Burslem,
burslem@networksmm.com.au

We ran an article on this vehicle a few years ago, in ReNew 82, page 71. As far as I can tell from their website (www.theaircar.com), they have new version of the cars and they have sold quite a few licenses but I haven't heard of anyone actually going into production. There is also an Australian air motor, it was in ReNew 89, page 18. Have a look at www.abc.net.au/science/news/stories/s1183531.htm

I am not a big fan of these motors unless the air is compressed using renewables, as the overall fuel cycle efficiency is quite low. Electric vehicles are much more efficient.

Lance Turner

Free ReNew back issues!

The ATA has many copies of back issues of *ReNew: technology for a sustainable future* and would like to distribute these to school or environmental organisations to help spread information about the environment and sustainability.

We have packages of 10 recent issues of *ReNew*, plus a *Your Home* consumer guide with CDROM.

If you would like multiple copies of back issues, packages of 50 copies of individual issues are available and postage would be individualised depending on quantity and destination.

For 10 back issues sent there will be a cost of $20 for postage and handling, or free if you are able to pick them up from our Melbourne office at:

Level 1, 39 Little Collins St, Melbourne

Office hours are between 10am and 4pm Monday to Friday.

Payment by credit card would be preferable (MasterCard/Visa/Bankcard), or send a purchase order.

If you are interested in taking up this offer, please contact the ATA office via email at renew@ata.org.au

Classifieds/ Suppliers Directory

When selecting an installer get 2 or 3 quotes and check accreditation/references. § = ATA Member discounter.

For Sale: Steca Solarix 20A Solar Regulator 12/24V (LED indicators), can be set to sealed or flooded batteries, $100 ono. Metasystems UPS's 3200 and 4800VA, true online sinewave, 24V with redundant circuitry and comms port; $600 and $800, *SE Melbourne. John 0410 349 019 or airy@netspace.net.au*

For Sale: Franco Belge wood/coal burning central heating cooker and boiler, model 707. Very Good Condition. $1900 ono. Excellent for hydronic heating. Collection only. *Contact: Geoff at Wangaratta ph: (03) 5722 2332 or 0418 134 886.*

For Sale: 150L Gold Diesel biodiesel machine. 1½ yrs old. Plus; air compressor, gear pump, 44 gallon drum hand pump, 1 plastic and 2 s/steel containers (1 with element). Methanol 100L, pot hyd 15kg, oil 500L, book. $6,000 (can separate). *Bayswater. Julie ph:(03) 9729 7116.*

Home exterior/ interior

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WA

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