WIN! A Solar Hot Water System

ReNew

Technology for a sustainable future

In the ReNew/ Edwards Solar subscriber prize
See page 7 for details
Conditions apply

Sustainable fire-rated home

Electric bikes
Essential buyers guide

Double brick retrofit

RECs and smart meters explained

DIY solar caravan

DIY double glazing

Easy lighting retrofits

Issue 111 April-Jun 2010
AU$7.95 (inc gst) NZ$8.15
ISSN 1327-1938
02
9 771327 193010

THE ONLY MADE

GRID INVERTERS JUST GOT BETTER!

Celebrating 25 years

Upgraded PV Edge Models Now Available

- ✓ Improved Efficiency
- ✓ More Power
- ✓ No additional cost

Turn Your Home Into a GREEN Power Station

PVE 2500
now accepts up to 3100W of PV

5 year warranty

PVE 1200
now accepts up to1600W of PV

Ideal for 1500W systems

LATRONICS®
A NEW WORLD POWER

www.latronics.com

Ph. 1300 550 204

EXTEND BATTERY LIFE

with OzCharge Battery Chargers..

OzCharge has a complete range of 6V, 12V and 24V Battery Chargers & Maintainers which have been designed and made for Australian conditions. They range from 900mA to 21Amps and are suitable for batteries up to 400Ah. Perfect for 4WD's, Boats, Motorcycles and the family car.
Our Chargers come with corrosion resistant connectors and terminals, heavy duty cables , reverse polarity and overload protection, internal over heat protection and a Two Year Warranty.

SWITCHING MODE AUTOMATIC BATTERY CHARGERS & MAINTAINERS





Heavy Duty Cables
Pulse Charge Output
Microprocessor Controlled
Reverse Polarity Protection
Internal Over Heat Protection
Corrosion Resistant Connectors
Quick Connector Alligator Clips
2 Year Warranty

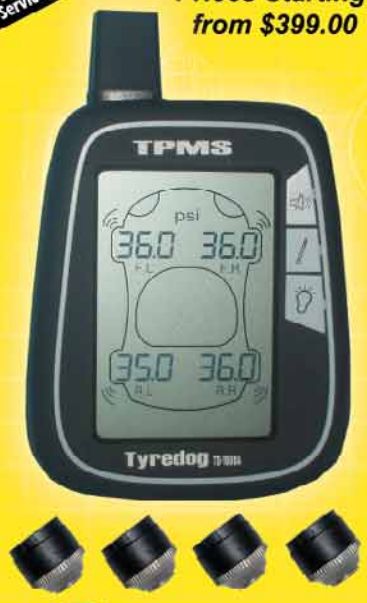
PASSENGER * RECREATIONAL * COMMERCIAL * AGRICULTURAL

OZ CHARGE
Designed and Made for Australian Conditions

For further information, please visit www.ozcharge.com.au
or call (03) 9482 2203. (Dealer Inquiries Welcome)

THE ORIGINAL
Serviceable Tyre Pressure Monitor

Prices Starting from $399.00



TYREDOG™

Wireless Tyre Pressure Monitoring System

LIGHT AND COMPACT
Extremely lightweight and compact with specially designed wireless electronic sensors

WIRELESS AND CORDLESS
D.I.Y. wireless sensors and LCD monitor ensures a quick and easy installation

ADJUSTABLE
Fully adjustable tyre pressure and temperature warning ranges

GRAPHIC USER INTERFACE
The LCD monitor displays both tyre pressure and temperature

- Monitors up to 8 tyres - Detect tyre blowouts - Expand tyre lifespan
- Alerts when pressure drops below / raises above recommended level
- Not affected by bumpy roads and **INCREASE FUEL EFFICIENCY**

ZYLUX®
Dealer Inquiries Welcome

166 Christmas Street, Fairfield, Vic, 3078 Tel: 03 9482 2203
Website: www.zylux.com.au Email: sales@zylux.com.au

mpower

Solar Power Solutions

MPower is one of Australia's leading suppliers of the highest quality solar energy equipment

SOLAR PANELS

kaneka

SUNTECH

BATTERIES

Sonnenschein

POWERHOUSE A200 GEL CYCLIC SERIES

HOPPECKE POWER FROM INNOVATION

INVERTERS

SMA

PLASMATRONICS

MORNINGSTAR corporation

OutBack Power Systems

GENERATORS

ADVANCED POWER
Honda Engine

CHARGERS

ZIVAN
BATTERY CHARGERS

Phone:
1300 733 004

www.mpower.com.au

Contents

Issue 111
April—June 2010

features

Don't be tied to powered sites—add some solar! Page 24.

ATA members Merryl and Lee Rigley volunteered on an off-grid farm in Spain. Their story is on page 52 or read about the farmhouse on page 48.

Bikes all round: see the electric bike buyers guide on page 38, a successful electric bike purchase on page 46, and the winner of our electric bike comp on page 8.

Nanette McCallum's BAL-FZ fire-rated home enroute from Holmesglen TAFE to South Gippsland. Page 20.

regulars

Insulate your home and help disadvantaged kids too! Products page 74.

Australia's first community wind farm will soon be generating power. Page 34.

From the Editor

About ReNew

ReNew has been published by the Alternative Technology Association, a non-profit organisation that promotes energy saving and conservation to households, since 1980. *ReNew* features renewable technologies such as wind power, solar power and alternative modes of transport. *ReNew* includes practical examples of water conservation or reuse, recycling materials or ways to achieve energy efficiency at home. *ReNew* provides practical information for people who already use sustainable processes and demonstrates real-life applications for those who would like to.

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
Editor: Jacinta Cleary
Technical editor: Lance Turner
Advertising manager: Amanda Schraer
Proofreader: Stephen Whately

Editorial and production assistance:

Thanks to David Ingram, Donna Luckman, George Smith and Moz.

Contacts and contributions

Send letters and contributions to:

ReNew
Level 1, 39 Little Collins St
Melbourne VIC 3000
ph:(03) 9639 1500, fax:(03) 9639 5814
Email: renew@ata.org.au
Website: www.ata.org.au

Contributions are welcome, guidelines available at www.ata.org.au or on request.

Advertising in *ReNew*

Advertising is available for products and services relevant to our audience. We reserve the right to refuse, cancel and withdraw advertising at our discretion. For enquiries contact Amanda Schraer via adverts@ata.org.au or call (03) 9631 5412.

Next advertising deadlines: Booking 23 April 2010. Advertising copy 30 April 2010. Next editorial copy deadline: 23 April 2010.

Sustainable jobs of the future

The poor form of a few installers and politicians means that a very good idea, the insulation rebate, has come to a sudden end. And the poor administration of the Green Loans program means that the loans element of the program has been dropped. Both are fine initiatives from a sustainability point of view, helping households to reduce their greenhouse gas emissions and at the same time generating 'green' employment.

Those drawn to jobs as insulation installers or Green Loans assessors thanks to government sustainability programs might lament what an unpredictable career path they have taken. The next few months will see how things turn out for them. The insulation rebate is due to return mid year with $41 million promised by the Federal Government to stabilise insulation jobs until then, and Green Loans assessors can still conduct household audits, albeit with caps on the amount of work they can undertake.

Beyond the Green Loans/insulation saga, households will continue to invest in sustainability measures, thereby creating employment. An Alternative Technology Association (ATA) member contacted us recently to talk about green jobs, suggesting we open a bit of a discussion on the topic. He wanted to hear from others what jobs we need to help make households more sustainable.

Would you be prepared to pay a small premium to ride in an electric taxi that's charged by renewable energy? Would you support a container deposit scheme? Would you buy a cylinder of biogas rather than LPG to fire the barbecue? These were just some of his ideas.

What type of green products and services would you buy if they were available? What are the areas of need? We want you to look at the areas of food, water, energy, waste and transport to imagine some jobs that can be created. Email your ideas to renew@ata.org.au. Try to keep it under 200 words. Also, check the ATA's on line forums for further discussion on the topic via www.ata.org.au/forums

Jacinta Cleary

PS. See you next time for a special issue. We're celebrating 30 years of *ReNew* magazine and its publisher, the Alternative Technology Association!

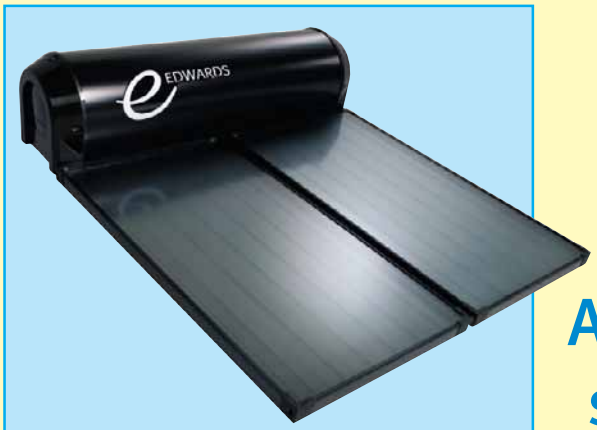
Cover photo: Aussie Kanck. See his story on page 60.

Printed by Impact Printing using best practice ISO 14001 Environmental Management System and PEFC certified stock. Distributed in Australia and New Zealand by Gordon and Gotch and overseas by Pansing IMM.

$7.95 (Aus) $8.15 (NZ) Recommended Retail Price. Registered for posting by Aust Post: No VBG 4172

ISSN 1327-1938

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



EDWARDS
solar hot water®

Features of the system:

- Titan LX3052 two panel roof mounted system
- Frost protected
- 10 year warranty
- Stainless steel tank
- 7 colours available
- Family sized system—305 litre tank

WIN!

An Edwards stainless steel solar hot water system, a Clipsal cent-a-meter and installation for both

in the ReNew/Edwards subscriber competition

Total prize value AU$7,029

Take out an ATA membership, subscribe to *ReNew* or *Sanctuary* magazines or renew your current membership or subscription before 15 September 2010 and you could win an Edwards Solar Hot Water solar water heater (inc installation) plus a Clipsal cent-a-meter valued at AU$7,029 (Titan 305L system $4999, Clipsal cent-a-meter $280, installation of both $1750) including GST. Australian entries only. See the conditions below, and get your membership or subscription in today!

VIC Permit No: 09/4138.

Terms and Conditions

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

(2) The promoter is the Alternative Technology Association, ABN 57 533 056 318, Level 1, 39 Little Collins St, Melbourne, www.ata.org.au, Ph. 03 9631 1500.

(3) Prize supplied by Edwards Solar Hot Water, ABN 34 106 360 57, www.edwards.com.au, Ph. 1300 765 277.

(4) The prize is not redeemable for cash. Price includes GST.

(5) Edwards Solar Hot Water reserves the right to change specifications without notice.

(6) Paid ATA staff, members of the ATA board, Edwards staff, Edwards dealers and members of their immediate families are ineligible to enter.

(7) The competition runs from 15 March 2010 to 5pm on 15 September 2010, and subscriptions/memberships must be paid in full by this time and date.

(8) The competition will be drawn at 10.30am on 20 September 2010 at the Alternative Technology Association, Level 1, 39 Little Collins St, Melbourne VIC 3000.

(9) The winner will be contacted by phone and will be notified in writing. The winner's name will be announced in ReNew 113 and Sanctuary 13, released in September and November 2010 respectively.

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

(11) To enter, subscribe or join the ATA using the subscription form in ReNew issue 111 or 112 (or a copy of it), or the form in Sanctuary 11 or 12, visit our websites (www.ata.org.au and www.sanctuarymagazine.org.au), or call the ATA on (03) 9639 1500.

(12) The competition is only open to Australian entries and includes delivery and installation within 200 kilometres of Australian capital cities. Edwards Solar Hot Water will cover standard install costs in other locations.

(13) Edwards Solar Hot Water reserves the right to change the brand/model of the system depending on the water conditions.

(14) Prize includes the supply and installation of a top of the range Edwards family sized stainless steel solar hot water system as well as a Clipsal Cent-a-meter valued at $7029.

(15) The winner agrees to assign any REC's (Renewable Energy Certificates) generated on this system to Rheem Australia.

(16) Authorised under Vic permit no. 09/4138

The *ReNew*/Edwards Solar Hot Water subscriber competition is proudly sponsored by Edwards Solar Hot Water, ph:1300 765 277, www.edwards.com.au

Electric-bikes—DIY style

Here are just some of the entries to *ReNew's* electric bike competition last issue. The winner receives a gift voucher from Todae. For more entries and details on what we were looking for go to www.renew.org.au

Winner: Blair Fraser

My electric bike started off as a Toy-

world $149 special. I then purchased an electric motor kit from ebay for $300 and got to work on it. I modifed the 24V controller to run 48V (at lower current). It has four 12Ah batteries fitted low behind the seat to keep it balanced like a normal bike.

I also fitted low-rolling-resistance tyres and strengthened the front forks by welding on a strong old set from a BMX. It is fitted with ultra-bright LED lights front and rear and I have a watt-meter installed to keep the batteries in check! I also visit the local tyre service from time to time and they let me have all the old mobility scooter batteries. Most of them have about six months in them!

The bike has a switch to turn it from 200 watts (road legal) to 1200 watts (off road). It has a top speed of 45km/h and will do 30km/h for 20kms. It's charged from my household wind and solar system. Truly free motoring!

2nd place: David Sweeney

My electric bike was built using a kit comprising a front-mounted 200W brushless Tongxin hub motor, control-

ler module and throttle. I used a truing jig to build up a front wheel for the hub motor, with a double-walled rim to ensure it could withstand the extra force. A spoke length calculator was very useful for determining correct spoke lengths with the larger hub diameter.

I made the cradle which houses the battery, controller, switch and fuse from a piece of recycled aluminium sheet, with a weatherproof fabric cover. The 24V 10Ah Nickel Metal Hydride battery provides a good compromise between cost, size, and weight, while avoiding the safety risks associated with recharging lithium polymer batteries.

I hoped to add a battery meter, but couldn't find a simple device that could accurately display the charge remaining in a NiMH battery.

However, when riding the bike it is easy to tell from the performance of the bike when the battery is due for a recharge. Due to its light weight and low rolling resistance the bike is lovely to ride and makes the commute to work enjoyable.

Special mention: Bruce Teakle

This bike was built at home from a folding bike I already had and a bought kit. It helps me cycle in the challenging

mountain environment where I live. Electric assistance greatly increases my enthusiasm for the long steep climbs, especially when carrying loads or pulling a trailer. Compact folding allows me to take the folded bike into a car or peak-hour train. Power comes from our surplus PV power at home.

The bike is a Dahon Boardwalk folding bike with six derailleur gears and forks spread to fit hub motor. The 36V, 200W Bafang hub motor provides assistance up to about 25km/h. The 36V, 14Ah lithium polymer battery is an unknown brand with unknown specifications. The controller is a 15A, 36V, 200W Ananda Drive.

Extras include a 'Cycle Analyst' e-bike computer so I know what's going on in the system. Total weight is 25kg. So far I've ridden around 1000km in one year.

Failures so far include the battery, which failed in the first few weeks and was reluctantly replaced by the vendor. The thumb throttle broke during loading on a car and was replaced with an imported twist grip throttle.

This bike is great and really helps replace car trips in hilly country, but watch out for dodgy batteries. The powered front wheel is prone to slipping on hills.

Contact Todae for a solar power quote P. **1300 138 483**

Solar Power made easy with Todae...

There has never been a better time to harness the Sun's free energy with a Solar Power Installation on your home.

Here are some of the reasons why:

- Solar Credits Rebates now available for most households
- Feed In Tariffs (bonus payback schemes) proposed for all states
- Very attractive system payback from as little as 5 years.
- 25 year warranty on all Solar Panels offered by Todae

Todae has been helping Australian's live more sustainably since 2003. Find out how we can make installing Solar Power simple for your home.

Recent Solar Projects

BONDI, NSW
2kw system

PEREGIAN, QLD
1.9kw system

MOSMAN, NSW
2.5kw system

CANBERRA, ACT
1kw system

BULLEEN, VIC
2.7kw system

LIVERPOOL,NSW
6.7kw system

todae solar

Visit us online: **www.todae.com.au**
phone: **1300 138 483** email: **solar@todae.com.au**

Up front

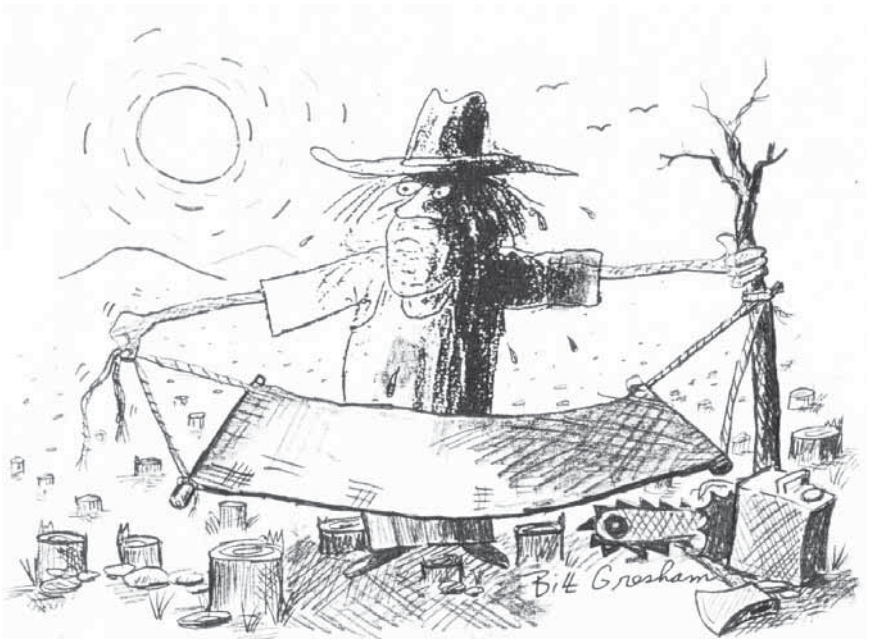
Green Loans

The Green Loans program is still active, although minus the loans aspect.

In major changes to the program in February, householders can no longer apply for interest-free loans up to $10,000 for sustainability improvements to their home. However, the free home sustainability assessments (which were essential before being eligible for a loan) are still available. Funding has been allocated for an extra 600,000 assessments on top of the 360,000 the government has committed to completing.

Only 1500 households received a loan under the scheme that was supposed to run for five years. The original target was for 75,000 homes to take out loans over the life of the program. Common complaints include rushed assessments, poor administration and an excess of trained assessors, leading to the overall failure of the program.

The Alternative Technology Association's online forum received over 150 comments on the Green Loans topics in four weeks. Both householders and trained assessors were disappointed for a couple of reasons. Firstly, the main aim of Green Loans, to help households become more sustainable, is lost amongst all the administrative difficulties, and secondly, a lot of trained assessors have been placed under job stress with uncertainty about the future of the program. Go to www.ata.org.au to participate in the discussion.



To improve the quality of future household assessments, the Federal Government has imposed a weekly cap of 15,000 assessment bookings and a daily cap of three bookings per assessor to ensure better quality. Interestingly, assessors can complete no more than five assessments per week, a somewhat difficult arrangement for those looking to make an income.

The ATA hopes that the assessment aspect of the program will be much improved from now on to enable greater uptake of water and energy efficiency at home.

Rebates switch again

The insulation and solar hot water rebates, announced last year as part of the Federal Government's financial stimulus package, folded in late February. The rebates remain, although under a different moniker and substantially reduced.

The new Renewable Energy Bonus Scheme is currently taking applications for solar hot water and heat pump rebates, with $1000 available for solar hot water and $600 for heat pumps.

It is intended that the insulation component of the Renewable Energy Bonus scheme will come into operation

by 1 June. A rebate of $1000 will be available, down from $1200.

In other changes to the insulation rebate, householders will claim the $1000 directly through Medicare rather than installers. A new registration scheme will require all installers to re-register and provide certified quality assurance to allay recent fears over safety issues.

Windy up there

Wind turbines keep getting taller and taller. An off-shore turbine planned for the coast of Norway will be the largest in the world when built, standing at 162.5 metres tall with a rotor diameter of 145 metres. The turbine will be built by Norwegian company Sway.

Interestingly, this turbine will float rather than sit on the sea floor, as seems to be the way with most turbines that Sway manufacture.

As reported on TreeHugger.com, the floating tower is a pole filled with ballast beneath the water creating a low centre of gravity. It will be anchored to the seabed with a single pipe and a suction anchor, being able to tilt 5° to 8°, and turn around with the wind.

As well as being the tallest in the world, it's estimated to be three times more powerful than current turbines, generating 10MW, enough to power over 10,000 homes. It should be installed by the end of next year and will cost around $67.5 million to build.

Clean swap

Without sounding like too much of a plug for Dyson vacuum cleaners, it's worth mentioning that they have a new voluntary initiative regarding electronic waste. When buying a new vacuum cleaner, they will take your old vacuum cleaner and send it off to be recycled by accredited e-waste recyclers. Hence, the old vacuum cleaners don't end up in landfill like 97% of other electronic waste (not that *ReNew* readers are likely to send anything to landfill unless they absolutely have to).

Photo: Leon Beaton

Maintain the rage

The student-based Outback Rode Rage Team have been putting their cycling abilities to good use, riding through the centre of Australia to raise awareness about climate change.

In their solar-electric assist recumbent trike, reaching speeds of up to 100km/h, the students from Damascus College travelled from Darwin to Melbourne between November 23 and December 9 last year. Their aim was to raise awareness on ways to reduce greenhouse gas emissions and also to raise funds for sustainable energy and food programs in neighbouring countries, in particular East Timor. The Alternative Technology Association's International Projects Group was the lucky recipient of some of those funds, receiving $7000 for projects in East Timor, with the students raising $17,000 in total. The ATA IPG is very grateful for the support.

The group also raise awareness on the links between climate change and extreme poverty. As it says on their website "if it doesn't rain in Sudan, hundreds of thousands of people die of starvation." Very wise students indeed.

www.roderage.com.au

The big idea seems to come from head office in the UK. In the mother country it's a legal requirement for manufacturers to recycle electronic products at the end of their useful life. In Australia, there's been some movement on the topic, with a National Waste Policy released late last year by the Federal Government, but in the end it comes down to manufacturers to lead the way.

Big fiery dish

A new solar power plant that incorporates 'the big dish' is planned for Whyalla in South Australia. The mirror-covered solar thermal dish, designed by the leader of ANU's solar thermal group Dr Keith Lovegove, is the largest in the world at four times the size of any such dish.

Wizard Power has picked up this technology, selecting Whyalla as the site for their $14.5 million demonstration solar thermal plant.

The demonstration plant will initially comprise four dishes, enough to power 1000 homes, and should be up and running by the start of next year. The next, more ambitious stage, is for 600 dishes to be built close to the city, generating around 130 gigawatt-hours of energy each

year, or enough for 19,000 homes.

The project is waiting on $100 million of Federal Government funding via the Renewable Energy Demonstration Program. Apparently the remaining $255 million of equity has been raised and is committed to the project, so hopefully the outlook is good for the second stage to be completed in the next three years.

According to *The Age* last November, the dish can be too powerful for testing with the sun's rays, with testing common at night, tracking the moon as it moves across the sky. Any daytime testing must be conducted carefully to ensure trees don't catch fire.

Solar saviour

In other large-scale solar news, it looks like there is some hope for the Solar Systems power plant planned for Mildura in northern Victoria, which would be Australia's biggest solar development. Solar Systems, the company behind the 154MW plant, went into receivership last September when unable to find another partner for the $420 million plant near Mildura.

Silex Systems, based in Sydney, recently announced it paid $20 million for the company's assets. Apparently the Mildura solar plant is part of the company's plans, although, as to be expected, it is dependent on further funding.

Build by stars

Changes will be made to the Building Code of Australia to increase the energy efficiency of new buildings. As part of the plans, the minimum energy efficiency ratings of new buildings will increase from five to six stars.

The new requirements come into effect from May this year for commercial buildings and by May next year for residential buildings. The national changes are part of a commitment by COAG.

Bike on

With an electric bike buyers guide in this issue of *ReNew*, it's good to know that bike sales weathered the global financial crisis, increasing yet again last year. This marks the tenth year in a row that bicycle sales in Australia have outstripped cars and the eighth year in a row they have exceeded one million. All the more reason for governments to increase funding for bicycle infrastructure such as bike paths.

According to the Cycling Promotion Fund, over 50% of car trips in Australian cities are under five kilometres and 30% are less than three kilometres. With transport responsible for 34% of household greenhouse gas emissions there's all the more reason to encourage more cycling, on the short trips at the very least.

Looking ahead

As part of the annual Sustainable Living Festival, the Alternative Technology Association presented a forum called 'Bringing a Safe Climate Future Forward'. Five expert speakers from a range of backgrounds (sustainable technology, community development, architecture, water management and policy) spoke about what a sustainable 2020 will look like and how we might get there. Speakers included Dr Mark Diesendorf, architect Andrew Maynard, Executive Director of the Victorian Women's Trust Mary Crooks, permaculturalist David Holmgren and ATA CEO Ian Porter.

To find out what was said about sustainable communities of the future, visit the ATA website for full details about the forum.

www.ata.org.au

Dr Mark Diesendorf from the Institute of Environmental Studies, speaking at the Alternative Technology Association forum.

Bake a cake—we're 30!

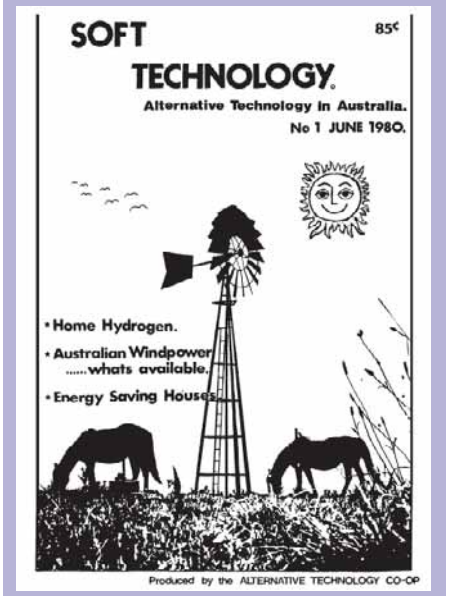
Join us next issue when we celebrate a double birthday bonanza. It's the 30th birthday of the Alternative Technology Association, which means it's also 30 years since *ReNew* was first published. How things have (and haven't) changed!

In *ReNew* 112:

A timeline of Australia's best member-based organisation promoting sustainability to households

What to expect in the future: tips for smart meter households and homes running on renewable energy

Plus *ReNew* grows up: the launch of our brand new website coming soon.



The first issue: published June 1980

Letters

Do governments ever learn?

I have finished re-reading *We Nearly Lost Detroit* by John G Fuller and guess what: deja vu all over again. In the early 1950s, a power consortium wanted to build a 430MW liquid sodium cooled fast breeder nuclear power plant. There arose a hue and cry against it when people started to realise what a potential disaster it could cause.

They had a partial core meltdown and near disaster in 1966 during tests at only 20MW power output. The US government was spending billions of dollars on promoting the development of nuclear. Opponents wanted more than the current peanuts spent on alternative power sources such as wind, solar thermal and PV, clean coal (few considered the greenhouse effect), geothermal, nuclear fusion, etc, but no-one was interested. For $130 million and growing, the reactor generated a few dollars worth of power before being left as a liability for posterity.

Where are we fifty years later?

Robert Vickers
Nyora VIC

Heat pumps

Regarding Alan Ramsay's letter regarding his troubles with his heat pump water heater in *ReNew 110*, I can't help thinking he is tarring all heat pump type water heaters with the same brush.

I have nothing but praise for my heat pump water heater. I found out that not all heat pump water heaters are the same. Not all manufacturers have the same environmental considerations as readers of *ReNew* do.

One problem is that the compressor unit stuck on top of the tank can be undersized. When built, the unit is not efficient because the heat exchanger (compressor and fan unit) is too small for the amount of water that it is required to heat. The solution to that problem from some manufacturers is to design an off-peak booster element incorporated into the unit! That to me is just silly. My advice would be to stay away from any heat pump units with boosters fitted because they are not designed efficiently in the first place.

I ended up buying a heat pump system that comes in two parts; the stainless steel storage tank and a compressor unit. The tank holds roughly the same amount as the old element type tank we replaced. The compressor unit is roughly the same size as the compressor units in split system air conditioners. I have the unit hooked up to off-peak electricity and in summer it runs for about one to one and a half hours a night. In winter it can run up to three or four hours because the air temperature is cooler.

The unit is an Australian family company with which I am not associated, apart from buying their product and being very satisfied with it. I have a Siddons Solarstream.

I would agree with Alan in that buyers of this type of water heater need to ensure the system they buy will suit their household needs prior to outlaying the huge amounts of cash manufacturers are asking for these units.

Scott Drew
Cheltenham NSW

Rainwater tank sludge solution

An excellent article in *ReNew 109* covers just about every aspect of rainwater tank selection and use. I would like to add one point to the maintenance section of the article, regarding inevitable sludge build-up in the bottom of the tank.

I have heard mention of fitting an extension pipe to the inside of the overflow outlet that runs down to almost the bottom of the tank. Now when the tank fills up and overflows, the water at the base of the tank is first to be pushed out—along with any sediment. The base of the internal pipe could be cut at an angle or double-scalloped so that even if it touches the base (with the inevitable settlement after installation) a sufficient gap would be maintained to keep a good outflow of water.

Remember to have an air gap near the top of the outlet pipe so you don't end up with a syphon effect draining your tank.

Peter Leske

Washing machine help

I am needing to replace a much loved Hoover Zodiac front loader. I was about to ask a question about how to use the free hot water from a solar hot water system instead of having to heat it from cold in the modern day washing machine.

But I have found some interesting and enlightening comments following threads on this website. Others may also find it useful: www.whitegoodshelp.co.uk/wordpress/i-want-a-washing-machine-with-a-hot-water-valve/

Meg Warren

Cool that roof space

I read the editorial for *ReNew 110* with interest. Currently to assist cooling of our home, which has a dark coloured roof (not my choice of colour), I open the manhole and close all doors and put the evaporative air conditioner on. This means that the cooled air is pushed up into the ceiling. Hence the ceiling space is cooled and the air is replaced quite quickly and the whole house does stay cooler—provided the atmosphere isn't too humid.

Rodney Champness
Mooroopna VIC

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. Due to space restrictions we can't guarantee to publish all letters received.
Send letters to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, Australia,
email: renew@ata.org.au

Rainwater tank heat storage

Whilst reading about large scale solar arrays in *ReNew 110* I was interested and delighted to read that solar heat can now be stored for use on a commercial scale, and that base load solar can now be provided.

As I sat there looking out the window contemplating the implications of this new technology my eyes rested on the rainwater tank we have in the backyard. I imagined it being full of liquid salt as part of a smaller household system... daydreaming again!

But then came the Eureka moment. I suddenly realised that it was indeed full of solar heat (as well as rainwater) and that the split system standing beside it was the ideal way to exploit that resource!

My split system is rated at 3 kilowatts. For every degree Celsius, my rainwater tank has 1.2kWh of heat stored for every 1000 litres of water. At the present moment the 8000 litres holds 9.6kWh of energy for every degree Celsius.

It would be a relatively inexpensive conversion to include a water-cooled condenser to the existing air-cooled system with an interlocking cut-out for the fan when temperature conditions do not warrant its use.

I am not an air conditioning specialist and I am unsure of all the factors which need to be considered but prima facie the solar resource sitting in the back yards of thousands of houses would seem ripe for the picking. Both winter and summer the mean temp of the water in the tank is likely to assist cooling and heating and the natural solar heating and cooling of the day would tend to return the tank to that mean.

I would think that suitable heat exchangers are already off-the-shelf, as geothermal systems would be likely to use similar if not identical exchangers.

I would be interested to know if any *ReNew* readers have tried this before?

Terrence Thompson
Geelong

Gross FiT not flawed

Whilst we respect the opinions of ATA members with respect to feed-in tariffs or any other policy issues, there were a few misconceptions in the letter *Gross Feed-in Tariffs Flawed* in *ReNew 110* that are worthy of further clarification.

Firstly the 'Solar Credits Scheme' (referred to as the 'Solar Bonus Scheme') is a completely separate policy mechanism that exists under the national Renewable Energy Target. There is no 'diversion of funds' between the Solar Credits Scheme and any state-based feed-in tariffs. Indeed, the problem with the Solar Credits Scheme is that micro-generators are awarded five times the amount of Renewable Energy Certificates (RECs) without generating five times the amount of renewable electricity. In a fixed market such as the RET, this has the potential to distort the annual generation targets and means that small scale solar, wind and hydro generators are actually drawing investment away from other forms of large scale renewable generation.

Secondly, as suggested, it isn't apparently clear how a gross feed-in tariff would encourage a waste of electricity (as compared with a net feed-in tariff). As Professor Garnaut stated in his 2008 'Climate Change Review': "The two externalities from embedded generation are present for every unit of electricity produced, not just the amount sold – implying that gross metering is the more appropriate approach for addressing this market failure."

The two externalities referred to by Garnaut are deferred augmentation of the transmission and distribution system and reduced transmission losses. When it comes to solar, a third externality is the value of peak time generation embedded in the electricity network. When it comes to solar, small wind and micro-hydro systems collectively, a fourth is the value of emissions-free generation.

If by waste of energy the contributor was referring to an incentive for energy efficiency by the use of a net feed-in tariff, the ATA has found no evidence that net feed-in tariffs lead to energy efficiency any more than gross feed-in tariffs do. Indeed, it is just as likely that net feed-in tariffs can lead to load shifting, to times when the emissions intensity of electricity from the grid is actually higher.

And finally, from a technical standpoint, feed-in tariffs delivered through gross metering are far easier to understand and manage from both the micro-generator's and the network's perspective. Investment return, payback periods, energy auditing and the level of embedded generation in the electricity grid are all far easier to calculate under a gross arrangement and those consuming energy during the day (e.g. young families, retirees) are not discriminated against. Ultimately, if governments and the public are concerned about the level of public subsidy inherent within feed-in tariffs, then the best response is to reduce the tariff rate, not change from gross to net.

Damien Moyse
ATA Energy Projects
and Policy Manager

Keep on keeping on

It is inspirational to read through the pages of *ReNew* both about the journeys of those who have secured elements of sustainability for themselves and the alerts to new methods and products which promise to take low environmental impact further. There are also the letters and questions from readers hoping to begin those paths, where uncertainty and reluctance about entering new and unfamiliar territory can be felt.

To the latter, from personal experience, I can vouch that by taking it one step at a time, the movement toward sustainability is a success, along the way stepping over the unsubstantiated fears raised by those only looking on from the sidelines.

Letters

Like most people, I didn't have the capital to go to lavish solutions in my own home. So it became a modest structure, embedding where I could the sustainable systems of the day and, just as importantly, leaving space for embedding later new or improved systems.

By taking time, much could be achieved by progressive cashflow that more usually would have involved borrowings if done quickly. The rigour learnt that way has meant that outcomes far beyond the original hopes could be targeted later. The low running costs of the sustainable abode (yes Virginia, you can live well without air conditioning and 60" plasma), then made possible securing a hybrid car (bought at suitable discount after its term as demonstrator). Savings in this transport mode (close to 10 years operation hasn't raised any of the bogeys critics forewarned about) has opened the path toward further options.

The home Rachel and I are now building again is three years in the making, one year to go (90% done, just 90% to go). Our interaction with other likeminded people is itself leading to associated interesting emergent possibilities.

The experience throughout is, that taking it one step at a time, while casting ahead for wider possibilities, is progressively securing the goals, without the trauma raised by the doubting souls from the sidelines.

Emilis Prelgauskas
Monarto SA

SHW tank elements

Regarding Bob Hutton's letter in *ReNew 109* and and Mark Walker's reply in *ReNew 110*, I think the problem could be the location of the heating element. If half the water is heated overnight and then next day is a cloudy day the pump starts and stops and very little solar gain is achieved, the only thing that happens is the tank contents get stirred up and drops the whole lot below showering temperature.

I know from experience with our system which we have run for 20 years. It is a 315 litre tank with 4m^2 of black paint collectors. I measured the system the year after it was installed and solar was contributing 82.3% compared to the previous non solar year. In the early years of the system with the element in the middle hole and boosted with off-peak power we were okay, but when my two daughters reached their teens the system could not cope on cloudy days.

The solution was to move the element to the top hole of the tank and run it from continuous (day rate) tariff. This means about 50 litres is heated to 60°C ready for use. We never run out of hot water and the solar can work on a greater fraction of the tank. The water that is boosted always has some heat in it. From my records of energy consumption this arrangement is more efficient as particularly in summer the booster is very rarely used, and in winter only the minimum amount is heated. It is very like having an instantaneous gas booster, only better in that it costs less and you can run the booster on green electricity and get your hot water totally GHG free. Yes you pay more for the electricity, but I did not see a jump in bills, further proving the efficiency case.

A further advantage is when the tank dies, as ours did a few years ago, any off-peak tank can be used as they all have the top element and they are considerably cheaper than three-hole solar tanks.

Gregory Churm
Woronora Heights NSW

A small price to pay

I have had a 1kW grid-connect solar system with a Sunny Boy 1700E inverter for over two years. At the end of 2009 I upgraded the system to 2kW using another five 200 watt polycrystalline Suntech panels added to my existing five 200 watt Solar Harvest panels.

The panels seemed to be quite efficient, but the inverter (rated to 2.2kW) kept going into derating mode on hot days. Typically on a clear hot sunny day I would average a disappointing 8kWh (I live at about 35° S and the panels are on a north-facing roof with a pitch of 12°). On reading my inverter manual I noted that derating mode occurred when the inverter reached 80°C.

The solution I implemented cost less than $50 using an existing 12 volt deep cycle battery and charger. I simply cut a a couple of holes in the meter box which holds our inverter and installed a $38 12 volt DC computer fan to blow across the inverter's heatsink (the fan consumes under 5 watts continuously) and mounted a 50°C thermocouple ($6) onto the heatsink. The thermocouple is normally open and closes when hot and so turns on the fan until it cools the thermocouple to below 50°C.

Now our inverter does not go into derating mode on the hottest days (35 to 40°C) so far. Our typical daily output on a clear day is now around 13kWh. Therefore, for a maximum energy usage of less than 100Wh (allowing for charger inefficiency, fan starting currents and battery inefficiencies) we get typically an additional 5kWh per day. Payback for this modification will be quick at 60 cents per kilowatt-hour.

Even if you did not have an existing battery and charger and had to buy them, it still would be a cheap way to improve the efficiency of your solar system.

Terry O'Leary
and Ellie McFadyen

It seems odd to me that an inverter, which is usually designed to be mounted in free air, would be placed inside a sealed, unvented box by the installer. I would have words to them about this. An even simpler solution would be to run the fan directly from a 12 volt plugpack, a small switchmode unit will cost around $18 and uses virtually no power when there is no load on it and also eliminates the need for a battery.

Lance Turner

Continued on page 18

He's the most trusted man on our solar system.

He's not Newton, Einstein or Galileo. But he is an expert when it comes to our solar system.

He's a BP Solar Certified Installer – he's someone you can rely on.

We know a solar power system for your home is a big investment, so you have every right to expect an even bigger commitment from us to ensure you receive the best product and service.

And you will.

Firstly our Certified Installers offer a complete service – from your initial enquiry to the completion of the job. Secondly, they will continue to provide you with the very best in ongoing support and service.

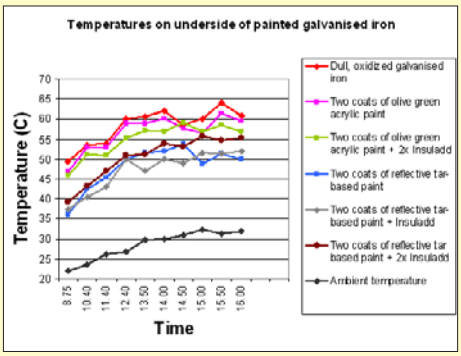
Phone us. You'll discover the first thing we install is peace of mind.

Call: 1800 802 762
www.bpsolar.com.au

bp solar

Letters

Reflective roof works best



Your article *It's not all black and white* in *ReNew 110* was of considerable interest.

Six or so years ago I was considering painting the oxidised galvanised iron roof of my house in Perth and, after a bit of research, favoured using reflective 'silver' paint (tar-based with aluminium). I also came across a website on Insuladd—a hollow ceramic micro-spherulite powder additive for paint, with reported insulating properties.

I acquired a carton of Insuladd from the USA and conducted some basic tests of mixing the Insuladd in the recommended proportion, as well as double the recommended proportion, with an external olive green acrylic paint and the reflective paint. Test patches about 450mm square were then painted onto an oxidised sheet of corrugated iron which was placed in the sun. The temperature at the centre of each painted square was measured on the underside of the sheet during the course of a day using a thermocouple. The results are shown on the graph.

Apart from a few spurious results, the trends are clear. Insuladd has a small impact but the use of reflective paint causes a dramatic lowering (10 to 15°C cooler) of the underside of the iron and hence on the amount of heat entering the roof space. Interestingly, doubling the recommended proportion of Insuladd to the reflective paint reduced the effectiveness of the paint.

The use of reflective paint on roofs is not permitted by some local authorities but by using the Insuladd the glare was largely eliminated and effectiveness of the paint improved. Additional trials were undertaken but overall were consistent with the results shown.

Tim Johnston
Mount Lawley WA

Dark-coloured roofs in suburbia

Firstly many thanks for a superb magazine—we read it from cover to cover each issue. Always some interesting articles, and the ads are a very useful source of resources.

I have been reading the article *It's not all black and white* in *ReNew 110* and offer the following comments.

We live in Adelaide in a 60-year-old concrete block cottage that has solid rendering over the blocks. It has the original concrete tiles which were originally dark red—since faded to a dirty grey.

In January we decided the roof needed some restoration and, after investigating thoroughly (including several discussions with various roof renovation 'specialists'), decided to use Astec Energy Star paints applied by an accredited applicator—Topcoat Home Improvements.

We chose 'Slate Grey' in the Energy Star range, since the specifications showed that even this dark colour has significant IR heat reflective properties. We also decided to paint our large shed roof (which is colourbond cliplock in an off-white colour) in a white Astec Energy Star.

To say we are delighted is an understatement!

The claimed 19°C temperature drop under the shed roof has not been actually measured, but sufficient to say that I can now work in the shed, with the doors closed, on 43°C days, of which we have had quite a few in 2009.

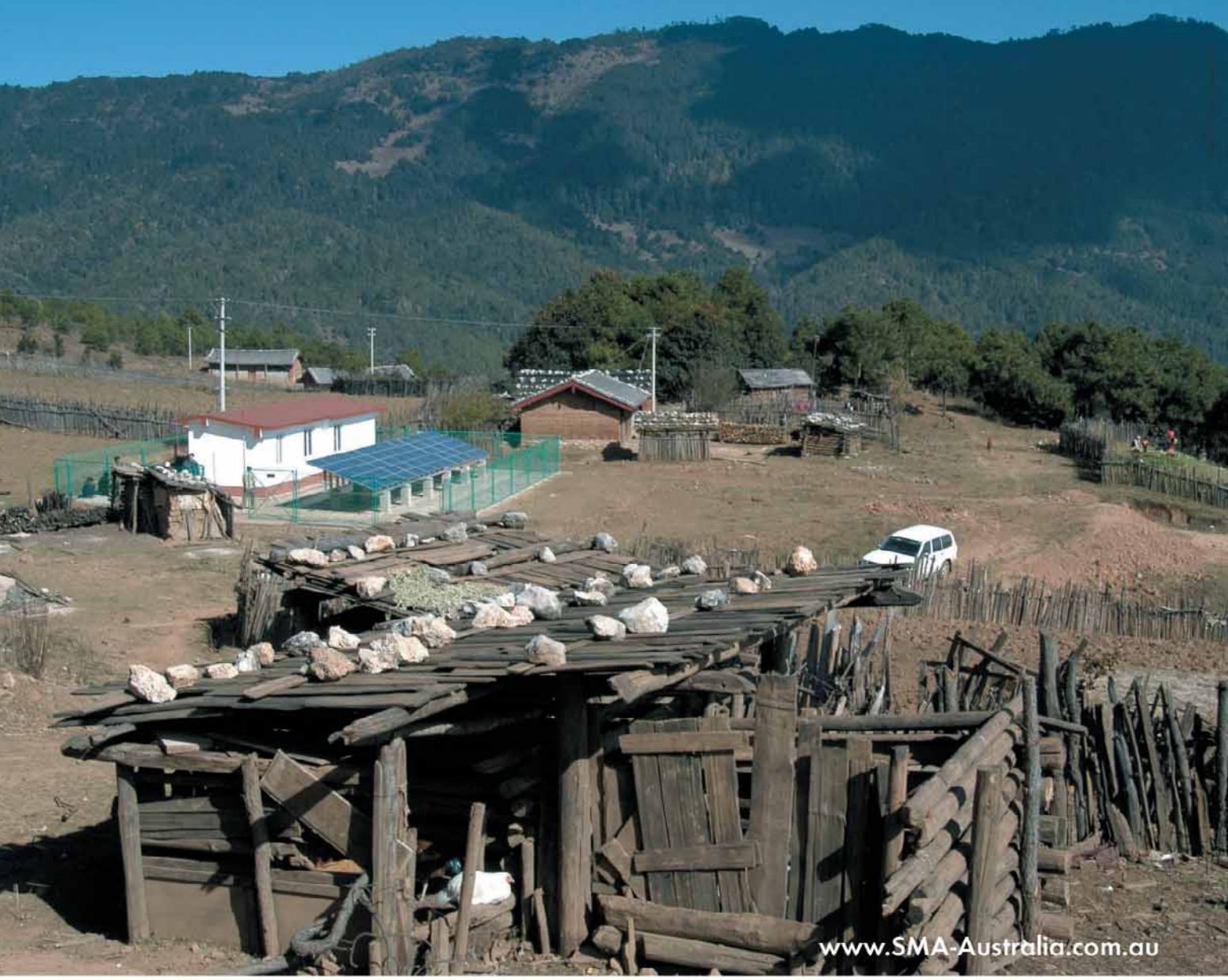
As a ready comparison, we decided not to paint the back veranda roof (also colourbond cliplock in off-white) since we are planning to upgrade this in the near future.

On these 43°C days, while I can work in the shed, my head gets burnt just walking under the back veranda roof, which is open on three sides.

I cannot understand why this product is not more widely promoted, especially by such groups as ATA.

I have included a photo of the finished roof for your information. This shows our Beasley solar HWS and the 1.2kW Solar Shop PV panels can just be seen. The bull-nose verandas are a great addition also.

Peter Newman



Sunny Island – Electric power. Everywhere.

Whenever and wherever electric power is needed, the Sunny Island battery based inverter provides perfect sine wave off-grid electricity with high efficiency, robust power and outstanding reliability and flexibility. In addition, the modular design results in simple integration of different energy sources. Simple to install and use, yet loaded with powerful and advanced features: with the Sunny Island SMA continues the successful AC coupling concept. To receive your free DVD about the possibilities of off-grid systems powered by Sunny Island, contact us today.

For more information, call 1800 SMA AUS

The Future of Solar Technology

SMA

Delivering a fire-rated home

Nanette McCallum's new water and energy efficient home was built by a keen group of carpentry students and delivered on the back of a truck. It's also one of the first built to stringent new bushfire regulations. She explains how it was done.

This is the tale of 'Frog Hollow', my relocatable holiday home built by carpentry students from Holmesglen TAFE in Melbourne. The house is one of the first built to the highest level of the new Victorian bushfire construction regulations developed after the tragic Black Saturday bushfires last year. Under the BAL-FZ rating, all external surfaces must provide 60 minutes protection during a bushfire. A number of sustainable features have been incorporated including toughened glass double glazed windows, a grid-connected solar PV system, heat pump hot water system, bamboo floor, a large bladder water tank and under-floor insulation.

Holmesglen carpentry students have built transportable homes, cabins, club houses, granny flats and other small buildings for customers mainly in country areas around Melbourne for years. Students from other disciplines undertake plastering and tiling work. Professional trades people perform the electrical, plumbing, painting and kitchen installation, which for this house were completed prior to transportation.

I discovered these student-built houses more than 10 years ago when I attended a short course in woodwork at Holmesglen. The instructor gave a tour around the school and took the class through a very impressive sports clubhouse and small home that were being built at the time. When the opportunity arose in May last year to buy a small block of land, I rang Holmesglen first to ensure they could build me a house.

Photos: Nanette McCallum

In the hangars at Holmesglen TAFE: Building inside meant the roof could go on last, which was important when waiting for important information regarding bushfire building regulations to come through.

My block is in the coastal hamlet of Sandy Point near Wilson's Promontory in Victoria, where I love to go windsurfing on the adjacent Shallow Inlet. Timing was tight. The house needed to be built by the end of the 2009 school year as it was anticipated students would be busy rebuilding homes to replace some of those lost in the Black Saturday bushfires. Yet at the time the Victorian bushfire building regulations were being redeveloped and in a state of flux. Bob Collins, a local Fish Creek draftsman, spent many hours along with Peter McMahon, Training Manager in the School of Carpentry and project manager on this build, trying to understand the new regulations in order to complete the plans to the required specifications.

Design

The house had to be designed around certain height and length constraints dictated by the height of the hangars at Holmesglen and the length for transportation. This resulted in a simple rectangular shape, 7.2m wide by 15.25m long with a shallow gable roofline. The house would be built in two halves lengthways, touching at the centre, with a team of carpentry students responsible for each half who would be marked on the quality of their work.

While Holmesglen have a number of

Leaving the TAFE with a full load.

On the road to South Gippsland in Victoria.

standard home plans, I had the freedom to adapt one of these to suit beachside family holiday living. Passive design principles I learned in a home energy-rating course a few years ago were incorporated where possible. The front of the house is oriented north-west, with two large windows across the front to allow winter sun into the open plan living area. Two additional glass brick feature windows with a 60 minute fire rating provide additional light and warmth for the living area. A veranda will be added to the front of the house to shade these windows in summer; however simple external bamboo blinds shade the house effectively for now.

Build

The required permits arrived just in time for construction to begin in August 2009. It was assumed that the required bushfire-rated products for the walls and roof would become available during construction, which proved to be correct. The house was built from the inside out, so that the roof could be completed after the test results had finally been published. It was only possible to construct the house in this way because it was under cover in the large hangars at Holmesglen.

Additional reinforcing was needed to support the weight of extra layers of cladding for the BAL-FZ rating, making the house particularly robust.

At the time of building, a number of construction systems were being tested for the bushfire rating. The system chosen for the external walls included two layers of fireproof materials and an air gap inside the external cement sheet cladding. We used 16mm water resistant Firestop plasterboard, vapour impermeable sarking and 9mm thick cement sheet cladding to achieve the fire rating. The Colorbond roof sits on a thick layer of fireproof material. Eaves and an under-roof alfresco area were sacrificed from the original design as no construction system had been developed in time to meet the fire rating, but the verandas will help compensate.

To achieve the BAL-FZ rating, one configuration for windows required 6mm toughened glass with bushfire-rated shutters, however I wanted the benefits of double glazing so opted for 10mm double glazed windows. While this more than doubled the cost of the windows compared to non-toughened single pane windows, the house has a lovely constant internal temperature and is remarkably quiet. At the time of writing, I believe there are no bushfire shutters on the market suited to the BAL-FZ rating so these will need to be added later when they become available.

Delivery

The house was transported to Sandy Point in early December 2009. Getting the house out of Holmesglen TAFE was a sight to behold, with some interesting manoeuvres to negotiate a couple of tight corners and get the truck on the road. At one point the house was tilted on the trailer to get past signposts, but eventually the house was on its merry way down the freeway towards South Gippsland.

Each half of the house was transported to the block separately then manoeuvred into place onto pre-installed stumps. Usually stumps are set up when a transportable house arrives on site, but due to the small size of the block the stumps had to be set up beforehand.

Once the house was in place, a beautiful uniclic-style floating bamboo floor was laid. A fire-rated plinth has been attached around the base of the building, enclosing a bladder tank under the house. A 1kW grid-connect so-

lar system has been installed and will more than cover the anticipated yearly electricity usage. The panels face north-east on the low gable roof, resulting in slightly reduced power production compared to the optimal orientation at this latitude. However, rather than build a frame to better angle the panels, it was cost neutral to add an extra panel and keep the whole installation flat on the roof. A heat pump provides solar heated water 24 hours a day using a small amount of power from the PV system.

The walls are so thick from the layers of bushfire cladding and the house so well insulated that the sun's warmth is retained a long time inside the house. Sandy Point is one of the windiest locations in Australia, and while houses are sheltered behind large sand dunes and plenty of coastal foliage, the frequent prevailing winds and sea breezes can nevertheless flow through windows at each end of the house to keep the house cooler in summer. A small wood heater, split system and ceiling fans will provide alternative methods for heating and cooling.

The township has no mains water supply or town sewerage so I added a 3000 litre and 7000 litre water tank off an existing cabin on the block and placed a 26,000 litre bladder tank under one half of the house. A SuperTreat black water system processes all used water and pumps treated water through a network of sub-surface pipes covering most of the area around the house, so the garden should be well irrigated. This part of Gippsland usually receives relatively good rainfall, however, if required a water bore can be drilled.

Cost

For work carried out by the Holmesglen students, I only had to pay for materials, which came to approximately $56,000, including $11,000 worth of double glazed windows. Other items were at professional rates such as painting, electrics, plumbing and kitchen installation.

Transportation (which included the stumping) was around $15,000. Onsite finishing works such as landscaping, plumbing, and the solar system are additional costs

This has been a terrific personal adventure and I will long carry memories of the sheer fun of designing the house and collaborating intensely but happily with the Holmesglen TAFE staff. For me, knowing that students built the house and that they appreciated the opportunity to work on a 'real' project adds a very special dimension to the experience. Everyone concerned has also learned a great deal about building to the new bushfire regulations.

After naming the house 'Frog Hollow', inspired by its happy yellow-green colour and cosy setting, I was utterly delighted one day to discover real live frogs living on the block. The garden,

Clockwise from top left: It's a narrow site but the house fits snugly; a 26,000 litre bladder tank placed underneath the house; Nanette McCallum onsite at Holmesglen TAFE; good orientation means the house receives a lot of natural sunlight; the PV system inverter next to a heat pump hot water system and additional rainwater tank to the right.

which is yet to be re-planted, will re-establish and enhance their habitat as well as being in harmony with the local native vegetation. ✻

For information about bushfire-rated construction in Victoria go to the Building Commission of Victoria website: www.buildingcommission.com.au
For information regarding student built homes from Holmesglen TAFE contact Peter McMahon on 03 9564 1604

New regulations

Sandy Point is one of Victoria's new priority bushfire areas, so this new home is obviously in a high bushfire risk area.

After the Black Saturday bushfires a new building standard came into effect in Victoria, with every new housing site given a Bushfire Attack Level (BAL). Nanette's new home was on a block with the highest BAL—the BAL-FZ rating. There are six ratings, ranging from BAL-Low where there are virtually no bushfire risks, to the highest one of BAL-FZ which accounts for 'direct exposure to flames from fire front in addition to heat flux and ember attack'.

For those living in BAL-FZ areas all external walls must be non-combustible made from brick-veneer, mud brick, masonry, concrete, aerated concrete or masonry with a minimum thickness of 90mm. Windows and doors must have bushfire shutters. The roof/wall junctions must be sealed and openings fitted with non-combustible ember guards. Decking must have no gaps and be non-combustible.

New homes should be built on a concrete slab or the floor enclosed by an external wall. At Nanette's new home a fire-rated plinth has been put around the base of the building instead of building the home on a slab.

These bushfire standards have also been adopted by the ACT, with other states expected to follow this year.

Difficulty rating: ★★★★☆

Give your caravan a solar boost

Add a battery and a solar panel to your caravan and break the 240 volt power connection permanently. Peter Jackson shows you how.

We were recently looking to upgrade our caravan, however we found that the vans set up with solar panels and batteries were top of the line and out of our price range. Instead I bought an affordable van and added the things that I thought were missing. Here's what I did in case there are any other (crazy) people who would like to take on a similar project.

Measure power use for a day

I measured the current drawn by each piece of 12 volt equipment (all the appliances and van fixtures that would be used while we are camping away from 240 volt power). This can be measured with either a clip-on ammeter or by inserting an ammeter temporarily into the circuit (most cheap multimeters have a 10 amp DC range). Or you can simply calculate the current by using the wattage marked on the 12 volt appliance or light globe i.e. current = power in watts divided by 12 volts, e.g. the current drawn by a 24 watt light globe connected to a 12 volt battery is 2 amps.

I estimated how long (in hours) each of these appliances will be used each day and entered it in a table. Minutes can be converted into fractions of an hour by dividing them by 60, e.g. 10 minutes = 10/60 = 0.17 hours. To calculate the amp-hour (Ah) usage for each item listed, multiply the current drawn by each appliance by the hours (or fractions of an hour) you expect to use the appliance each day. Finally, add up the 'Approx Amp-hours usage each Day' column to give the estimated total daily amp-hour usage figure for each day.

In the sample table (p 25), the 'Total daily Ah usage' came to 29Ah per day, which is rounded up to 30Ah per day.

A solar caravan means you're not tied to caravan parks or powered sites.

The total power required for a 14 day stay would be 30Ah x 14 days = 420Ah. In a domestic caravan it would be impractical to try and carry enough batteries to last that long because of the weight and the cost.

Finding power when bush camping

The best option was to solar power my caravan. There are some down sides to solar; most caravan systems aren't large enough to run a microwave oven or air conditioner, so you must ask yourself 'Can I live without those items?' You also need a back-up system very occasionally for long stretches of cloudy or rainy days.

Knowing that we needed 30Ah per day I selected a 12 volt, 80 watt solar panel, which will supply us with around 30Ah per day (i.e. approx 5 amps x 6 hours = 30Ah) and a bit more on good sunny days. To harvest this much power from an 80 watt solar panel I found that I needed to track the sun rather than just sit the panel in one position and have the sun pass over it daily. I manually move the panel three to four times per day to maximise the power output from the panel. (*For an automatic solution, check out www.campatracka.com—Ed.*)

If your choice is to use a fixed panel then you may need to buy a higher wattage solar panel than I used or otherwise reduce your daily power usage. My BP 80 watt panel cost approximately $800 a few years ago, although prices have possibly come down now. Discuss what will best suit your application with the solar panel supplier.

Cloudy and no sun?

I chose a 130Ah battery. It weighs 30 kilograms, which is light enough to carry around and lasts me 4.3 days using 30Ah per day before the battery fully discharges—normally enough time for the sun to return. I typically only rely on my battery for two days and then I reduce our daily power consumption because discharging batteries below 50%

of their capacity shortens their life. To cut back on power usage we don't use anything powered by the inverter (unless essential), don't read so long in bed and don't use the laptop or television as much. By following these simple steps we can easily halve our daily usage.

If it's still cloudy after three days then I charge the caravan battery from my tow vehicle. I have installed a 12 volt MotorMate charger in my caravan next to the battery and it delivers 13.8 volts at 20 amps directly into the van battery. By running my tow vehicle motor for 30 minutes I can put another 10Ah back into the van battery, giving us enough power to last almost another day on our reduced power rations. In nearly 200 nights that we have bush camped with this set-up, I've only had to use this method of charging four times.

This 12 volt charging system does require quite heavy cabling and Anderson plugs between the vehicle alternator and the van charger. This is because currents of over 30amps can be required, although voltage drops aren't very important as the charger will work with input voltages as low as 8 volts. I spent a lot of time researching this subject because I wanted to know it would work before spending $240 on a charger.

Much of the equipment is mounted in the caravan's front boot, where the gas bottles used to reside.

Charging between campsites

I can also charge the caravan battery quite adequately while we are driving between campsites, allowing me to arrive at the next camp site with my battery 'fully charged'. If I drive 1.5 hours before lunch I could put 30Ah (1.5 hours x 20 amps = 30Ah) back into the van bat-

Example caravan power usage audit

Item	Current drawn by each appliance	Approx hours usage each day	Approx Ah usage per day
LED lights over table and sink	0.5	4	2
Reading lights over bed each (however time is x 2)	0.9	2	1.8
Bathroom light	1.8	0.2	0.4
Radio	0.6	2.5	1.5
TV on standby	0.1	10	1
TV operating	3	2.5	7.5
TV playing a DVD	3.3	2	6.6
Water pump	5	0.3	1.5
Inverter no load	1.3	0	0
Inverter powering 240 volt electric blanket on high	5.8	0.5	2.9
240 volt rangehood operating from the inverter	13	0.1	1.4
Charging the laptop computer from 12 volt inverter	2.1	0	0
Charging & using laptop computer from 12 volt inverter	4.8	0.5	2.4
		Total daily Ah usage	**29**

tery. If I did the same length of driving after lunch I could put another day's charge back into the van battery.

Wiring

I found that most things in the caravan were designed to operate from 12 volts (a good start) which was supplied by a 240 volt to 12 volt, 22 amp regulated power supply. This power supply wasn't suitable for charging the van battery when we were on 240 volt power, as you need an intelligent charger that knows when the battery charge is coming up and reduces its output accordingly, preventing overcharging and 'cooking' the battery.

I traced out the van wiring through some changeover switches that switched the 12 volt lights and appliances over to a circuit that was connected to the tow vehicle's battery via the usual 'caravan-tow vehicle' cable and plug. This made re-wiring a little easier.

The job would have been easier if I used a sealed deep cycle battery that could be easily installed in the caravan (under a seat), however I already had an almost new Trojan 12 volt 130Ah flooded cell deep cycle battery. This type has liquid acid that can spill and they give off hydrogen gas when being charged, which can explode. This meant that the battery had to be mounted outside the habitable areas of the van in a vented location. The front boot had once housed the two LPG gas bottles and this had necessitated the front boot being ventilated to the outside world, so the front boot became the obvious home for the new caravan battery. Other people mount batteries on the "A" frame/drawbar of the van.

The process from here was becoming clearer. I needed to mount the battery, the 240 volt battery charger, the 12 volt to 13.8 volt charger and the solar panel regulator. Then a 240 volt power point needed to be installed in the front boot to power the 240 volt battery charger.

Next I needed to run a 12 volt fused circuit from the van battery to the changeover switch inside the van, run cable via fuses to some new 12 volt power outlets inside the van and finally install a 12 volt to 240 volt, 800 watt inverter. The inverter also required some 240 volt outlets to be installed above the bench in the caravan. The fittings I used for these 240 volt outlets have red neon indicators inbuilt, which make it easy to see when the inverter is running.

The evaluation

I am delighted to be able to travel to bush or un-powered campsites where we can stop for a couple of weeks with free electricity, provided the sun shines most days in a week. If we are leaving the campsite for the day I pick a point facing north and set the solar panel to collect as much power as it can. I use a padlock and a curly cable to secure the solar panel to something substantial before we leave.

I use a 10 to 15 metre lead on the solar panel, which means the panel can be in the sun and the van remains in the shade. Even if we have the luxury of staying in a caravan park we often take an un-powered site and set up the solar panel to keep the battery charged. What really gives me a kick is when people ask us if that solar panel is making enough power to run the whole caravan? Then they, along with me, typically think it's great to be independent of other power sources. ✻

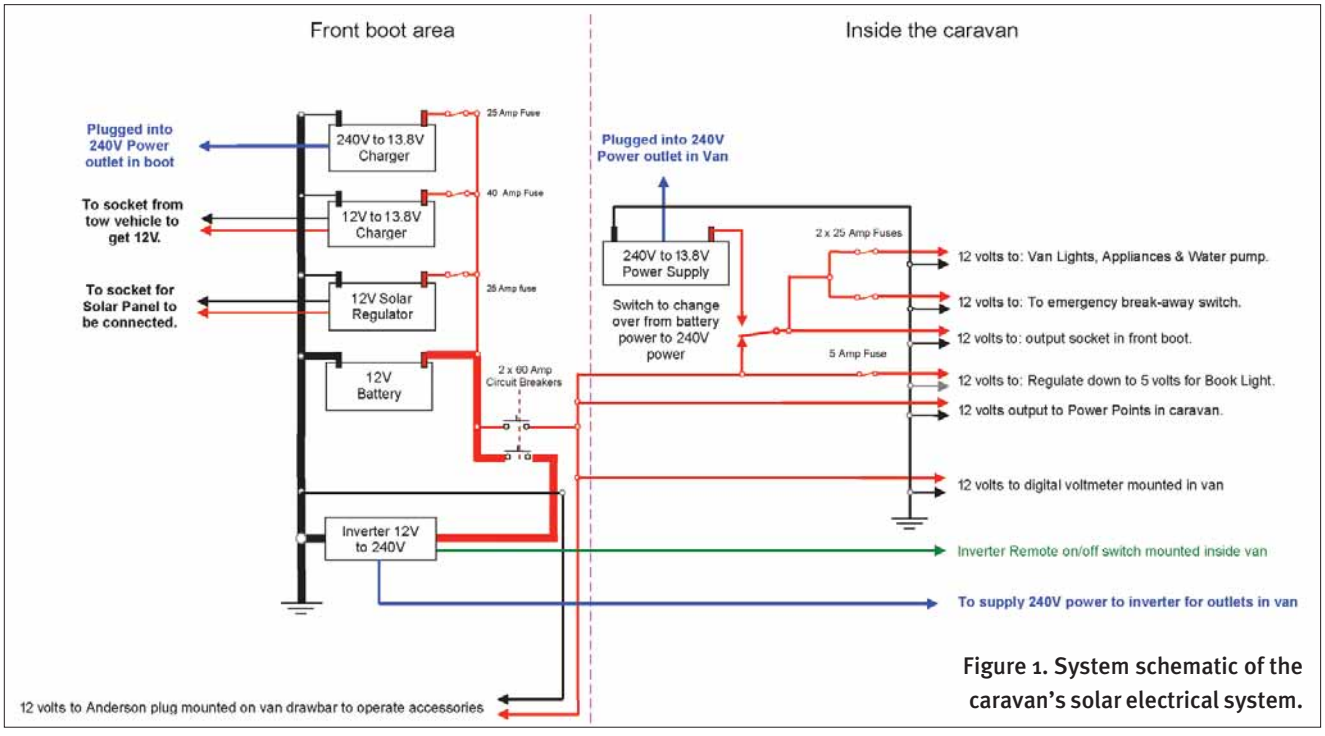


Figure 1. System schematic of the caravan's solar electrical system.

Is your solar payback disappointing?

Optimize your system and maximize your return with SolarMagic™ power optimizers.

SolarMagic technology enables each solar panel to produce maximum energy regardless of whether other panels are under-performing due to real-world conditions such as shade and architectural obstructions. This advanced technology monitors and maximizes the energy harvest of each individual solar panel and reclaims more than 50% of energy lost to real-world mismatch conditions.

Real-world residential conditions like shade from trees, chimneys, and power lines, can significantly decrease solar power output.

Real-world commercial building conditions like shade, vents, and air-conditioning units, can limit solar power output and ROI.

SolarMagic power optimizers can recover up to **50% of the energy lost** to real-world conditions.

2009 inter solar AWARD

WINNER, Innovation Award—Photovoltaics

To learn more and find an authorized dealer, visit **www.solarmagic.com/payback**

Solar for the real world. www.solarmagic.com

SolarMagic™ by National Semiconductor

Authorized Australia Distributor

Solco Choice Electric

Tel.: 1800 074 007
Fax: 07 3216 4756

Email: sales@choiceelectric.com.au
Web: www.choiceelectric.com.au

Mum, what was the Great Barrier Reef like?

Reducing global carbon emission sounds so overwhelming! But just as one raindrop joins a river and that river joins a sea, the small efforts by each of us can become a powerful force for change.

Switching your home to solar power has never been more affordable than right now. And its even easier to install with the expert guidance and products from Carbon Management Solutions (CMS).

A 100% Australian owned and operated company, CMS can arrange for our team of highly experienced and accredited electricians to advise and manage your family's investment in renewable energy.

Take the plunge into renewables by calling us now on 1300 902 110, and we'll put you in touch with a solar power specialist. Be part of the sea of change.

cms
CARBON MANAGEMENT SOLUTIONS

Be part of the solution.

Difficulty rating: ★★☆☆☆

Dumping the halogens without compromise

The problem with halogen downlights is that most of the simple replacement options just don't produce enough light. Lance Turner looks at a retrofit that improved illumination with a huge reduction in energy use.

When we decided to take a look at a downlight retrofit to eliminate halogens from a home, we asked around the office if anyone had recently done this. Amazingly, no-one had, but one staff member did have an investment property that had halogen downlights and was slated for upgrading. So, together we sat down and worked out the best option for the upgrade.

The aim of the retrofit was to eliminate not only halogens, but fluorescent lamps as well. While fluoros use a great deal less energy than halogens and produce much less heat, they do have drawbacks, such as a long start-up time to reach full brightness, and of course the tubes contain small amounts of the very toxic metal mercury. So, of course, we were aiming to change the lighting to LEDs.

The first step was to find out what LED options were available. This retrofit had to be done to a budget, but it also had to be done to a level of quality, so it was important to find the most suitable solution rather than opting for what was easiest to get. Of course, the best way to find out what's out there is to look online, and after considerable searching and a number of phone calls, we put together a list of the most viable options. These can be seen in the table on the next page.

The first five options in the list were Australian sourced, the rest were from overseas. If you look at the prices it is obvious that by going overseas you get a lot more bang for a lot less buck. This is something the Australian importers need to work on. LEDs will never become a mainstream option when each globe or light fitting costs 10 times as much as the halogen it is to replace.

A quick cut with a plasterboard saw and the new light fittings can go straight in.

In the end it was decided that standard Crompton CFL downlight fittings would be used, with the CFLs replaced by LED bulbs. The final tally was eight of the ZetaLux warm whites, along with two EvoLux warm whites, which would be spare bulbs in case the tenants needed some extra light in the kitchen area. Both of these bulbs come from EarthLED and have UL listing and FCC approval. While that doesn't mean much to Australian authorities (overseas approvals never do, we always have to reinvent the wheel here in Australia), it shows the bulbs have been tested and approved elsewhere.

Installation

A time was made to visit the house and the bulbs and fittings were purchased. The bulbs were ordered in two orders as the EarthLED website didn't allow the purchase of them all together due to weight limits. The fittings came from the local hardware store.

The original halogen fittings were GU10 units, so there were no trans-

formers to remove. The mains cable was simply disconnected from the old fitting and connected to the new one.

However, there was a step between those two, and that was to make the holes in the ceiling larger. The old fittings used a much smaller cutout of around 65mm, while the new ones were a little over 100mm. A simple plasterboard saw was used to open up the holes, taking less than a minute to do each one.

Once all the fittings were in place, the bulbs were installed and the fittings tested.

Overall, the installation was a snap, taking just 90 minutes to do eight fittings and clean up the plaster dust mess afterwards.

One thing that we noticed though was that several of the original diecast zinc halogen fittings had actually distorted from the heat of the bulb and there were mild scorch marks on the plasterboard. This is despite the fact that most of these fittings were in an uninsulated ceiling-floor cavity (the house is double storey) and the ones that weren't had covers in the roof cavity over the downlights to prevent any insulation falling onto them.

It's not hard to see how halogen fittings can start a fire with even the lightest covering of insulation, or even a heavy layer of dust. It really makes you wonder how the electrical authorities approved them for use in the first place, at least without protective covers, and why there are now millions of halogen fittings in homes across Australia.

The end result

When the lights were turned on for the first time, the result compared to the halogen lighting was impressive. There was more usable light due to the much wider beam angle of the LED bulbs and the rooms looked noticeably brighter. The tenants were very happy with the results—they can now read the titles of the books in their bookcase without resorting to using the table lamp for extra light.

What the tenants may not appreciate until their next power bill is that 400 watts of halogen lamps have been replaced with just 48 watts of LED bulbs!

One of the original halogen fittings can be seen on the left. One of the new fittings, with LED bulb in place is at right (photos not to scale).

The thought process

As mentioned earlier, the aim of the process was to eliminate halogens and fluoros altogether while providing the greatest number of options should future owners decided they want something different. There also had to be easy bulb replacement options for the tenants should one or more of the LED bulbs fail.

The Crompton downlight fittings seemed the best solution. They were low cost (a pack of four including CFLs was $50) and because they use ES27 (27mm Edison screw) bases, there is a vast array of bulb options, from 60 watt R60 incandescents through to ES based halogens, CFLs and LEDs. Further, as the ES base is by far the most common in use around the world, the range of lamps available from overseas suppliers is huge. Many fluoro and LED bulbs now have universal voltage drivers so they can run on any voltage from 90 to 250 volts. A bulb with these specs can be bought from anywhere and used in such light fittings.

The only issue is one of electrical approvals. However, often the only difference between a bulb approved for use here and one that isn't is a stamp on the bulb itself. Most bulbs sold here are made in China and are no different to the bulbs sold everywhere else, whether they be incandescent, halogen or CFL, so why should LED bulbs be discriminated against just because none of the large suppliers offer decent LED bulbs in the Australian market. The bulbs exist, we should be allowed to use them.

Brand/source	Style	Wattage	Lumens	Beam angle	Colour temp	Price	Currency
JAG Trading (ebay) 7W kit (Aust)	Dedicated downlight fitting	7	500+	70	Warm	$72.95	AU$
LED Australia Luxstar (Aust)	Dedicated downlight fitting	15	750	36	Warm or cool	$119.79	
Alternate Energy Solutions Ignite (Aust)	Dedicated downlight fitting	8	472	150+	Warm or cool	$130.00	
LED Australia LA Series 13 (Aust)	Dedicated downlight fitting	13	850	120	3000K or 5000K	$133.00	
Digilin Icon 812 (Aust)	Dedicated downlight fitting	12	950	up to 56	Warm	$154.00	
Sino Union Tech (ebay) Fusion 9010K1	ES27 bulb	5	500+	150	Cool	$29.00	US$
Earthled ZetaLux (USA)	ES27 bulb	6	450/350	180	3000K or 5000K	$38.00	
FobSun (China)	Dedicated downlight fitting	12	1140	Up to 60	3000K to 6000K	$39.40	
Earthled EvoLux (USA)	ES27 bulb	12	1075/1000	180	3000K or 5000K	$48.00	
Safer Seller (ebay) 6 watt Nichia fitting	Dedicated downlight fitting	7.8	~460	90	Warm	$58.00	
Safer Seller (ebay) 12 watt Nichia fitting	Dedicated downlight fitting	16.8	920	90	Warm	$102.00	

The various LED downlight retrofit options were considered and compared. In the end, Australian options ended up being outside the budget.

Illumination levels

The original halogen lamps suffered from the same problem most halogen fittings do—they produce a large bright spot on the floor, but very little spill to the sides. So the rooms end up with bright areas under the fittings, but are very dark in the corners. Because floor coverings tend to absorb rather than

EFFICIENCY
ECONOMY
EXCELLENCE
ENVIRONMENT

Our Future is Solar

- Long life stainless steel
- Contemporary colours
- So advanced it pays for itself
- Award winning Australian design
- Government rebates and incentives available*
- Free in home quote
- Pay no interest ever with Solar Direct[1]

Edwards
Heat Pump

GTD Series 2
Ground System

GTS Series 2
Ground System

1300 SOLARS

1 3 0 0 7 6 5 2 7 7

www.edwards.com.au

* See instore to find out what you qualify for.

[1] Conditions apply - Solar Direct is a retail payment option provided by Certegy Australia Limited. ABN 68 050 021 513. Min. deposit of 25% of the total installed value is required.

EDWARDS
solar hot water®

EDW9255_REN

One of the new LED bulbs. Not very exciting, unless you like having lower power bills!

reflect light, the total lumens available from the 800-1000 lumens produced by the 50 watt halogen lamps tends to end up more like 200-400 lumens. This can be partially improved by using halogens with a 60 degree beam angle, but that's still quite narrow, especially with today's modern low ceiling heights.

The LED bulbs are designed to spread their light at a wide angle so they illuminate objects and surfaces in the room directly. This gives the impression that the 350 or so lumens from the LED bulbs is just as bright, if not more so, than the original halogen.

However, this doesn't apply in task lighting situations where the lamp needs to be directional. Should this become a problem, such as with the fitting in the kitchen directly over the sink, then a more directional LED bulb will be fitted.

The other great thing about using LEDs though is that they improve in efficiency all the time. The LEDs in the bulbs used in this retrofit are Cree LEDs. Cree make the most efficient power LEDs available anywhere and now specify bins for some of their LEDs of up to 150 lumens per watt! This is vastly better than any fluoro, and even after optical and driver losses, bulbs of over 100 lumens per watt are achievable and will soon start to appear on the market.

But it doesn't end there. As LEDs become more efficient, they produce less heat. So, the next version of the 350 lumen, 6 watt ZetaLux lamp may be a 450 lumen, 6 watt bulb that produces less heat, or a 550 lumen, 8 watt bulb that produces the same heat as the original 6 watter. This is something that simply isn't possible with other lighting technologies.

Heat dissipation and insulation

In our installation the main concern was that the bulbs might have a shortened lifespan due to heat build-up in the light fittings. The fittings are open to the back somewhat (normally a bad thing as it breaches your ceiling insulation) but they are mostly mounted in a 300mm deep space between the ceiling and the floor above, so not a lot of air movement can be expected.

However, most of the bulbs are 6 watt units, which will produce around 3 to 4 watts of heat, so the space inside the fitting, plus the fact that the fitting is metal and will conduct heat easily, should be adequate to keep them at realistic temperatures. Besides, the ZetaLux bulbs have been tested at temperatures above 80°C and continue to work, although light output and lifespan would be reduced at such temperatures.

Heat shouldn't be a problem for the EvoLux bulbs as they use forced air cooling—they contain small internal fans.

During testing, after 30 minutes of running, the ZetaLux bulbs were still cool enough to be easily handled, so heating shouldn't be a problem.

Overall though, the end result has been a simple and relatively low-cost retrofit that should eliminate the need for the tenants to change bulbs while providing them with good levels of illumination. ✻

Fluoros can be upgraded too

Here in the Alternative Technology Association office we upgraded the old ferromagnetically ballasted T8 (25mm tube diameter) fluorescent fittings with the slimmer, more efficient T5 (16mm tube) fittings. These have electronic ballasts, so not only is there no flicker when starting, but the tubes produce more light for less energy use.

However, after almost three years of service we started to lose some tubes, as they tend to run all day and had clocked up quite some hours. Faced with the prospect of replacing 26 fluoros and having to dispose of the old ones, we thought we should look at LED replacement options.

T8 LED tubes are easy to find and they usually have the LED driver built into the tube, so you just bypass the ballast and starter in the fitting and fit the tube. There are low-cost ones from China that are only $30 to $40 each, through to the high-grade units like the EverLED tubes, which sell for around $200 a tube!

However, we had T5 fittings, so we needed T5 LED tubes. The problem with T5 tubes is that, because they are so thin, they usually don't have an integral driver, but instead are driven by a driver in the base. This means that the tube and base are usually sold as a single unit and have to be used together.

This meant that we would have to replace our nice slimline fittings with whatever T5 LED fittings we could get. Most fittings don't look great and seem to be a simple base with tube. Further, most manufacturers don't seem to have any concept of electrical isolation and safety requirements and the fittings don't remotely meet Australian standards—most don't even have provisions for earthing!

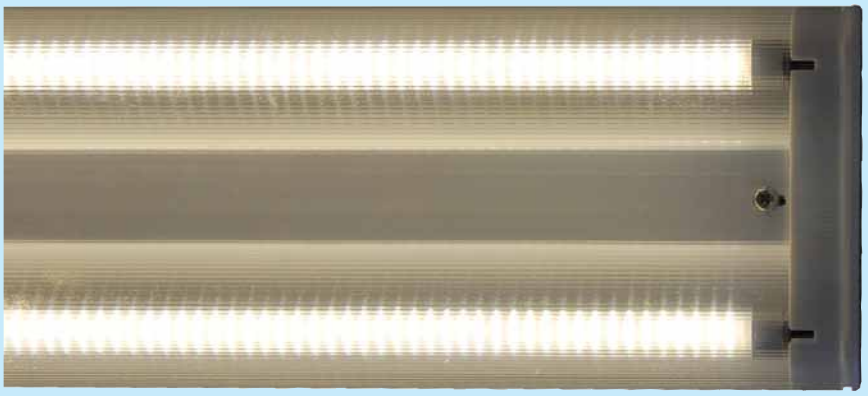
After looking around we bought a pair of 1200mm T5 warm white tubes and fittings from EarthLED for US$145 plus US$20 shipping.

Upon receiving them (in just four days!), my suspicions about the electrical design were confirmed. The units consisted of a rectangular section aluminium base with the tube holders fitted to each end. Inside each base two drivers were fitted, one for each half of the tube. The 1200mm tubes are actually the equivalent of two 600mm tubes in a single unit, so require a driver for each half.

Anyway, the EarthLED fittings were a long way from being suitable for use in Australia. Not only did they have no provision for earthing, but the drivers were simply wrapped in thin polyester tape (probably high temperature tape) and slid inside the aluminium base—hardly adequate insulation.

The solution of course was to disassemble the EarthLED fittings and fit the drivers into one of our office fluoro fittings. These are a low profile unit made by Nelson. They have a single large driver inside that runs both tubes. The driver was simple to remove, being held in with just two screws. The wires from the tube holders were mostly long enough, some were way too long and were trimmed, the extra cable being used for some of the internal wiring yet to come.

The four LED drivers from the EarthLED fittings were unwrapped and the original (very thin) wires unsoldered from the boards. I wanted the drivers to be open to the air as much as possible for cooling, but still be prevented from moving and coming into contact with the inside of the fitting.



You can see the individual LEDs inside each tube—there are hundreds of surface mount LEDs per tube.

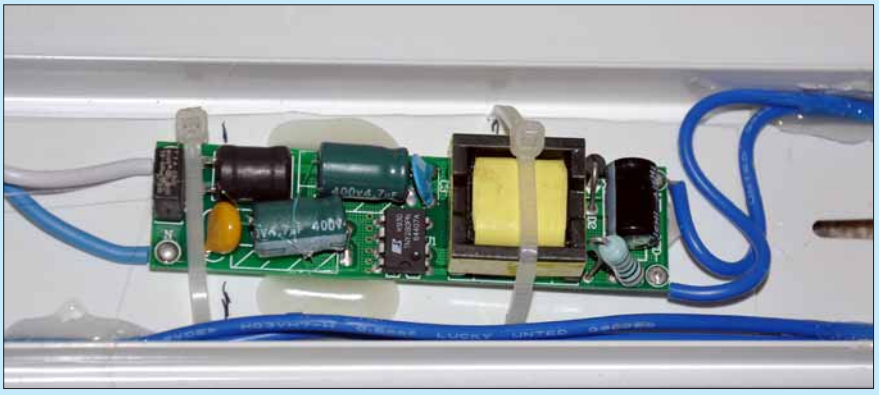
I started by installing two strips of 2mm thick plastic sheet into the channel in the fitting base. The plastic was held in place with double-sided tape and three 4mm high-temperature nylon bolts in each strip. Also under each strip I pre-fitted four cable ties to hold the drivers in place. You can see the set-up in the photo.

The rest was simply a matter of soldering new mains-rated wires to the drivers and wiring them back to the mains terminal block, as well as connecting one tube holder to each driver. On our fittings, the pair of holders at one end had two wires each, but the pair at the other end shared one wire. I solved this by removing the holder assembly from the base and cutting the wire that linked the common terminal on the two holders. This wire was then led out of the holder and the holder assembly refitted to the base. It sounds complex but, once you see the fittings, it's pretty obvious what has to be done.

Anyway, the wiring was completed and the drivers locked into place with their cable ties. I neatened up the wiring by holding it in place with hot-melt glue. I also put a large blob of this on either side of each driver to prevent any movement. It's pretty much impossible for the drivers to move now.

It should be noted that the hot-melt glue I use is not the average stuff from your local hardware, it is a special glue made by 3M for electrical potting and bonding work and has a high melting point. The sticks are larger than most, being 15mm diameter, and require a special 3M glue gun. Mine was bought from a US supplier so the gun is 120 volts and has to be run from a step-down transformer.

After the wiring was complete, the tubes were fitted and the fitting was run for a while to test it. It was then reassembled and fitted back into place in the office. The light output was slightly less than the original tubes, but the energy consumption for each tube is just 16 watts, compared to 28 watts for the fluoros. The fittings do have very poor power factor though, coming in at around 0.5, so manufacturers still need to do some work in this area. While there are higher grade fittings available, their prices are generally too high to realistically consider using them for many applications. ✻



Each tube requires two LED drivers.

Turbines at the ready

Five years of hard work have gone into the Hepburn Community Wind Farm, all for just two turbines. But communities all over Australia are asking the team behind Hepburn Wind how they did it, writes Alicia Webb.

Australia's first community wind farm is heading towards completion. Over the past 18 months the Hepburn Community Wind Park Cooperative Limited (Hepburn Wind) has secured over $11.3 million from over 1000 members (most of them local), Sustainability Victoria and the Bendigo Bank. Having recently placed an order for turbines and clearing numerous other technical hurdles, it won't be long before Hepburn Wind will have some clean, renewable energy flowing from Leonards Hill near Daylesford, possibly later this year.

Hepburn Wind began five years ago in the towns of Daylesford and Hepburn Springs north-west of Melbourne. With help from developer Future Energy, the Hepburn Renewable Energy Association presented a permit application to Hepburn Shire in early 2007. Members later offered huge support to the project when its development was contested within the shire. The case received a reported 18 complaints and 320 letters of support.

These days the wind monitoring is all done and dusted. Having gathered three years of data from Leonards Hill, the mast was taken down in January. The cooperative is close to finalising the four major contracts: wind farm construction, grid connection, bank financing and the power purchase agreement. And they're currently working on a plan with an energy retailer to allow the community and other groups to purchase branded power from the project.

Photo: REpower/Jan Oelker

The MM82 turbine has been selected for the Hepburn Community Wind Farm, pictured here in the green pastures of Europe.

Turbine selection

When it was time to choose a turbine, the technical people behind Hepburn Wind received unsolicited emails from start-up turbine manufacturers wanting to try out their product on a small demonstration installation. Following the global financial crisis in late 2008, it was even suggested that the project could go ahead using second-hand turbines. The technical team knew, however, that as they were building the first commu-

nity wind project in Australia, the stakes were high and success was critical. It was decided that they could only go with highly regarded, internationally proven brands.

The Hepburn Wind project had a few extra criteria when searching for the right turbine, driven by the local community. Firstly, the turbines had to be very quiet, as the nearest houses are only just over 500 metres from the proposed turbine locations. Secondly, the turbines had a height limitation of 110 metres. If they were any taller the Civil Aviation Safety Authority can require blinking lights to be on at night, which the community didn't want.

Pinning down a turbine manufacturer was challenging for Hepburn Wind due to the somewhat petite size of the order. Manufacturers more accustomed to receiving orders for 50 to 100 turbines at a time could conceivably push this smaller order to the bottom of their priority lists.

Fortunately, a German company called REpower Systems AG, came through with the goods. REpower already has a significant stake in Australian wind farms, as they are supplying turbines to the large Portland Wind Energy Project in south-west Victoria and six REpower turbines have been spinning since 2006 at Wonthaggi in eastern Victoria. Their machines are well respected internationally and known to be one of the quietest.

The MM82 proved to be the ideal machine for the site. It has a blade diameter of 82 metres and when operating at rated wind speed will generate 2050kW. This means that the two turbines will have a rated capacity of 4.1MW and over time will generate enough power for the twin towns of Daylesford and Hepburn Springs. Having received the order, REpower is currently busy organising contractors to do the civil and electrical works at the site. The final contracts are due to be signed as this article goes to print.

Grid connection

Grid connection for the wind farm has been a major technical hurdle. Powercor, the grid operator in the region, has never connected a wind farm of this size to the distribution network before and so a range of studies has been undertaken in order to ensure that the connection is smooth and doesn't degrade the quality of the power in the area. Since there will be powerline upgrades in the area at the project's expense, the Daylesford/Hepburn region is likely to have more reliable power after the wind farm is installed.

Due to the fact that Hepburn Wind is a community project, $15,000 per turbine per year will be put into the Daylesford/Hepburn area so that even the locals who are not investors will benefit from the proceeds of the energy sales. When construction is complete, it will be the closest wind farm to Melbourne, hopefully prompting a steady stream of visitors to the area.

In Europe, community-owned wind projects are commonplace. In Denmark, 5500 turbines are owned by over 200,000 community investors. And now that the first Australian one is close to being built, communities all over the country are asking Hepburn Wind how they did it. Having to take so many steps for the first time and the associated learning curve has meant that work has at times been hard and progress slow. But Hepburn Wind hopes that all the lessons learned will translate into a blueprint for others. ✻

Hepburn Wind is still open for investment. Go to www.hepburnwind.com.au for more information. *ReNew* will keep readers posted this year on the progress of the Hepburn Community Wind Farm.

Other projects

The community of Denmark in south Western Australia has been investigating a local wind farm since 2003. Although the proposal is for only one turbine, development approval has been their biggest stumbling block. For more information visit www.dcw.org.au. Communities in Bathurst, New South Wales, and Castlemaine, Woodend and the Surf Coast in Victoria are all in the early stages of investigation and have a lot to learn from the hardworking Hepburn gang.

The CERES challenge

It's busier than ever at Australia's leading environment park. Bryce Gaton explains how CERES will become a zero emissions zone by 2012.

CERES environment park in Melbourne's north is undergoing a transformation. These changes are only the start of a series of technology, education and training developments happening in the next few years.

The most obvious change so far is the Vaan Ray Centre: the new training, office and restaurant centre being built at the main entrance to the site. These buildings, partly funded through a bequest and government grants, will showcase sustainable building and energy saving technologies and will become a hub for an expanded range of environmental education and training courses.

Another part of these changes is a series of projects grouped under the ZEC2012 banner, which stands for Zero Emissions CERES by 2012. These include a new vertical axis wind turbine, conversion of a two tonne van to plug-in electric drive, solar-thermal energy generation, solar cooking installation, solar/electric vehicle charging station, biogas digester plus many more.

There will be more articles on these projects in *ReNew* this year. Below is a taste of what is coming at CERES in 2010 and beyond.

Photos: George Smith

CERES will extend its currently booming urban agriculture to a series of city hubs.

Biogas plant

CERES is undertaking a feasibility study into building a community-sized biogas plant. The plant will process food waste to produce methane for use in heating, cooking and energy generation projects around the CERES site. As well as producing energy, the biogas plant will also produce a digestate slurry which will be dried and used as a rich organic fertiliser.

Solar-thermal energy

Solar collection and concentration technology will be used to provide heat to an engine which will then generate electricity. Visitors will be able to see the direct conversion of sunlight into useful energy and understand how this type of system could be applied in wider society.

Stirling engine technology is currently being considered for the project, as its simple closed cycle lends itself to efficient conversion of solar heat to energy. It is hoped the system will output approximately 1kW of power; this level would be useful at a residential scale, and will prevent a reasonable amount of emissions being created at CERES.

Plug-in electric van

After the success of the first CERES electric car conversion project (a Citroen Berlingo), CERES has secured funding to embark on a more ambitious project: to convert a two tonne Mercedes Sprinter van to plug-in electric drive. The aim is to show how small to medium business can reduce its reliance on fossil fuels beyond 'peak oil'. The van will provide some of the transport requirements for the farm, food co-operative and nursery.

Van Raay Centre

The new CERES Van Raay centre is being designed as a zero emissions building complex. The project involves innovative energy and water systems including stormwater collection and treatment to organic farming standards, rainwater collection and distribution, smart metering and a super-efficient commercial kitchen design.

Solar shelter

Solar panels are typically opaque, fairly

boring and set out on roofs in rectangular arrays. For a new shade structure in the Energy Park, CERES is developing a super light-weight organic structure of semi transparent PV panels. The aim is to test the limits of possible PV panel layout design.

EcoHouse redevelopment

Now all but completed, the EcoHouse has been redesigned and overhauled to showcase the latest in energy efficiency design possibilities for retrofitting existing housing stock. The newly renovated CERES EcoHouse is open every Saturday morning for guided tours between 10am and 1pm.

Waste water treatment redevelopment

This waste water treatment system will processes waste water from the café and composting toilets which are used by up to 1000 people a day. The current system design includes a reed bed filtration system, wood chip biofilter for grease and fats and a solar powered subsurface irrigation system.

CERES Solar Café 2020

CERES has begun re-imagining and redesigning the CERES café as a Zero Emissions Café of 2020. This project will demonstrate how innovative cafés in ten years time could be operating if we are to effectively tackle issues leading to climate change.

Urban 'Food Hub'

CERES is seeking to extend its high density urban agriculture projects into the community and provide increased training opportunities in urban farming. CERES is currently planning an intensive and modular urban farming hub system based around aquaponics (growing fish and vegetables) that can be located on any available land.

The project under development will be the first of a planned network of hubs around inner-city Melbourne which will produce a variety of fresh organic produce grown onsite, potentially including fish, mushrooms, herbs, vegetables and fruit. The hubs will provide extensive food co-operative services catering for hundreds of surrounding houses, training facilities and will showcase leading ideas in urban food production and sustainable design. The first hub will be constructed in early 2010.

The composting loos weren't designed for the big crowds that CERES now attracts so will get an overhaul.

Looking ahead

Other projects to get going this year include a 4 to 5kW vertical axis wind turbine and a solar electric vehicle charging station near the Vaan Ray Centre.

With a comprehensive suite of new and improved infrastructure, CERES will continue to provide state-of-the-art demonstrations and stimulus for new learning opportunities, greatly enhancing all of CERES' energy education and training initiatives, as well as assist all visitors to envision a future where we tread lightly on this lonely, living, planet. ✻

Bryce Gaton is green technology and tertiary liason manager at CERES and will be working on ZEC2012 projects. CERES is the most visited community environmental centre in Australia, known for being a pioneer of community arts, experiential education, sustainable urban agriculture and for demonstrating innovative and achievable solutions to pressing environmental and social issues.

The Swift wind turbine on the Alternative Technology Association tower.

Biking without the effort

Want to ditch the car but just don't have the fitness to cycle everywhere? Well, let the bike do most of the work by getting an electric-powered one. Lance Turner explains what to look for and what's available.

Electric bikes (e-bikes) have become more readily available in Australia in recent years, mainly due to the larger number of manufacturers and the increase in demand as people discover the benefits of a bike that has a bit of power assistance.

Firstly, we should start by looking at what an electric bike actually is. There are two broad categories of design. The first is of a standard style of bike, such as a mountain bike or similar, which has fitted to it a motor and battery, along with some form of speed controller. These are quite common and come in a range of sizes, with many varied drive systems.

The other type of electric bike is known as a 'step-through' bike. These more resemble a moped than a regular bike and are often designed so that the motor does all the work—the pedals are not much more than ornaments. Because of this, many riders of such bikes have run afoul of the law, as while they may have a motor power output within the legal 200 watt limit (more on this later), they are considered to be a motor scooter and as such need to be registered. However, because they generally are not designed to be road registered, they don't meet Australian Design Rules (ADR) requirements and so cannot be registered.

Whether this style of e-bike is considered illegal in your area seems to depend on the powers that be. Some people ride them without problems, others have been pulled over and been told they can no longer ride their bike. This is a rather expensive problem as you are then left with a bike that is designed purely for on-road use, yet can no longer be used on the road.

This issue seems to come about from the more open definition of what a bike is in the countries these types of bikes are made. Of course, these are also countries where bike use is actually encouraged, rather than in countries like Australia, where bike riders have to deal with roads without bike lanes, motorists with bad attitudes (not to say there aren't bike riders with the same problem) and poorly thought out and overly draconian regulations.

A typical electric bike. This one is from Erider Electric Bicycles. Note the battery pack behind the seat post and the hub motor in the wheel—a common configuration.

Uses for your e-bike

Like a normal bike, e-bikes are used for commuting, car replacement, mobility for less able and elderly, and even just for fun. For many people, they provide the extra assistance needed to get up that steep hill, or a sense of assurance that should you become too tired (or strain a muscle), the motor can get you home.

Frames

E-bikes, like regular bikes, come in a large range of frame styles, from mountain bikes for all-purpose use, to compact folding bikes that can more easily travel with you on public transport.

There are e-bikes with very basic features, and there are those with the whole box and dice, including full suspension. There are steel frames and there are aluminium (often just called alloy, which is incorrect—an alloy is a mixture of any metals, not just aluminium).

In short, most types of frame that are available as a standard bike can also be found for sale as an e-bike.

Complete versus kit

It should also be mentioned that, should you already have an 'old faithful' bike that you really don't want to give up, you can go the conversion kit route. Conversion kits are available in a range of motor style, drive type and battery options. They allow anyone with suitable skills (or your local bike shop if

you don't have those) to convert your current bike into an e-bike.

Beware though that the finished e-bike may ride rather differently to how it did previously, due to the extra weight and the change in weight distribution from the added components.

In this guide we have looked at conversion kits in a separate table.

Battery issues

One of the big limiting factors when it comes to range of your e-bike is the type and capacity of battery pack. Traditionally lead-acid batteries were used for all manner of electric vehicles, however other options have crept into the mix.

First there were nickel-cadmium (NiCad) batteries. While these offered twice the capacity of lead-acid for the same weight, they are a very toxic battery chemistry and have (fortunately) fallen out of favour. They also suffered from memory effect, whereby batteries which are regularly discharged say 20% each cycle, behave as if they only have that 20% capacity if you try to discharge them further.

Then there is nickel-metal-hydride (NiMH). These are similar to NiCads but are far less toxic and don't suffer from the dreaded memory effect. They also have greater capacity for the same weight, so range is improved.

More recently, as battery prices have started to fall, various lithium-based batteries have become more popular. These include lithium-iron phosphate ($LiFePO_4$), lithium ion and lithium polymer.

Lithium batteries have three or more times the capacity of lead-acid batteries for the same weight and so e-bikes using lithium batteries either end up being lighter, or they have greater range. Lithium batteries also tend to have longer lifespans as they can be deep cycled many hundreds or even thousands of times before they degrade to the point where they need replacing.

The old lead-acid batteries would often only make a few hundred cycles before needing replacement.

This doesn't mean that, for your situation, a lead-acid won't do the job. If you regularly take long commutes and use the motor a great deal, and so regularly deep discharge the battery pack, then go for a lithium battery. However, if you only use your e-bike to go a few kilometres to the local shops and so rarely discharge the battery deeply, then a lead-acid could easily be up to the task. It all depends on the depth of discharge of the battery for your particular situation, so be wary of anyone who states that lead-acid are never suitable and only lithium will do. If the lithium battery costs three or four times as much but you get no benefit from it, why would you buy it?

Also remember that all batteries have a finite shelf life. Even most lithium batteries, especially lithium ion, really only last a few years whether you use them or not (laptop owners will be well aware of this problem). So why buy an expensive battery if you are not going to get the use out of it before it wears out? While this situation isn't applicable to many people, it is something to be aware of for the more occasional rider.

Motors

Motors are either brushed or brushless. Both have advantages and disadvantages, but for on-road e-bikes, either type is limited to a maximum continuous power of 200 watts.

Brushed motors are the older style of DC motor, where the stator is made of permanent magnets and the rotor (the bit that turns) has coils of wire forming electromagnets. Electricity gets to the rotor via carbon composite brushes, which are small springloaded blocks of carbon material that rub on a circular piece of the rotor called the commutator. The commutator is divided into sections with each section being connected to two or more (depending on motor configuration) of the rotor's coils. The magnetic fields act against the stator magnets, causing the rotor to rotate.

The carbon brushes can eventually wear out, although this can take a very long time, and depends on how fast the motor runs and how heavily it is loaded. You may or may not need to have the motor brushes replaced in your bike's lifespan.

Brushless motors are the opposite of brush types. They have permanent magnets on the rotor and the stator is made of electromagnets. Because there is no need to get power to the rotor, there are no brushes, hence the name. However, the power to the stator still has to be commutated (switched on and off or varied in a sinewave-like manner) to make the rotor turn. This means that the controller for a brushless motor is much more complex than for a brush motor. Indeed, a brush motor doesn't even need a controller and, in a pinch, just connecting the motor straight to the battery pack via a big switch can get you home.

Controlling speed

While on the subject of speed controllers, we should look at the different types of controllers available and how you interact with them while riding.

The simplest types just use a throttle control on the handlebars. You adjust the control to provide the level of power you want, just like the throttle on a motorbike. These have the advantage of being simple, but they rely on the rider to use them correctly. They also let a rider use purely motor power for as long as they wish, without the need to provide any mechanical power via the pedals. These types of controls are called 'power on demand' controls.

The other main type of control system is called 'pedal assist'. These work by sensing how much torque is being applied by the rider to the pedals (i.e. how hard you are pedalling) and pro-

viding a proportional amount of assistance from the motor, up to the 200 watt limit. Most are programmable in the amount of assistance they provide. They can be set to provide a lot of assistance for someone who's not very strong right down to a minimal level that just compensates for the extra weight of the bike. Most have at least 'eco' and 'sport' modes accessible to the user as well as being adjustable by opening up the unit or plugging it into a computer.

Pedal-assist controllers have the advantage that they make you pedal, so you can't just sit back and be lazy. However, if you can't pedal at all (you might be hurt, elderly or disabled) then they may not provide much assistance.

Note that there can be problems with cheap pedal-assist controllers, the main ones being fragility and slow response. The cheap ones tend to break easily and often go into a 'sensor broken, motor disabled' mode. When working, they're usually slow to provide assistance, have few speed steps (they lurch into action) and, worst of all, are slow to react to braking.

The type of control system purchased is up to you, but make sure you understand the differences before buying—and remember, you get what you pay for.

Power to the wheels

Another big part of any e-bike is the drive system—how the power from the motor gets to the wheels. There are a number of drive systems in use, some using the bike's original chain drive, some not. Some have gearing and some don't.

Hub drives are fairly common. These consist of a motor that completely replaces the wheel hub in either the front or rear wheel of the bike. For conversion kits, they usually need to be fitted to the bike at a bike shop, as they have to respoke the wheel. Some kit hub motors are supplied complete with wheels. Hub motors are usually direct drive, meaning they have no gears at all. Because they are slow-revving, large-diameter motors, they don't need to be geared down to bike wheel speeds. It's a bit like the direct drive motors now used in many washing machines. However, some hub motors do have gears, and these can provide extra torque for those scary hills, albeit at lower speed of course.

Some motors are linked to the bike's rear wheel using an extra sprocket and chain. They can also have belt drive, which tends to be quieter. The least efficient of all the drives, and one that seems to have faded away now, is the friction drive. This has the motor mounted above the wheel. The motor drives the wheel using a small roller attached to the motor which presses against the bike tyre. This type of drive causes problems when the tyres are wet and is considerably less efficient than other types.

How far will it take you?

Range specifications must be taken with a large grain of salt. There is no standard method to specify how far an e-bike will travel on a full charge. Range is affected by many factors including the weight of the rider and the bike, the road surface, the terrain (hills will drain batteries more quickly), how fast you ride, how much you assist the bike's motor (or how much it assists you), tyre pressure and even what clothing you are wearing, which affects wind resistance.

All of these factors mean that the specified range of a bike can be pretty much meaningless. Possibly a better indicator is the energy capacity and type of battery. A bike with 200 watt-hours of battery capacity is likely to have a greater range than one with 120 watt-hours. This is because the other mitigating factors, such as weight and wind resistance, don't vary that much for a given rider. Even motors are of similar efficiencies nowadays, with most coming in at better than 80% under most conditions. However, really cheap motors may be less than this and can markedly affect range (and waste a lot of energy), so bear this in mind.

Running costs

You might not think running costs are a big issue, but they can be.

The most obvious running cost is the electricity used to charge the battery. This may only be a few cents each night and so does not even compare to the cost of running a more conventional vehicle such as a car or motorbike.

However, the greatest cost of running an e-bike is maintenance, including replacement of the battery pack every few years. For lithium-based batteries, this can be very expensive and can be more than $1000 for a new battery, so check with the dealer about availability and price of new packs. Weigh this up against the expected lifespan of the pack, which means taking into account the depth of each discharge cycle and the rated battery lifespan at this depth of discharge. These sorts of detailed figures probably won't be available for most battery packs, so the best you can do is an educated guess.

However, there are some batteries that are tougher than others. Lithium-iron phosphate are now considered to be the toughest battery chemistry out there and usually have the longest lifespan. Unfortunately, they are also the most expensive, but the extra expense can be worth it if you really give your bike a workout.

Don't assume that you have to use an original equipment battery pack. Like many other battery-powered devices, there are other options when it comes to battery replacement. If you are the DIY type you can replace the dead cells in the battery pack with new ones. There are many sources for them, including a lot of online stores and even ebay, although I recommend you stick with cells from Australian suppliers if possible as you will get better backup service. Companies like Lithium Batteries


schottsolar.com
Photovoltaics made us grand.
CSP unique.
whatever the future holds.
With more than 51 years of experience, SCHOTT Solar is one of the worldwide leading manufacturers with expertise in both photovoltaics and receiver technology. In the field of concentrated solar power our receivers are at the leading edge and our photovoltaic modules set quality standards.
Two key technologies for the efficient supply with solar energy. That is what we work for. Whatever the future holds.
SCHOTT Australia Pty. Ltd.
Unit 1, 9 Rodborough Road
NSW 2086, Frenchs Forest
Phone: +61-2 8426-1607
Fax: +61-2 8426-1666
Gonzalo.Muslera@schott.com
Dr. Kuckelkorn
Head of Development
SCHOTT Solar CSP GmbH
SCHOTT
solar

Australia (www.lifebatt.com.au) make very rugged lithium cells for these sorts of uses.

Other potential running costs include motor brushes or replacement motors and the usual things like bike tyres and chains that need maintenance on all bikes.

Rules and regulations

As mentioned earlier, there is a 200 watt power limit on electric bikes in most states and territories in Australia. In New Zealand, the limit is a more sensible 300 watts. Rules, and the enforcement thereof, can vary in each state, so if not sure, talk to the local road authority.

In most cases, 'step-through' moped style e-bikes are probably not legal. You might get away with it, you might not. If you want an e-bike that looks like this then buy a real electric moped which has passed ADR certification. It will be more expensive but it will be legal, although you will then have to pay registration costs. Again, if in doubt, ask local authorities, don't trust the e-bike dealer, who may just be after a quick sale and not really care if you get fined or not.

While on the subject of regulations, in May 2009 the NSW Centre for Road Safety reassessed the regulations regarding e-bikes and tried to come up with a

Continued on page 45

Table 1. Conversion kits.

Brand (made in)	Model	Motor type and power	Battery type and capacity	Kit weight (kg)	Warranty (years)	RRP Inc GST ($)	Comments/ accessories
AAEV ph:(03) 9746 9648 sales@aaev.com.au www.aaev.com.au	20" front wheel brushless	Brushless 200W	24V 8Ah Li-Ion	10	6/12 months	695.00	Wide range of parts & spares.
Crystalyte (China) Stealth Electric Bikes (Australia) ph:0414 394 854 info@stealthelectricbikes.com.au www.stealthelectricbikes.com.au	X4-24	Brushless direct drive 600W rear hubmotor	Lithium Iron Phosphate, 24V 10Ah with BMS	11	1 year	850.00	Choice of twist or thumb throttle. Top speed with 26" wheel is 20km/h. Wheel size options of 20", 26" and 700c. Hub motor comes with 7 speed freewheel and disk brake rotor mounts standard. Comes with 2A battery charger. Battery capacity and charger upgrades are available.
	X4-36	Brushless direct drive 1200W rear hubmotor	Lithium Iron Phosphate, 36V 10Ah with BMS	11.5		1150.00	Choice of twist or thumb throttle. Top speed with 26" wheel is 30km/h. Wheel size options of 20", 26" and 700c. Hub motor comes with 7 speed freewheel and disk brake rotor mounts standard. Comes with 2A battery charger. Battery capacity and charger upgrades are available.
	X4-48	Brushless direct drive 2000W rear hubmotor	Lithium Iron Phosphate, 48V 10Ah with BMS	13		1290.00	Choice of twist or thumb throttle. Top speed with 26" wheel is 40 km/h. Wheel size options of 20", 26" and 700c. Hub motor comes with 7 speed freewheel and disk brake rotor mounts standard. Comes with 2A battery charger. Battery capacity and charger upgrades are available.
	X5-36	High torque brushless direct drive 1700W rear hubmotor	Lithium Iron Phosphate, 36V 10Ah with BMS	16		1310.00	
	X5-48	High torque brushless direct drive 2300W rear hubmotor	Lithium Iron Phosphate, 48V 10Ah with BMS	18		1450.00	Choice of twist or thumb throttle. Top speed with 26" wheel is 52km/h. Wheel size options of 20", 26" and 700c. Hub motor comes with 7 speed freewheel and disk brake rotor mounts standard. Comes with 2A battery charger. Battery capacity and charger upgrades are available.
	X5-72	High torque brushless direct drive 3400W rear hubmotor	Lithium Iron Phosphate, 72V 10Ah with BMS	20		1800.00	Choice of twist or thumb throttle. Top speed with 26" wheel is 70 km/h. Wheel size options of 20", 26" and 700c. Hub motor comes with 7 speed freewheel and disk brake rotor mounts standard. Comes with 2A battery charger. Battery capacity and charger upgrades are available.
EDB (Taiwan) Edeals Bargains ph:0404 977 013 sales@edealsbargains.com.au www.edealsbargains.com.au	EDB-200S1	200W 24V brushless	24V 10Ah LiFePO4	9.5 with battery	1 year	1550.00	Comes with free 5 stage, 5 amp charger.
eLation ph:1300 782 511 info@elationebikes.com.au www.elationebikes.com.au	ebk-200	BLDC 200 W	24V 10Ahr at 3C	6	1	1430.00	Gear-driven system - fits most bikes.
	ebk-300	BLDC 300 W				1485.00	
Epacpower (Australia) ph:(02) 6494 4321 ben@epacpower.com.au www.epacpower.com.au	X2	Geared 200w	LiFePO4 24V 10Ah	8	6 months	849.00	Kit to fit standard bike.
	Freeride			10		1099.00	
The Electric Bicycle Co ph:(03) 9584 3000 info@electricbicycle.com.au www.electricbicycle.com.au	Hurricane Conversion Kit	200W Brushless	Sealed lead acid 36V 15Ah	15	6 months	1099.00	-
			Lithium 36V 10Ah	10	6 months	1499.00	
Erider (China) Erider Electric Bicycles (03) 8746 8003 info@erider.com.au www.erider.com.au	Erider 36 volt pack rack	200 watt (EU) high speed brushless gear DC hub motor	36V 10Ah Li-ion battery	11	1	990.00	Comes complete with tyre and battery (Note this a rear wheel kit).
Power Ped (China) Electric Vehicles P/L ph:(03) 9763 6271 info@evehicle.com.au www.evehicle.com.au	EVO4 conversion kit	200 watt brushless	Lithium 37V 14Ah	8	1	1795.00	20", 24" 26" 700c Mounted on Alex Rim double walled alloy rim, 13g stainless spoke, PAS and throttle, Easy disconnect quick release plug for motor.
	EVO3 conversion kit		Lithium 37V 10Ah			1495.00	
	EVO2 conversion kit		Lead-acid 36V 10Ah	15		995.00	
	EVO4 conversion kit	HD 350 watt brushless	Lithium 37V 14Ah	8		1995.00	Off-road use only. 24" 26" 700c Mounted on Alex Rim double walled alloy rim, 13g stainless spoke, PAS and throttle, Easy disconnect quick release plug for motor.
Solar Bike ph:0404 695 106 sales@solarbike.com.au www.solarbike.com.au	Conversion kit	200W	36V 10Ah LiFePO4	12	3 months	800.00	-
		350W					
		500W					

Table 2. Electric bikes

Brand (made in)	Model/type	Wheel size	Frame material and/or type	Battery type and capacity	Motor type and power	Rated bike range (km)	Weight (kg)	Warranty (years)	RRP Inc GST ($)	Comments
AAEV (China) ph:(03) 9746 9648 sales@aaev.com.au www.aaev.com.au	Jen-03 Folding	16" x 2.125	Steel	SLA AGM 12Ah or 14Ah	Brushless 200W	Up to 50-70	26	1	850.00	Custom options and upgrades available. All bikes come with free workshop maintenance service, at 90 days, personal tuition/instruction on pickup/delivery and free delivery within 35km of postcode 3337.
	Jen-06 Folding	16" x 2.125	Steel and suspension			Up to 35-50	26		1150.00	
	Li-751 Folding	20" x 2.125	Aluminium alloy	Li-Ion 10Ah		Up to 20-30	22		1650.00	
	Passion - Compact	18" x 2.125	Steel and full suspension	SLA AGM 12Ah or 14Ah		Up to 50-70	34		1350.00	
	DR-Z - Medium	18" x 2.125				Up to 50-60	38		1500.00	
	Jen-32 - Large	16" x 3.0		SLA AGM 12Ah/14Ah/24Ah/28Ah		Up to 80-100	46		1400.00	
Conqueror MTB (Taiwan) Edeals Bargains ph:0404 977 013 sales@edealsbargains.com.au www.edealsbargains.com.au	edb200s1	26" alloy double wall	Double wall alloy frame	LiFePO4 24 volt 10Ah	200 watt brushless high torque	35	22	1	2299.00	Motor works through the bike's gears for huge power and top speed.
Easybike 1300 794 567 info@easybike-australia.com.au www.easybike-australia.com.au	Easymini	20"	Aluminium 6061	Lithium Ion 36 volt 10Ah	200 watt brushless	40	19	2 years electrical, 1 year battery, 5 years frame	1699.00	Compact folding design ideal as a daily commuting bike.
	Easymax	26" alloy double wall					23		1899.00	Step-through city bike ideal for commuting or weekend riding.
	Easymax Premium	700c alloy double wall			200 watt		25		1999.00	Larger step-through frame and 28" (700c) wheels
	Easyland	26" alloy double wall			200 watt brushless		23.5		1899.00	Versatile bike suitable for the bike path or off-road.
eLation ph:1300 782 511 info@elationebikes.com.au www.elationebikes.com.au	Crossfire (M & F)	700c - Hybrid	Alloy (15", 18.5", 21")	24V 10Ah at 3C	BLDC 200W	20-25 at 30 kph	18	1	2280.00	Gear driven, motor driven through all gears.
	Storm (F)	26" - MTB	Alloy (13.5", 15", 17")						1950.00	
	Eagle (M)	26" - MTB	Alloy (15.5", 17.5", 19", 20.5")						1930.00	
	Sportage (M & F)	700c - Hybrid	Alloy (15", 18.5", 21")						2100.00	
	Crossfire (M & F)	700c - Hybrid			BLDC 300W	20 at 30 kph			2335.00	
	Storm (F)	26" - MTB	Alloy (13.5", 15", 17")						2005.00	
	Eagle (M)	26" - MTB	Alloy (15.5", 17.5", 19", 20.5")						1985.00	
	Sportage (M & F)	700c - Hybrid	Alloy (15", 18.5", 21")						2115.00	
Electric Bikes Oz (China) ph:0413 262 400 info@electric-bike.com.au www.electric-bike.com.au	L1	26	Alloy	36V 8Ah LiFePO4	200W hub motor	30	23	6 months parts	1395.00	Unisex frame, 6 speed Shimano gears, luggage rack, C-tick approved charger.
	L8	20							1295.00	Folding bike, C-tick approved charger.
Erider (China) Erider Electric Bicycles (03) 8746 8003 info@erider.com.au www.erider.com.au	Step-through Folding Bolt	20"	Alloy 6061 T6	36V 10Ah lithium ion	180 watt (EU) high speed brush gear DC hub	45 - 55	25	1	1575.00	
	Sports Folding Bolt								1575.00	
	City Folding Bolt								1575.00	
	Retro Bolt	26"			200 watt (EU) high speed brushless gear DC hub motor	55 - 70	36		1685.00	
	City Bolt						37		1750.00	
	Mountain Bolt								1681.00	
Ezy commuter (China) ph:(07) 56678024 info@ezycommuter.com.au www.ezycommuter.com.au	ebike-ezy081	20 inch	Aluminium alloy	Lithium ion 24 volt	200 watt	30	21	2	2295.00	(Folding) call for discount off RRP
	ezy-traveller			Lithium ion 36 volt		50				
Powabyke (UK) ph:(02) 9929 6506 www.powabyke.com.au	X-24 24 speed	28" 700c Accedo double wall alloys	Aluminium	36V lithium ion	Brushed 200 watts	30	22 gross	5 years frame 1 year electricals	1999.00	Dual mode; pure power or pedal assist. Imported from the UK with 12 years history.
	LS6 6 speed						21 gross		1899.00	
Power Ped (China) Electric Vehicles P/L ph:(03) 9763 6271 info@evehicle.com.au www.evehicle.com.au	Mantis 14 Deluxe Step Thru	26"	6061 Alloy	Lithium 37V 14Ah	200W 2 stage geared brushless	Up to 80	21	5 years frame 12 months balance	2495.00	Includes carry rack, pump, 3 mode pedal assist, throttle, throttle/PAS, safety vest, tool kit, cable lock, lights
	Tracker 14 MTB	26"							2495.00	Includes carry rack, pump, safety vest, tool kit, cable lock, lights, 3 mode pedal assist, throttle, throttle/PAS
	Sherpa 36V Foldable	20"							2395.00	
	Charger MTB	26"		Lithium 37V 10Ah	200W geared brushless	Up to 50	20	6 years frame 12 months balance	1795.00	Lightweight, strong frame, great value
	Mantis 10 Step Thru	26"						5 years frame 12 months balance	1795.00	
	Sherpa 10	20"							1595.00	Lightweight, strong frame, great value foldable bike.
Gazelle (The Netherlands) ph:(02) 9666 9497 www.gazellebicycles.com.au	Orange Innergy	700C	Aluminium frame	Lithium ion (made in Germany)	HR brushless front hub (made in Germany) - Power adjustable	40 to 75	26	10 year on frame, 5 years on front forks and paint, 2 years on components.	4450.00	Won bike of the year in The Netherlands for 2009. Range depends on terrain and power settings.
Lancaster (China) ph:1300 781 866 info@electrobikes.com.au www.electrobikes.com.au	Javelin MK2 - Sports	26"	Alloy	24V lithium ion	Brush - 200W	40	25	1-2 years	1995.00	Dual suspension, rear carrier optional.
	Javelin MK3 - Sports			36V lithium ion	Brushless - 200W				POA	
	Harrier MK2 - Male			24V lithium ion	Brush - 200W		24		1895.00	Front suspension, rear carrier, lights.
	Harrier MK3 - Male			36V lithium ion	Brushless - 200W				POA	
	Galaxy MK1 - Uni Sex			24V lithium ion	Brush - 200W				1895.00	Front suspension, rear carrier, lights.
	Galaxy MK2 - Uni Sex			36V lithium ion	Brushless - 200W				POA	
	Hornet MK2 - Foldable	20"		24V lithium ion	Brush - 200W				1995.00	Dual suspension, fold-up.
	Hornet MK3 - Foldable			36V lithium ion	Brushless - 200W				POA	
	Voyager MK3 Step-thru	26"		36V lead acid	Brush - 200W		34		1295.00 approx	Front suspension, rear carrier, lights, front basket.
NOPE (parts made in Taiwan, assembled in China) ph:(07) 3852 3299 info@nope.com.au www.nope.com.au	LUXE IV	26"	Aluminium step through type with four colours: black, white, olive and bronze	36V/12Ah lithium polymer	200 watt	50	24 (inc battery)	1 year conditional	2250.00	Features multifunction electric cycle computer, RST adjustable front suspension, Tektro front/rear disc brakes, Shimano seven speed derailleur, integrated riding light and rear carrier rack.
	DYNO IV	26"	Aluminium step over type with four colours: black, white, olive and aqua						2250.00	Features Velo seat with light reflecting pads, multifunction electric cycle computer, RST adjustable front suspension, Tektro front/rear disc brakes and Shimano seven speed derailleur.
	FOLD III	20"	Aluminium fold up type with four colours: black, blue, red and raw				20 (inc battery)		1800.00	Features multifunction electric cycle computer, seven speed Shimano derailleur; Velo seat with seat suspension, aluminium foldable basket and foldable pedals.
	DYNO II	26"	Steel step over type with three colours: black, white and silver	36V 10Ah lithium polymer		40	26 (inc battery)		1499.00	Features six speed Shimano derailleur, front/rear disc brakes.

Brand (made in)	Model/type	Wheel size	Frame material and/or type	Battery type and capacity	Motor type and power	Rated bike range (km)	Weight (kg)	Warranty (years)	RRP Inc GST ($)	Comments
Ride My Chopper (China and Australia) ph:(02) 9986 3776 info@topguntechnology.com	Chopper	Front: 24 x 2.10 Rear: 20 x 4 1/4	Custom chopper-style steel frame with motorcycle-sized specifications including wheels, tyres, brakes	Drycell 12 volt, 10Ah	200 watt brushless integrated hub-mount	20	35	1	1750.00	$1950.00 with twin battery packs which provide range of up to 50km or 5 hours.
Ebike (China) Select Scootas Ph:1800 726 682 info@eurekascoota.com.au www.eurekascoota.com.au/ecycles	Mens	26" alloy double wall	Alloy frame, suspension forks	NiMH battery pack	200 watt brushless high torque	Up to 40	24	1	1430.00	Six speed gears, pedal assist, up to 800 charges. Seat post has air suspension and pump.
	Unisex	26" alloy	Alloy frame				22			Six speed gears, pedal assist, up to 800 charges. Comes with rear carry rack.
	Folding	20"					22			
Stealth Electric Bikes (Australia) ph:0414 394 854 info@stealthelectricbikes.com.au www.stealthelectricbikes.com.au	Stealth Fighter / Full suspension mountain bike	24" x 3.0"	Chromoly monocoque frame, 160mm front suspension, 200mm rear suspension	1.2kWh Lithium iron phosphate	Brushless direct drive 2000W rear hub motor	60+	35	1	from 5490.00	Designed and manufactured in Australia. Suitable for every type of terrain. Two speed internally geared bottom bracket. Suspension and brake upgrades available.
	Stealth Bomber / Full suspension mountain bike		Chromoly monocoque frame, 203mm front suspension, 250mm rear suspension	1.5kWh Lithium iron phosphate	Brushless direct drive 3000W rear hub motor		57		from 6990.00	Larger and more extreme brother of the Stealth Fighter. Capable of speeds above 80km/h. Designed to handle the toughest trails with ease. Nine speed sequential gearbox. Suspension and brake upgrades also available.
Solar Bike ph:0404 695 106 sales@solarbike.com.au www.solarbike.com.au	Trotter	20"	Alloy	Lithium ion 36V 10Ah	200W	50 +	22	1	1300.00	Folding Bicycle
The Electric Bicycle Co ph:(03) 9584 3000 info@electricbicycle.com.au www.electricbicycle.com.au	Transporter Tricycle	20"	High tensile steel	Sealed lead acid 36V 15Ah	200W brushless	30-35	46	2 years frame	2199.00	
				Lithium 36V 10Ah						
	Cruiser Nomad	26"	Alloy	Sealed lead acid 36V 15Ah		35-40	36		1299.00	
				Lithium 36V 10Ah			25		1699.00	
	Trekker Folding	20"		Sealed lead acid 36V 8Ah		25-30	28		1599.00	
				Lithium 36V 10Ah		30-35	24		1999.00	
	Challenger	26"				35-40	23		1999.00	
	Commander								1999.00	
Value-E-Bikes "Ezi-Go" (China) ph:(07) 5455 5672 noosa@value-e-bikes.com.au www.value-e-bikes.com.au	AEB 01 Folding	16"	Aluminium alloy	Li-ion 24 volt 8Ah	Rear hub 180W BLDC	25	20	6 months	717 (1360 for 2)	
	AEB 02 Folding	20"		Li-ion 24 volt 10Ah		30	22		767 (1460 for 2)	
	AEB 04 Folding			LiFePO4 36 volt 10Ah	Rear hub 200W BLDC	45			867 (1640 for 2)	
	AEB 05 Folding					45			867 (1640 for 2)	
	AEB 03 Step thru	24"		SLA 36 volt 12Ah		50	34		617 (1170 for 2)	
	AEB 06 Unisex	26"		LiFePO4 36 volt 10Ah		45	22		997 (1890 for 2)	Off-road upgrade + $70
	AEB 07 Mens								997 (1890 for 2)	
	SEB 02 Step thru	24"	Steel	SLA 36 volt 10Ah			38		567.00	
	SEB 03 Step thru	24"		SLA 36 volt 12Ah					577.00	
	SEB 07 Step thru	16"			Rear hub 350W BLDC				597.00	
	ET 01 Tricycle	20"/24"	Aluminium alloy	LiFePO4 36 volt 10Ah	Front hub 200W BLDC		28		1097.00	
Zega Pty Ltd ph:(03) 9563 3200 zega@bigpond.net.au www.zega.com.au	Sunny (5 models available)	18 inch HD alloy	Steel	48 volt 12Ah sealed lead-acid	200 watt digitally phased brushless and gearless	40 - 60	50	1	999.00 to 1589.00	Very zippy. Plush suspension. Equipped with lights, horn, indicators, mirrors, remote alarm system etc
	Knight 20	20 inch	Alloy foldable	Lithium 36 volt 10Ah	Brushless	50	25	1	1299.00	Hub motor, twist throttle plus pedal assist plus cruise control. Six speed shimano gear set.
	Offers a consultancy and design/development service for the industry. Builds one-off electric bikes, trikes, cars etc. Manufactures small foldable electric trike. Develops existing products for outside clients. Working with government departments on future guidelines for electric commuter transport.									

Continued from page 42

standard set of rules governing e-bike specifications. Part of those rules were to be an increase of the power limit to 250 watts, a maximum assisted speed of 25km/h and a requirement that all e-bikes use the pedal-assist controller method. This would have made most e-bikes currently on the road illegal. At the time of writing there's no indication that these rule changes will actually go into law (if readers have more information, we'd love to hear it).

Off-road e-bikes

E-bikes are not just available for on-road use. There are bikes available with power outputs above the 200 watt limit that are designed for off-road use only. These can have power outputs up to 5kW or more and make eco-friendly alternatives to trail bikes on farms. Imagine, all those noisy trail bikes replaced with clean, quiet but just as exciting e-bikes.

However, the downside of electric off-road bikes is that habitat disruption from their use remains almost the same as for IC (internal combustion) powered ones. Unfortunately, the main use of these seems to be allowing motorbike riders to illegally use mountain bike areas with less risk of being caught.

None the less, we have listed off-road bikes in the table as they are just as useful to many riders as on-road bikes, and *ReNew* readers tend to be aware of such environmental issues. *

Resources

- NSW Centre for Road Safety e-bike regulations proposal: www.cityscape-news.com/SUPP-S1-RTA.pdf
- NZ low powered vehicle regulations: http://nzta.govt.nz/vehicle/your/low-powered.html
- http://en.wikipedia.org/wiki/Electric_bike

Thanks to Chris Moseley for his invaluable input in writing this guide.

How I came to buy an electric bike...and left the car at home

Paul Reily shares his criteria for a successful electric bike purchase.

Electric bikes have always held an air of excitement and fascination for me. I think it is because I see the technology as so sophisticated and the concept so smart.

I started to think about owning one late last year to get to and from work about eight kilometres from my home. I work in a large architectural practice on the outskirts of the Perth CBD. I have various public transport options to get to and from work, but most of them involve at least 45 minutes travel. If I worked late, the travel time could be one hour and fifteen minutes sometimes.

I generally took my car to work, leaving it parked all day. Climate change is upon all of us and I felt I had to take some individual action to reduce my carbon footprint, but still retain the freedom of being able to work the hours I wanted without having to think about bus timetables.

Benefits

Electric bikes are more expensive than normal bikes, so I began to rationalise the expense by listing all the things taking a bike to work would do for me.

- Save on parking - $10 per day ($2000 pa)
- Save on fuel for the car - $3 per day ($600 pa)
- Personal fitness – what cost?
- Enjoy the environment as I commute
- Reduce my carbon footprint
- Less public transport – waiting at bus and train stations is not my idea of a good time, nor is the need to rush from home or work in order to catch my bus or train service.

Research

So what kind of electric bike? E-bikes are very popular overseas and there is a lot of material to sift through on the internet. It became evident that there is as much variety in electric bikes as there is in cars or boats. The Chinese are heavily into electric bikes, and most of the models that come to Australia are from China. European bikes are also available in the Australian market.

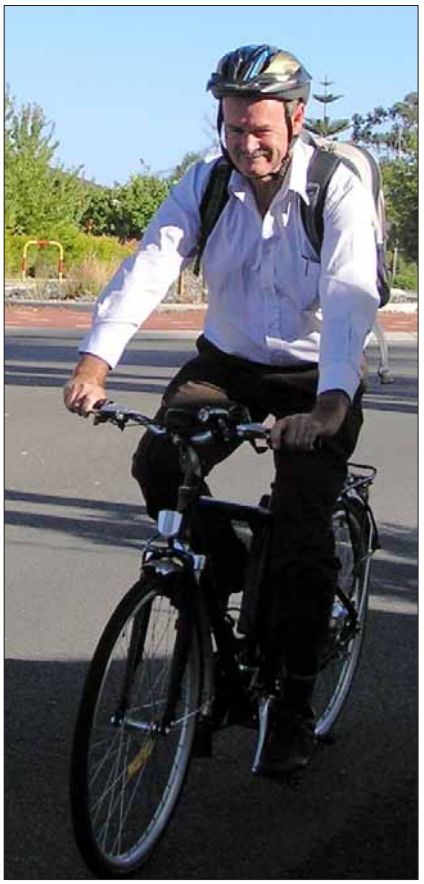
I wanted a bike that had the following:

- Lightweight with an aluminium frame and modern battery
- 21 gears so I could ride it like a normal bike
- Luggage rack to take my briefcase to work
- Heads-up riding position – I get a sore neck and sore wrists in the 'racing' position
- Reliability – it had to get me there without a sweat and get me home after a long day
- Compliant to Australian regulations and built to our conditions
- Easily maintained and access to warranties and back-up service

A **lightweight** bike has the advantage that it is easier to pedal without any electric motor assistance. I wanted a bike that was easy to manoeuvre, park and pedal without the power on. Despite what my friends think, I actually consider the bike as a form of exercise, so lightweight meant I could still get a workout if I wanted one.

Twenty one gears is a bit of a rarity in electric bikes; most of them have only six or eight gears with a 1x6 or 1x8 configuration (one cog at the pedals and six or eight cogs at the rear wheel). This simplifies the controls at the handlebar and presumably there is less to go wrong in the delivery of power. I chose the maximum number of gears because I wanted flexibility whenever I happen to run out of battery.

A **luggage rack** and the ability to have either permanent or removable panniers is essential on a commuting bike; all sorts of things need to be carried



Paul Reily: riding into the future.

from time to time and from experience the back pack can get a little warm on summer days.

Heads-up riding is so important in my opinion. Apart from the social aspects of being able to converse with fellow riders and take in the environment, it is better for the body (eyes, neck, shoulders, spine and pelvic floor). An adjustable handlebar that reduces stress on the wrist is vital to a heads-up riding position. The use of peripheral vision is certainly a safety factor whilst on the road and having the head level so that it can range easily from side to side enhances your awareness of others on the road.

I find **reliability** an important factor in anything that I can't fix myself. They say electric motors are one of the most reliable motors around because they have very few moving parts, but I see the whole drive train and controls as part of the system, so it all has to work perfectly every time for me. A sealed brushless hub motor seemed like the latest technology so I looked for that feature in a bike. These motors were a lot quieter, which is important when sharing a bike path with others.

Having done a fair bit of research on the net, I was aware of the wide variety of power units available. **Australian regulations** limit the size of the motor to 200 watts whereas some countries, such as the US allow up to 450 watts. More powerful motors would be illegal on Australian roads as bicycles and would require a special licence. I understand that this rating is currently under review; 250 watts may become the norm which will be a big boost to electric bikes in Australia generally.

Maintenance was important to me especially tuning and servicing the bike and being able to find parts. I chose a bike that had good service back-up through an Australian distributor.

The final choice

So what kind of electric bike did I choose? Weighing up all of the above, I decided on a 700C Commuter Hybrid from the Electric Bicycle Company through Movement Systems in Burswood. The battery is a 36V lithium ion type with a charge time of four to six hours. It is a throttle type control which can be brought on whilst pedalling. The range in the owner's manual says 40 kilometres on electric power alone, and I can achieve this easily.

The car generally stays in the garage now and I use it only for the occasional site visit or on weekends when I'm not off riding around the wonderful Swan River. ✻

Wind and solar farmhouse—Spanish style

One inspired couple retrofitted an old rural property with independent water and energy supplies. Simon Beckmann explains the ins and outs of off-grid living in Spain.

Photos: Simon Beckmann

Simon and Donna did their best to maintain the traditional Spanish architecture when retrofitting a cluster of old farmhouses.

At a thousand metres above sea level, Cortijada Los Gázquez is an 'off-grid' farmhouse high in the mountains of southern Spain. In the heart of the Parque Natural Sierra María-Los Vélez, in the north-east corner of Andalucia, this guesthouse and 20 hectare farm resides within a place of extreme natural beauty, profound peace and tranquillity and an awe inspiring wilderness in one of Spain's most dramatic alpine deserts.

Cortijada Los Gázquez combines two of the principal ideas fundamental for people who love peace, inspiration and the natural world: ecology and creativity. We run creative courses for artists of all abilities and host residencies for professional artists working within transition culture, where their work responds to environmental and energy challenges. In ecological terms the house sits benignly in the environment.

My wife Donna and I are originally from England, but it was our honeymoon in Spain which first drew us to this landscape. A picnic in the mountains around Grazalema watching the griffon vultures flying beneath our dangling feet made us gravitate to the primal places of Spain's interior.

I'm a painter and Donna is an illustrator but life in London saw me use my love of landscape and architectural design to make a living. Yet it was our environmental concerns which began to provoke the need for a change. When twins Solomon and Sesamé arrived eight years ago they precipitated the need for a change too, for an adventure, to explore more deeply solutions for our concern for the environment and to exercise our creative needs more completely.

Naturally we were always drawn back to Spain. Eventually we found Cortijada Los Gázquez, a cluster of five traditional Spanish farmhouses, and now our dream of a sustainable carbon-free home is nearly complete. But it didn't come without a few technical and logistical problems along the way as we renovated the old whitewashed stone and adobe farmhouses into one carbon neutral building.

Volunteers working on the greywater system.

Sourcing water

The first problem was water. There wasn't any. Six hundred metres from the house there is an old well and a water tank but they are both dry. Our neighbour, who lived here as a child, told us that when she was little the well could fill the tank (approximately 20,000 litres) in 24 hours. "What happened?" I asked. "It stopped raining" came the reply.

So the next step was to choose which options to take to get water here. Option one was to apply for permission to dig a bore hole. Now, after three and a half years of living in Spain, I know from first hand experience that bureaucracy here is a profound form of social cohesion, it binds and glues society together rendering them unable to move. So the prospect of getting permission for a bore hole was slight and distant. Besides, something told me that this wasn't the best ecological solution.

We decided to harvest rainwater from the roof. A search on the internet turned up an excellent document called *Rainwater Tanks, their selection and maintenance* by the Department for Environment Heritage and Aboriginal Affairs, Government of South Australia. It helped us to calculate our potential water consumption and it guided us on how to calculate our average rainfall over the last ten years multiplied by the area of roof surfaces we had to utilise. Then we could work out our tank size.

I confess my eyes slightly glazed over when it asked us to estimate the type of rain i.e. drizzle or downpour etc. and the type of roof material. We have a very old and traditional terracotta tiled roof which we restored. Each tile is said to be moulded on the thighs of local girls from the village and believe me no two tiles are the same size. We also didn't want to install guttering as that would ruin the traditional look of the house. So we built our own system and cut corners. Rain now falls from the roof into a series of wide canals at ground level which we keep scrupulously clean. This water is guided to an existing underground deposit which we restored and which holds up to 50,000 litres. As I write we have just come to the end of a week of snow and the melt water from the roof has completely filled the deposit. In the dry summers we have to buy water in from local wells which are more fruitful than our own. I would estimate the system to be 75%

efficient, with room for improvement.

Reusing water

Waste water was the next problem. During the renovation of the house we decided to divide the greywater from the blackwater. This meant that we ran parallel waste pipes the length of the building under the floor. Greywater from showers and basins as well as the kitchen sinks and dishwasher exits the house and flows directly into a series of field drains in an open trench, which is mulched with barley straw. Here we planted fruit trees on each terrace and we can alternate which terrace the greywater flows to. I should add that we only use ecological detergents throughout the house so there is no contamination of soils or produce.

The blackwater (from the toilets) runs to a 45,000 litre septic tank which is divided into three vertical cylinders connected half way up by a horizontal pipe. This processed material was then going to drain into a soak away, but we found the earth to be solid clay and unable to percolate the material. So the next course of action was to build reed beds. We built three in total. The first two are vertical aerobic filters of gravel planted with *Phragmites Australis*, a reed very adept at living in harsh environments and very good at consuming bacteria. The waste water drips into these reed beds and exits at the bottom. We built two so we could alternate them, allowing the reeds time to rest. The next stage would be a sludge tank which captures the dead bacteria in the bottom of the tank, allowing the cleaner water to be skimmed off the top. This then moves to the third reed bed which is anaerobic and horizontal. It's like a pond planted with regular pond plant-life and full of amoeba and other such microscopic life which cleans up the remaining human waste, rendering the water 95% clean when it leaves at the other end.

However, reality was slightly different. We built the system to operate with the guesthouse running at a six month

Photos: Simon Beckmann

guest full capacity. The guesthouse has six double rooms and we are a family of four plus a succession of volunteers through the year. Tally this with the fact that 2010 is our first year of trading. It's a big system and we couldn't liberally pour water down to artificially support it so it could operate when needed—the water was too valuable. Currently we have the first two reed beds bursting with new growth of Phragmites, the sludge tank full of water and frogs and the horizontal reed bed dry as the water evaporates away in the sunshine. I would estimate the system to be 100% efficient as we are not polluting, but we are going to have to work out modifications to the final reed bed to complete the cycle when it's needed. It's going to need either a blanket at ground level for the plants to grow through or a pergola to reduce the evaporation.

Heating the water

Hot water is produced in two ways. Firstly, to maximise the potential of the climate, we installed a solar evacuated tube system which produces 600 litres of hot water a day without any problem most of the year. In our short winter it still heats this body of water by 30%.

As a backup and to heat the house (winters at this altitude can be very cold), we installed two giant bio-mass

Photo: Lee Rigley

Clockwise from top left: An evacuated tube hot water system that can produce 600 litres of water a day; a six-panel 960 watt photovoltaic array on a solar tracker; the wind generator being installed; whitewashed adobe and traditional terracotta roof; the wood-burning kitchen range contributes to heating and hot water along with the bio-mass boilers.

wood burners. We could have saved ourselves a lot of effort and opted for pellet burners, but after the hike in the price of fuel last year we didn't want to be at the behest of market forces. Plus, for the capacity we needed we would have to store huge quantities in an unsightly hopper outside. We are surrounded by acres of pine and almond which we thin and prune, and the Ferroli TL19 wood burners can take lengths of wood up to a metre which reduces the need to cut and chop fuel. These boilers operate an underfloor heating system which is fantastic. In winter I can burn less than a cubic metre of wood and the house stays warm for 24 hours. We also cook on a wood burning range that contributes to the heating system.

Wind and solar

For electricity, we have a 48 volt system fed by a Juan Bornay Incline 3000 watt wind generator atop a 12-metre tower and a six-panel, 960 watt photovoltaic array which tracks the sun. We also have a backup 8.5kVA Inmesol IL-008 diesel generator. These are controlled by a Xantrex SW4548E inverter/charger displacing power into 24 Tudor 765 AHD batteries. The PV array uses a Xantrex C40 charge/load controller and the wind generator uses a Juan Bornay regulator.

We get some furious winds here in spring and on our perpetually bright sunny days the system is fantastic. Summer sun combined with thermal winds makes the system work like a dream. On the down side I should have made the solar installer sit down with the plumber and work out a balanced system for us. Late autumn can be overcast with no wind and it's cold. The pumps for the underfloor heating prompts the generator into action, something we would rather avoid. The solution is a bigger renewable energy system but this will have to wait for funds to allow. I would say annually we are 75% efficient and maybe with a bit of tweaking we could get that up to 80%. ✻

Cortijada Los Gázquez website www.losgazquez.com/en/

See page 52 to see how ATA members volunteered on this farm.

Alternative Technology Association member Lee Rigley volunteered at Cortijada Los Gázquez as a Wwoofer, working on sustainability projects while he was there.

Photos: Simon Beckmann

Merryl and Lee Rigley helping out on the farm. Below: Cortijada Los Gásquez on a very hot day. Nestled in this landscape is not a bad place to complete an energy inventory.

WHEN TELLING people that we would be Wwoofing in Spain for two weeks as part of our Europe trip, the usual response was either a blank stare or raised eyebrows. We'd then hasten to explain that Wwoof actually stands for World Wide Opportunities on Organic Farms, an organisation that links potential volunteers with hosts, the idea being to provide help in whatever form needed in return for food and a bed; with added bonuses being the interesting locations, cultural differences and sharing of skills and knowledge that can be experienced by doing a stint as a 'Wwoofer'.

After looking online at the details of several hosts in Andalucia, we decided to apply at Cortijada Los Gázquez based on the location, type of help needed and other sustainable practices being developed on site.

We were accepted, agreed on dates, and then counted down the weeks to our time with the Beckmann family, although we were slightly nervous about spending two weeks working outdoors at 1000 metres elevation during winter!

When the time came, though, we were in luck and couldn't have timed it better. We were treated to days of sunshine, blue skies and gentle breezes—good for the PV panels, not so good for the turbine! We helped out with collecting, chopping and stacking wood in readiness for the inevitable winter chill (which arrived in the form of a snowstorm just before we left!), extending the greywater irrigation system, mulching, composting, landscaping and various other tasks that Simon and Donna needed doing to run the property and further prepare to receive guests and resident artists.

Our weekends involved biking and hiking (and being stalked by ever hopeful vultures) in the local stunning area, trips to markets in town, and relaxing by the fire with a glass or two of Spanish red. Overall it was a great experience in a beautiful location with our very welcoming and friendly host family, and inspiring to see so many sustainable principles and ideas being put into action.

The other view

Simon the owner of Cortijada Los Gázquez benefited from Lee's stay too. "We learnt from each other, building greywater systems, chopping wood and Lee did the energy inventory for the house which allowed us to measure how efficient we were being. Add to that fun and exceptionally good company, we have fond memories of their stay and now have friends 'down under'." ✻

RECs for householders

Damien Moyse explains the current state of play with RECs, helping to unravel some of their mystery in a constantly changing market.

RECs and Australia's Renewable Energy Target have been an integral part of the renewable energy industry now for more than a decade, with the scheme changing and expanding significantly in the past 12 to 18 months.

REC stands for Renewable Energy Certificate, with these certificates being the trading currency for renewable energy in the renewable energy market. The value of one REC is equal to one megawatt-hour of renewable electricity generation (or in the case of some energy efficiency technologies such as solar hot water or heat pumps, one megawatt-hour of avoided electricity consumption).

Renewable electricity generators such as large wind farms, hydro-electric power stations or small-scale solar photovoltaic (PV) installations are able to create these RECs and sell them to the renewable energy market, thereby receiving a financial return.

The majority of RECs are purchased by electricity retailers, in line with their mandatory requirements set by the Federal Government under the Renewable Energy Target (RET). This cost to the electricity retailer is passed on to all electricity consumers (apart from a few large industrial users) in the form of a slightly higher charge per kilowatt-hour on your electricity bill. The Federal Government has recently expanded the RET so that 20% of Australia's electricity supply (equivalent to 45,000 gigawatt-hours) comes from renewable energy sources by 2020.

What's a REC worth?

Whether you're a householder or a large-scale renewable energy developer, one of the key aspects of the market for any renewable energy investor is the variable price of RECs. The renewable energy market is a fixed market, with demand being mandated by the Federal Government each year. However, supply is not fixed, with any accredited renewable electricity generators being able to create RECs in any given year.

RECs are also traded through long-term contracts set up outside the electricity market. For example, a large wind farm operator might establish a contract with an electricity retailer to provide a fixed number of RECs for a fixed price over, say, five or ten years, in order to give both parties certainty regarding the supply and cost of RECs for business planning.

Recent RECs oversupply

Depending on the level of REC supply in the market, the price of RECs changes, similar to the price of shares. As an example, in April 2009 the price of one REC had reached a high of $54. By October 2009, with a significant oversupply in the renewable energy market, the price had dropped to $28. Historically, the renewable energy market has always operated with some level of oversupply, with more RECs being created than are required to be purchased each year. However, this oversupply has increased significantly in recent times, with the Federal Government giving more incentives to purchase solar hot water systems and heat pumps as part of the stimulus package, and under the Solar Credits Scheme (more detail on Solar Credits later in the article).

Greens senator Christine Milne has proposed that RECs generated by solar hot water systems and heat pumps be added on top of the Renewable Energy Target, so they are additional to the target and thereby don't continue to decrease the value of RECs. It's a complex problem: the drop in RECs value prompted by household energy efficiency incentives means that large-scale wind farm and solar investments are on hold until RECs gain value and can help fund big projects.

GreenPower and RECs

RECs can also be traded through the GreenPower mechanism. GreenPower is a voluntary renewable energy product that can be purchased by residential and business consumers to ensure that their electricity is tied to generation from renewable sources.

When a householder or a business purchases GreenPower through their electricity retailer, the retailer in turn purchases additional RECs from the renewable energy market. These RECs are purchased 'in addition' to the retailers mandatory requirements under the RET, meaning that the consumer has achieved investment and an environmental benefit on top of that mandated by the Federal Government's target.

Solar credits and RECs

One of the recent additions to the RET market is the Solar Credits Scheme. This new scheme came into effect in June last year, replacing the former Solar Homes and Communities Plan, which offered households a rebate of up to $8000 for the installation of a solar system.

The Solar Credits Scheme works by offering investors in small-scale renewable generation systems the ability to

RECs on solar hot water and heat pumps have contributed significantly to their decrease in value. A drop in the value of RECs is stalling large wind projects.

Photo by Richard Pocknee, Project Manager, Cathedral Rocks Wind Farm, SA.

create and trade five times the number of RECs, thereby providing an increased financial incentive. This REC multiplier is available to solar PV systems up to 1.5kW in size, small wind turbines up to 10kW in size and micro-hydro systems up to 6.4kW in size. From mid 2012 the government plans to reduce this multiplier by a factor of one each year, until it expires in mid 2015, in anticipation of cost reductions in the small-scale renewable industry over that period.

One of the problems for consumers looking to invest in small-scale renewable energy systems under this new scheme is that it actually reduces the amount of new renewable electricity generation deployed in the market. If a householder can create five times the amount of RECs than normal (and bear in mind that small-scale generation units can create and trade RECs equal to 15 years worth of generation upfront), then for every five RECs created, four do not represent actual renewable electricity generation (i.e. four megawatt-hours).

These four RECs, once traded, will still be purchased by electricity retailers out of the market in line with their mandatory annual targets. In this way, investors in small-scale renewable energy systems are contributing to a reduction of the annual renewable electricity generation targets actually achieved. From the perspective of an individual household, one system may not make that much of a difference. However, given that over 70,000 micro-generation systems were purchased in 2009, the Solar Credits Scheme has the potential to substantially distort the achievement of the RET!

The way forward

Previously, many renewable energy system owners held on to their RECs to ensure that the renewable electricity generated from their system was additional to the mandatory government targets, as described in *Don't wreck those RECs* in *ReNew 105*. Unfortunately, under the new Solar Credits Scheme, holding on to your RECs means that you miss out on any upfront financial assistance and pay the full retail cost of any solar, wind or micro-hydro electricity generation system. The Alternative Technology Association, along with a host of other environment, community and industry organisations, is currently lobbying the Federal Government to alter the Solar Credits Scheme to ensure the annual renewable energy targets are adjusted (i.e. increased) to account for the quantity of 'fake' RECs traded in the market.

In the long-term a much better mechanism to drive the uptake of small (and large) scale renewable generation is a strong gross feed-in tariff, whereby the investor knows exactly the price they will be paid for all the electricity they export and over what time frame, and the electricity networks know exactly how much additional distributed generation capacity is available. To date though we have seen only two effective feed-in tariff policies implemented for small-scale systems in Australia (in the ACT and NSW) and none for large-scale technologies.

With the current oversupply problems in the existing REC market and its inability to drive investment in the kind of large-scale renewable energy projects we need to deal with the climate crisis, the imperative for a strong, nationally consistent feed-in tariff to drive both small and large-scale technologies, complemented by a significant increase in energy efficiency investment, becomes more and more critical. ✻

Damien Moyse is Energy Policy Manager at the Alternative Technology Association.

Smart meters—a rough guide

Smart meters are getting a lot of attention in the media lately. Craig Memery explains what they are and what they mean for household energy use.

Despite the tendency of governments and many energy industry businesses to lump all smart meters into one basket, the experience of the Alternative Technology Association (ATA) is that smart meters, and the networks of infrastructure required to support them, can take many forms.

As well as a number of makes and models, a diverse range of features and functions are (or can be made) available with smart meters. There are various ways in which they can allow a household or business to interact with the electricity network and these are accompanied by various tariff options.

At its most basic, a smart meter is an electronic *interval meter* with *remote communication* capability. These two features alone offer benefits primarily to distributors and retailers, however, smart meters can also incorporate features to benefit consumers, and it's these features that ATA is strongly advocating to be included wherever smart meters will be rolled out.

Such features may include *load control* options, *visual displays* of energy consumption and generation, the ability to interface to a Home Area Network (more on those in the next issue of *ReNew*), better metering for household solar PV and other generators, and the ability to monitor and report the quality and safety of the energy supply to a consumer.

Let's translate some of these features into English.

A recently installed smart meter.

Interval meters

Traditionally, electricity supplied to homes and businesses has been metered with mechanical 'spinning disk' type cumulative meters which can only tell you one thing: how much energy you have used since last time you looked at the meter.

Although the cost of supplying energy to a home varies during the day, mechanical meters can't tell you what time the energy is being used, therefore your energy retailer charges the same amount per kilowatt-hour (kWh) for all the energy you use.

Also, if you have access to an off-peak tariff (where you are charged less for electricity used for water heating or space heating at night) you need two meters and a switch with a timer.

An *interval meter* is an electronic meter that measures and records energy flows at regular intervals, typically every 30 minutes. This data is stored in the meter and is accessed for billing purposes, either via *remote communication* (making it a smart meter) or uploaded to a handheld device carried by the meter reader.

With an interval meter, a *Time of Use tariff,* such as an off-peak tariff, can be charged without an additional meter.

Remote communication infrastructure

Smart meters require a network of wireless and/or hard-wired communication infrastructure. These networks will typically allow two-way communication between a meter, the distributor (who operates the electricity network) and

retailer (who sells you your electricity).

Remote communications can support a number of key smart meter functions, including:

- accessing meter data without having to manually read meters
- automated connection or disconnection of power supply to a property (when moving in or out of a property, or to alleviate stress on the electricity network during times of high demand)
- signalling to the distributor to alert to a power failure or possible safety issue
- switching of a controllable load, such as an air conditioner compressor or a pool pump
- sending messages to consumers, for example to advise of high energy prices if customers are on a *critical peak tariff.*

Load control

Load control is the ability for the meter to operate (i.e. switch off and on) various appliances as a way of reducing demand on the electrical network. Load control may work by, for example, cycling (switching on and off for set periods) air conditioners to alleviate demand on a network while avoiding blackouts, or by shifting some loads, such as pool pumps to off-peak when energy prices are consistently lower.

Load control may be operated directly by the meter or remotely (in real time) by the network operator using the meter.

Visual display

A visual display on a smart meter is key to making a customer aware of their energy use.

A visual display for a smart meter may come in many shapes and sizes, such as:

- a numerical display of power (kW) and energy (kWh) imported or exported, displayed on the face of the meter
- a 'traffic light' type display of power consumption, with a green light indicating low power consumption and a red light indicating that it might be time to think about switching off some appliances, attached to the meter via a Home Area Network
- a detailed breakdown of real-time and historical energy use data accessed by web-based portal or via a Home Area Network.

Smart meter tariffs

Smart meters will change the way we pay for energy.

Time of Use tariffs. With interval metering, an energy retailer can see what time of the day the energy is being used. This allows the retailer to offer a Time of Use (ToU) tariff, where consumers pay more for energy used during times of high demand and less when the demand is lower. For example, instead of paying 20c/kWh for all the energy you use, you might pay 30c/kWh during weekday afternoons, 10c/kWh overnight, and 20c/kWh at other times (these figures are indicative only: actual charges and tariff structures will vary between products and retailers).

Critical Peak tariff. Critical peak pricing is a Time of Use tariff where, on those few days of the year that energy usage peaks at its highest (usually hot days in summer but also on cold winter days in some areas), consumers on a critical peak pricing tariff will pay a far more (possibly ten or more times the 'normal' charge per kWh) which is compensated by a low tariff at other times.

The logic behind critical peak pricing tariffs is that a large amount of the capital cost of the electricity network is spent building and upgrading the generation, transmission and distribution infrastructure required to keep the electricity network operating on these high-demand days, and critical peak pricing passes more of this cost on to the user.

Controlled load tariff. As an alternative to critical peak pricing (or even in conjunction) some customers may have certain loads, such as air conditioner compressors and pool pumps, switched remotely to reduce strain on the network during times of high demand. In many cases, this can be done in a way that will not affect a customer's comfort or amenity.

A corresponding tariff for controlled load customers may include a discounted Time of Use rate, or a reduced service charge.

What do smart meters mean for householders?

Smart meters are seen by ATA as a mixed blessing for consumers. On one hand, they offer opportunities to improve energy efficiency, better inform consumers about their energy use and reward them for using less power during times of peak demand. On the other, smart meters and associated infrastructure are costly, still technically immature, and offer benefits to energy distribution and retail businesses that consumers may not gain from.

Can smart meters save consumers money?

The cost of implementing smart meters and associated infrastructure will be passed on to consumers, so to save money for consumers the benefits need to outweigh these costs.

In Victoria smart meters are being rolled out state-wide over the next three years at a total cost of over $1billion. This cost is passed on to consumers in the form of an increased service charge which varies from one distributor to the next and from year to year; an average Victorian household will pay $53 more during 2010 and face a further $25 increase in 2011, even if their smart meter is not installed for another three years.

How any new tariff affects your total bill will depend on the daily pattern of your energy use. Choosing the right energy retail product and understanding how you use energy will be key to getting the most out of smart metering.

Any cost savings will come from reduced energy consumption, using power at different times, or choosing a tariff that gives the best value for your energy use. As mentioned earlier, with

a Time of Use tariff energy will cost more during time of high demand (eg midday on weekdays) and less at times of low demand (at night).

This is great for households who can save money by shifting some of their loads (e.g. for washing) from daytime to night, and for working households where nobody is home during weekdays. Yet, people who are home during the day, including stay-at-home parents, retirees, people with medical difficulties, and whose energy use is not so flexible, may find their bills increasing if they are charged for time of use.

For a number of years now, all energy customers who do not use air conditioners or heaters on high-demand days have been subsidising those who do. Critical peak pricing may be an effective way for customers who are able to avoid using large amounts of energy during temperature extremes to reduce their bills.

Customers with air conditioners may benefit from a controlled load tariff, which will reduce their exposure to high peak energy prices.

Smart meters and consumer choice

As smart meters will be rolled out (installed on a large scale) across most states and territories, relevant state governments will select which features or functions are enabled in their jurisdiction.

The ATA (along with other consumer organisations) is actively involved in advocating for the interests of its members to ensure that features which benefit consumers are included, and that expensive features which do not benefit consumers are kept to a minimum.

Distribution businesses will have the final say on which makes and models of smart meter technology are installed.

While individual households can't opt out of having a smart meter, ideally many consumers will be able to save money through using the most appropriate tariff option, and some will be able to maximise functionality of the meter by using their Home Area Network.

In the next *ReNew* we'll look at:

- the problems with the smart meter rollout in Victoria. Victorian electricity consumers started paying for smart meters from January 1 this year, even though it will be at least three years until meters are installed at some properties
- the recent wins ATA has had advocating for its members in the National Smart Meter Program. ATA has been busy pushing for features that improve the value of smart meters for consumers
- Home Area Networks: the future of household energy management? *

Craig Memery is ATA's Energy Policy Advocate and can be contacted via craig@ata.org.au with any enquiries about smart meter policy.

The evolution of an energy efficient home

Aussie Kanck made his ordinary double brick home more sustainable with double glazing, passive heating and cooling and some experimentation with roof paint. And the solar hot water and electricity helped too.

When we purchased our house in 1981 there were no major plans for renovations. It was built by Hickinbotham Homes in 1968 as a standard project house, being double brick, sitting on a concrete slab, with a tiled roof. The house faces 25° west of north and is located near the base of the Adelaide Hills. Previous owners had made some passive energy efficiency modifications such as blow-in cellulose ceiling insulation, adding a small porch and second front door to create a thermal barrier at the front entrance, and fitting a carport on the western side of the house and a semi-enclosed veranda at the rear.

Photos: Aussie Kanck

A 1.5kW photovoltaic system, with a smaller 240 watt system in the background.

Of course those plans changed by the mid 1980s when we added a guest room to the back of the house for friends and relatives to stay in when visiting. We also removed a wall to make a larger kitchen, in turn losing the laundry. Since then further modifications have focussed on improving the overall energy efficiency of the home.

Laundry

We built a free-standing room next to the rear veranda for a laundry and a sewing room. This became the first of my 'passive designs', making use of an overhanging eave to the north with a shallow window immediately beneath to act as a 'light tunnel' to increase the amount of diffuse light entering the laundry. We added a pergola on the east side and planted grape vines with it, so there is full shade in the summer and the winter sun gets through. The long carport protects the western side from the sun.

We've recently added Magnetite double glazing to the three windows and this has had a noticeable effect in stabilising the temperature in both rooms. The window frames are aluminium and the Magnetite framing works in such a way as to minimise heat flow through the metal frame as well as the glass.

New rear veranda

The original rear veranda had an unlined iron roof, a light-duty southern wall and an open side to the carport. This was very hot in summer and cold in winter, causing noticeable heat movement through the wall and windows on the southern side of the house. We decided to rebuild the veranda from below the foundations upwards. It took a year to find a builder who was prepared to build what I had designed, mainly because all the work had to be done between the existing house, carport and rear concrete paths. Although the local council require energy efficiency design features in new constructions, it took almost a year to get design approval. I suspect this is because I designed it instead of a professional architect, and because the design was non-standard. When our PV system was installed there were seven people on the veranda roof at one point and I could not feel any movement in the frame, showing how strong the steel-framed veranda ended up being before the council finally approved the design.

The veranda roof was designed with a sawtooth profile facing north, incorporating long overhanging eaves to shade the windows during summer, yet

Top: Shadeblades on the veranda controlling light into the home; Below: winter sun hitting the veranda wall.

allowing the low winter sun to shine into the veranda and strike the brick half-wall on the southern side.

I used two types of glass in the veranda. The northern high windows are made from a mid U-value glass so that radiant heat can still come through (but less than standard glass) and the south facing windows have Comfort Plus glass fitted, a laminated and coated glass which has very low heat-flow properties.

I did have some problems getting thermal break framing for the window frames. I spent many weeks searching for a supplier and in the end gave up, planning to cover the inside of the aluminium frames with PVC mouldings instead. A week after placing the order for the windows I came across a supplier of thermal insulated window frames in Adelaide! They are the UPVC type of frame and I've noticed there are several suppliers of those frames in Adelaide now.

The bottom half of the southern wall has an inner brick facing which acts as a heatsink for the winter sun coming

Washed, plain and nano-ceramic tiles.

Cool paint for the roof

After the rear veranda was completed it was obvious that the roof would need repointing and repainting. We decided to repaint the roof the same colour as before, and as the nano-ceramic version of the paint was now available (at the same price) it was an obvious choice.

At times I've been asked, 'does nano-ceramic paint work?' I relied on manufacturers' brochures for this answer, and a certain level of my technical knowledge, but no objective 'before and after' measurements had been made. I decided to run my own tests.

I had some spare roof tiles in the yard which were all the same 'Bill Brown' colour. One was coated in the new nano-ceramic paint, one was the original unweathered brown and one had all the old paint stripped off it in preparation for repainting.

Testing temperatures

The tiles were left in the yard for the temperature to stabilise. Six readings were taken on front and rear faces of each tile during a one hour period, where the ambient temperature started at 32°C and finished at 34°C, with a clear sky all the time. Results were averaged for the readings.
Standard 'Bill Brown' tile:
top=62°C rear=61.5°C
Nano-ceramic 'Bill Brown':
top=59.2°C rear=58.4°C.
Paint stripped tile:
top=59.7°C rear=57.9°C

The important numbers are the rear temperatures (roof space); with the nano-ceramic tile being 3.1°C cooler than the standard tile and, interestingly, the faded tile was 3.6°C cooler, though this tile was not sealed against water ingress.

North facing windows and eaves letting natural light in.

through the northern windows. The roof has been fitted with Aircell insulation and is lined with plasterboard. The final touch is multi-fold doors in the wall facing the carport so we can open these up and have a large undercover entertaining area.

We recently recorded the temperature of the veranda roof and our thermal efficiency improvements seem to be working well. While the temperature outside was 34°C, the outside zincalume cladding was 45°C, the inside roof 34°C, and the veranda ambient temperature 26°C.

Front veranda

Some years ago we experimented with an adjustable wooden slatted front veranda, but this lasted less than 10 years before we had to pull it down.

This was replaced with a metal fixed blade version using Shadeblades. The only problem was when the installers started fitting the slats facing south rather than north!

Solar water heating

We fitted a solar hot water system in 1990, laying out the extra money to get one with a stainless steel tank. This unit is still working well and I can usually leave the electric booster turned off for about seven months of the year. For those with an economic eye, it took about 11 years to recoup the extra capital cost from electricity savings—and we had no RECS back then.

Solar power

First version: I designed and installed a small 240 watt photovoltaic system in 1997 that operated all the household lights from a sinewave inverter. The system had auto changeover so the lights could operate from the grid if the batteries went too low in winter. This system operated successfully until I upgraded to a grid-connected system.

Second version: We have upgraded our PV system to a 1.5kW grid-connected system and have converted the old PV system to an automatic backup unit to run the lights and fridge/freezer for several hours when a power failure occurs. This has been operating for nearly two years now, with the first year's electricity bill being a credit of $29. The biggest headache I had was getting the electricity retailer to calculate the bill correctly, and the only reason the final bill was correct was because it was worked out manually, but that's another story.

Aussie at home with his roof top electricity supply.

Rainwater storage

We have increased our rainwater tank capacity from 1000 litres to 16,000 litres, with a total of five tanks. This means we can capture run-off from every roof downpipe. The largest 9000 litre tank has to have water pumped up to it in the backyard and gives extra head pressure for watering the garden.

Ducted evaporative air conditioning unit

We have recently installed a new air conditioner that uses an inverter motor drive. This is a very efficient type of motor drive, giving very quiet motor operation and 10 speed settings. I have modified the water supply to the air conditioner so that I can select either rainwater or mains water.

Considering the amount of salts in Adelaide water, I will be running it mainly on rainwater—especially as the water dump valve can be programmed to drain the unit when a set salinity level has been reached.

More additions

I am planning to add another 500W (for a total of 2kW) of solar panels to the carport roof soon, and that should do us, as we will then be generating about 90% of our total yearly electricity consumption. This will mean that for the four peak energy demand months of November to February we will be generating more electricity than we use in the house—electricity in the bank so to speak. ✻

D.I.Y. SOLAR

GUIDE TOWARDS A GREENER TOMORROW

STEP 1 — MASSIVE SOLAR SAVINGS!

These monocrystalline panels are more efficient than polycrystalline panels and are as strong and tough as the better known brands, but at a more attractive price. Sizes range from 5 watts to a massive 175 watts.

		WAS	NOW	SAVE
12V 5W	(ZM-9091)	$78.20	$59.95	$18.25
12V 10W	(ZM-9093)	$119.00	$94.95	$24.05
12V 20W	(ZM-9094)	$191.25	$149.00	$42.25
12V 65W	(ZM-9096)	$433.50	$399.00	$34.50
12V 80W	(ZM-9097)	$595.00	$475.00	$120.00
12V 120W	(ZM-9098)	$870.40	$695.00	$175.40
24V 175W	(ZM-9099)	$1190.00	$999.00	$191.00

MORE INFO AVAILABLE ONLINE

STEP 2 — LINKABLE SOLAR CHARGE CONTROLLERS

These professional grade, high current solar charge controllers offer the flexibility to suit almost any solar installation. System voltage can be 12, 24 or 48V, and multiple units can be stacked together (up to 10 units max) allowing your system to grow and expand without rendering your old charge controller useless. Each unit features an LCD and front panel controls, and can be used as either a battery charger, load controller or diversion regulator. They can also be connected to a remote control for remote monitoring, and are fully protected against reverse polarity, short circuit, high temperature and overvoltage. Particularly suited to our SuperCombi and CombiPlus units.

NEW

45 or 60A models available:

45 Amp (MP-3726) $389
60 Amp (MP-3728) $459
Remote (MP-3729) $149

MORE INFO AVAILABLE ONLINE

Visit our website to view our full range of panels, controllers, batteries & accessories. Jaycar - all your alternative energy options under one roof.

STEP 3 — DEEP-CYCLE GEL BATTERIES

Genuine deep-cycle batteries that can be operated & charged in any position. They are leakproof & completely sealed.

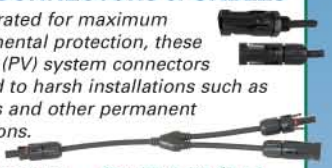
12V 26Ah (SB-1698) $139
12V 38Ah (SB-1699) $199
2V 200Ah (SB-1696) $289

IDEAL FOR SOLAR

*Note: These are genuine high **capacity** batteries and are extremely heavy. Please see website for detailed specifications.*

STEP 4 — CONNECTORS & CABLES

IP67 rated for maximum environmental protection, these photovoltaic (PV) system connectors are ideally suited to harsh installations such as solar panel arrays and other permanent outdoor applications.



Female In-line Connector	*Cat. PS-5100 $7.50*
Male In-Line Connector	*Cat. PP-5102 $7.50*
Panel Mount Female	*Cat. PS-5104 $7.50*
Panel Mount Male	*Cat. PP-5106 $7.50*

UV STABILISED CABLE

Dust, age and UV resistant, with tinned copper conductors to minimise corrosion. Rated to 1000VDC.

30 Amp 2.5mm² (WH-3120)
$400 per 100m roll or $4.80/m

55 Amp 6.0mm² (WH-3122)
$750 per 100m roll or $8.90/m

STEP 5 — SOLAR PANEL MOUNTING HARDWARE

We have a range of solar panel mounting hardware that is adaptable and modular to fit most applications.

Extruded Rail 1m	*HS-8702 $39.95*
Extruded Rail 2m	*HS-8700 $69.95*
U-Type Joiner Bracket 80mm	*HS-8714 $19.95*
L-Type Bracket Pk 2	*HS-8704 $34.95*
Z-Type 28mm Bracket Pk 4	*HS-8706 $79.95*
Z-Type 35mm Bracket Pk 4	*HS-8708 $79.95*
T-Type 28mm Bracket Pk 2	*HS-8710 $39.95*
T-Type 35mm Bracket Pk 2	*HS-8712 $39.95*

MORE INFO AVAILABLE ONLINE

THE EXTRAS

Suitable crimping tools
Cat. TH-1834 $23.95
Cat. TH-1950 $49.95

Assembly tool
Cat. TH-1930 $5.95

EDUCATIONAL KITS FOR THE YOUNGSTERS

NEW

SOLAR ROBOT!

Build your own solar powered robot.
- *No batteries needed*
- *Recommended for ages 8+*

Cat. KJ-8821 $29.95

SOLAR POWERED ROWING BOAT

Easy to build, using a solar panel to power its oars. The clever mechanics enable it to go forward or backward with the flick of a switch.
- *Suitable for ages 8+*

Cat. KJ-8922 $29.95

6-IN-1 SOLAR EDUCATIONAL KIT

Build any one of six different projects from the parts in the kit. No tools, soldering or glue required.

Projects:
• Windmill • Car • Dog • Plane • Airboat • Revolving Plane
Suitable for ages 10+

Cat. KJ-8926 $24.95

HOURS OF FUN

DELUXE SOLAR EDUCATIONAL KIT

A series of do-it-yourself experiments to acquire the basic knowledge of solar energy.

Includes Solar cell module, musical unit, plastic lamp, motor accessories and plastic adaptors.

Cat. KJ-6694 $29.95

SOLAR ECO-HOUSE KIT

This instructive kit will help teach the fundamentals of electric circuits & solar power. The house is fun to build and will introduce your child to eco-friendly concepts.
- *Solar, wind or 2 x AA battery powered*
- *Approximately 160mm square*
- *Suitable for ages 8+*

Cat. KJ-8924 $29.95

How to place your order: • Phone - Australia: 1800 022 888 • Phone - NZ: 0800 452 922 • Email: techstore@jaycar.com.au • Website: www.jaycar.com.au

OVER 60 STORES ACROSS AUSTRALIA & NZ VISIT OUR WEBSITE FOR YOUR NEAREST JAYCAR STORE

Prices are in Australian Dollars. Prices valid until 31/05/10 *Check www.jaycar.co.nz for NZ prices.*

Jaycar Electronics

See our full product range at www.jaycar.com.au

Difficulty rating: ★★★☆☆

Making a LED 'fake' skylight

Chris Molloy shows how he put one of his solar panels to better use by making a skylight that isn't.

I decided my 20 watt photovoltaic panel was not working hard enough. It was currently running the solar-powered attic-to-basement fan system, plus a separate fan system used to redistribute heat from our lounge to our bedrooms in winter. But this still left a good deal of spare capacity when it wasn't hot or cold enough to need the fans running. The heat redistribution system also relied on a lead-acid battery to do its job, and I've never had much luck when it comes to lead-acid batteries. It was time to come up with yet another use for my PV panel.

A couple of articles in *ReNew* magazine had caught my eye: an article to build your own mains powered LED light fitting in issue 104 and an article about skylights, including how to build your own 'fake', LED-based one in issue 108. I decided to combine these two articles to build a fake, LED-based skylight driven directly by a PV panel, with no electronics in between to complicate the system (or use some of the power being produced).

This project is possible because a PV panel is a constant current source and an LED is a constant current consumer—a perfect match! A non-obvious feature of this system is that the brightness of the fake skylight will vary with the level of insolation falling on the panel, and will thus mimic a real skylight amazingly well.

The basic plan is to hook up strings of Cree XR-E LEDs (rated at 3.3 to 3.7 volt each at up to 1000mA) to match the rating of your PV panel. A good match (that allows a safety margin when driving the LEDs) is to hook up strings of five LEDs in series (i.e. with a total forward voltage of 16.5 to 18.5V), and then connect these strings in parallel, one for each 10W of PV panel output (i.e. approximately 600mA per string). Based on this plan I needed two strings of five LEDs in order to match my skylight unit with my 20 watt PV panel.

The finished skylight. You can clearly see the 10 LEDs, wired as two strings of five.

One possible addition to this plan concerns fuses. If one of your LED strings were to fail (for whatever reason), then the current from the PV panel will be split between the remaining strings. If this results in more than 1000mA (1.0A) flowing through the remaining strings then you risk damaging the LEDs in those strings. A solution is to put a 1.0A fuse into each string. The prudent approach might be to add this fuse into each string regardless of circumstances, but if it is unlikely to be needed (e.g. the loss of one string will not cause too much current to flow though the remaining strings), then the non-prudent approach might be to save the cost and complexity (not to mention a small drop in power) of putting the fuses in. I've written an LED calculator to help you with this decision, which can be found at www.chrismolloy.com/skylight.

One further issue to deal with is that of heat dissipation. Like all power LEDs, Cree XR-E LEDs run hot enough to do themselves damage unless they are properly heatsinked. The *ReNew* articles stated that a good rule-of-thumb for this is to allow 100cm^2 of 3mm aluminium plating per watt of LED. Ten Cree XR-E LEDs will thus require 3000cm^2 of aluminium (e.g. 100cm x 30cm). Each LED should be securely fastened to your aluminium base plate and should be bedded on heat-sink paste to ensure good thermal conduction.

In order to make my fake skylight look like a real one I wanted to have it mounted in a frame and behind glass. I decided to use aluminium 'U' channel to make the frame and to ensure a good thermal bond between it and the aluminium base plate to further help in keeping the unit cool. The frame was to be left open-ended to ensure good airflow through the unit. The glass was to be textured (unlike most real skylights) in order to blur the look of the LEDs somewhat. I also wanted to be able to tilt my fake skylight, rather than be forced to have it shine straight down, so I built a hinge/tilting mechanism into the frame as well.

Building it

Here's how to put a unit together.

Assemble the materials. Leave the

protective plastic on one side of the aluminium sheet—this will be the LED side of the skylight. Rule lines on the protective plastic to indicate where you're going to place the LEDs with the aim of distributing them evenly and maintaining a good separation between them. I ruled lines across every 100mm, beginning 50mm in from one end and along the length of the plate, 75mm in from each side. This resulted in twenty spots, of which I used every second one, in a staggered pattern.

Drill 3.2mm holes in the aluminium base plate. Each LED will need two pairs of holes: one pair that matches the body of the LED so it can be secured to the plate and one pair perpendicular to the first and 20mm away from the LED on either side to accommodate the wiring. You will also need a row of holes, around 200mm apart, along each side of the plate to facilitate riveting on the side rails (aluminium 'U' channel).

When drilling the rivet holes, drill the plate and rails together to ensure a perfect match. You may also wish to drill holes to accommodate your mechanism for connecting your skylight to your ceiling. I used a pair of semi-concealed hinges on one side and tapped a pair of holes in the other side to allow for a pair of set screws (which are coupled to a pair of hasps on the ceiling during the final install). Ensure all holes are burr-free, especially those for the wiring.

Cut away the protective plastic along each side of the base plate and rivet on the side rails (aluminium 'U' channel). I ran a bead of heatsink paste between each rail and the base plate to ensure good thermal conduction. Go easy with the heatsink paste as a little goes a long way. Cut away the protective plastic where each LED will be mounted.

Attach any appropriate components for connecting your skylight to your ceiling, in my case the semi-concealed hinges.

I had not used Cree XR-E LEDs before and found them to be a little user-unfriendly. There are two pairs of soldering pads on each LED, presumably to provide some level of wiring flexibility. Unfortunately these clash with the notches that seem useful for accommodating the mounting bolts, such that it is very easy to short out each LED by electrically coupling one set of pads to the base plate via the bolts. To get around this I covered one pair of solder pads on each LED with liquid insulation and let this fully set before mounting the LEDs. *(You can also mount LEDs without screws by using heatsink adhesive such as arctic silver epoxy or a similar hard-setting heatsink paste. If using screws, you can use nylon washers under the screw heads, or use countersunk screws so that the screw heads only grip the inside edge of the notches in the LED. Both methods eliminate shorting issues—Ed).*

At this stage the LEDs have been fitted (they are on the back in this view) and the hinges, one of which can be seen, have been fitted. Hinges are not necessary of course, but they allow you to aim the skylight to make better use of the light.

Mount the LEDs on top of a small amount of heatsink paste, taking care not to over-tighten the mounting bolts. Ensure the solder pads align with the wiring holes on each side, and ideally ensure the polarity of each LED is consistent, to reduce the risk of wiring things up incorrectly.

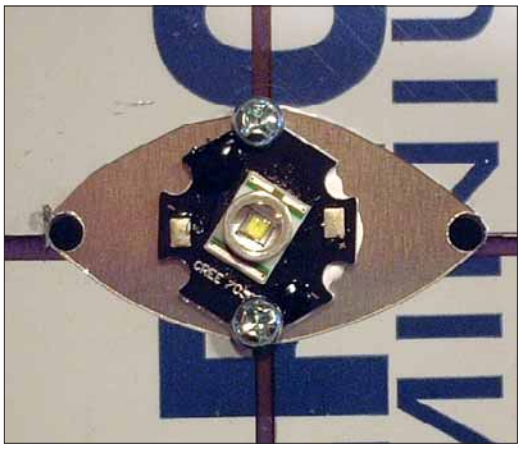
Wire the LEDs up in strings of five in series. I grouped my strings by end, so each string starts and finishes in the middle of the base plate, but you could just as easily wire up one string along each edge. However, this leads to much longer wires to connect the strings together.

Connect each string in parallel to one

Materials List

Here's a list of what I used to build my fake skylight. You may want to tailor this list to meet your specific needs:

- 10 Cree XR-E Q5 LEDs
- one 1000mm x 300mm x 3mm aluminium plate
- one 1000mm x 285mm textured safety glass (ensure whatever you use complies with the local building code for overhead use).
- two 1000mm x 25mm x 25mm x 3mm aluminium 'U' channel
- 3.2mm diameter aluminium rivets with 6.4mm and 9.6mm grip depth
- M3 x 12mm button/dome/pan head bolts and nuts
- cable/wire
- a connector block
- heat-sink paste
- a means to connect your skylight to your ceiling (I used hinges and hasps)
- optional: fuse holders and 1A fuses (one per string) and a switch on the PV side of the connector block to allow the power to be disconnected more easily.



One of the LEDs mounted on the aluminium base. Note how the plastic has been removed from the mounting area. This lets you work on the metal without scratching it.

side of a connector block. The other side of the connector block will go to the PV panel. Double-check the polarity of every connection that you've made.

Now you are ready to test it out. If you have a (current limited) bench-top power supply, use this to test the unit. Limit the output current to 1A (if one of your strings is not working, you don't want more than 1A going through the other string), set the output voltage to 16.5V, connect your skylight up and switch it on. All the LEDs should light up. Disconnect the power immediately if you spot a problem.

Secure the unit to the ceiling and connect it to your PV panel. To help with airflow around the unit I made sure that there was at least 25mm between the unit and the ceiling. By tilting the unit a little (to throw more light into the centre of our room), the air gap at the back is more like 50mm. If you want to move the skylight, simply unscrew it from the ceiling. Try doing that with a regular skylight!

Cost

The total cost to build this unit was around NZ$300, excluding the PV panel. The single most expensive item was the safety glass (NZ$120), which could easily be omitted if cost was more important to you than aesthetic. As a comparison, a single Solatube-type unit (including installation) can be bought for around NZ$800.

This is by far the best PV/LED-based thing I've built. This unit is extremely functional and pleasantly illuminates an otherwise dim end of our lounge.

Possible improvements could be to add a stick-on strip thermometer (the kind you see on the outside of fishtanks, available from any pet shop) to the outside of the aluminium frame to monitor the temperature of the unit. These thermometers typically only go up to 38°C or so, but this unit should run well under that. ✻

Visit Chris Molloy's extensive blog at www.chrismolloy.com

Run On Sun Australia Pty Ltd

These solar water heaters come with both radiator and wetback fittings.
Combine a wetback and use multiple radiators.

SOLAR HEATING KIT $1450.
INCLUDES
VENTED "SYDNEY TUBE"
SOLAR WATER HEATER.
LOW ENERGY PUMP
WITH ONE N.T.C HEAT SENSOR.
A COPPER CONVECTION RADIATOR.

FREE INFORMATION PACK
PH - ANDREW 02 6734 6322

FREE E-PACK
andrew@runonsun.com.au
www.runonsun.com.au

COPPER / STEEL CONVECTION RADIATOR $400 - $600

STAINLESS STEEL CONVECTION RADIATOR

LED Lighthouse Pty Ltd.

Website - www.ledlighthouse.com.au
No Internet - Phone Kim 02 6734 7392
LATEST HIGH LUMEN LED'S ONLY.

Lowest prices in Australia with a 3-year warranty. Mercury free with no u-v.

LED light bulbs.
LED spot lights
LED fluro replacements
LED Horticultural lights.
LED factory & office lights.

Run On Sun Australia Pty Ltd

All stainless steel solar water heater with a gas or electric booster

Simple & Effective.

Sydney University patented tri-tubes with heat pipes.
Government rebates and factory discounts available.
No pumps or electronic controllers needed.
No antifreeze liquid to change every year.
Simple freeze proof design (-25 degrees C)
Free info pack - Ph Andrew 02 6734 6322.

www.runonsun.com.au

Difficulty rating: ★★☆☆☆

Airtight with DIY double glazing

A problem window was leaking air in and out of Chris Moseley's rental house. He fixed it by making his own double glazing.

I'm a DIY fan living in a rented villa in Melbourne. The house is insulated and has thermal drapes on most windows. We've put masking tape over the internal vents in the double brick walls because it blocks them but is not visible unless you get very close. The landlord has not noticed the tape, and the external vents are still open. So our house is already reasonably airtight and insulated.

The main living area is open plan, with the kitchen, dining and living area one space. The only un-curtained window is the north-facing kitchen one. This window, like the rest, is a fairly large aluminium-framed sliding window that rattles in even gentle wind gusts. As a result it leaks air like a sieve.

Initially I wanted to know whether it was going to be worth spending money on the project. One problem is that we spend very little on heating, using extra clothes instead. This meant that the benefit would be not financial but more for comfort.

To see if it would work I got some random steel out of my scrap pile and made a frame that filled the window space, then wrapped it in pallet wrap, a kind of industrial cling wrap. Putting this up cost almost nothing and showed that the idea had merit. On a chilly night it was about 5°C outside, 6°C between the glass and the wrap, but 20°C degrees inside the room. Taking the frame down made the room noticeably cooler.

The real thing

The next step was something more permanent and ideally a bit more transparent. Since we're renting, whatever I do has to be easily removed and either not noticed or obviously not doing any damage to the property. As the window sill is horizontal and the other edges are also at right angles, a window within a window approach seemed like the easiest approach.

I built a wooden frame that sits on the window sill and sits close to the surrounding wall with a groove running all the way round. The timber is all internal use softwood and cost less than $50 including white paint for it. A local glass retailer delivered a sheet of glass cut to fit the window less 5mm all round, cut into three so I was less likely to break anything. That cost around $400 for a total of 1100mm x 2400mm.

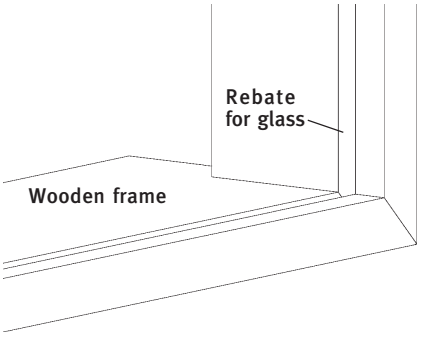
I used a thicker piece of timber for the top of the frame so I'd have a little room for errors; with more wood and a deeper groove there it doesn't matter if the glass is slightly too short. Since the top piece just sits on the other timber and is held in place by the glass it's easy to experiment. After a bit of experimentation and a trip to the shed to dig the top groove another couple of millimetres deeper I got the unit assembled and slid it into the window. It's a tight fit!

The small gaps between the three sheets of glass don't appear to affect performance, as sealing them with clear sticky tape had no detectable effect. Sealing around the edge did, because of course the glass is square and the window sill is neither square nor straight. So I cut some found polystyrene sheets into strips and wedged them in the gaps.

Results

The room feels noticeably warmer in winter and cooler in summer. A few temperature readings suggest it does help; I still see most of the temperature difference between inside and outside across my sealed window rather than the external aluminium one. On reflection, I think one of the main benefits from what I've done is actually draft proofing. ✻

A frame was made for the new glass sheet, the whole assembly then sits in the window recess to effectively form double glazing.



The glass sits into a rebate in the new frame which holds it in place securely.

Monkeying around with solar

We look at one reader's experiences playing with a home-brew grid-interactive solar power system.

Photovoltaics are amazing—you just put them in the sun and they make electricity. But if you want to install a solar array on your home and feed energy back into the grid, there's lots of red tape to go through before you can do this. While some of it may be valid, most of it is there to protect the electrical trades industry.

I had seen a number of small grid-interactive inverters and wondered what it would be like to set one up. The idea is that you just connect your solar panel(s) and plug the inverter into a spare power point. This seemed amazingly easy, so I bought a couple of 80 watt Chinese import solar panels at an excellent price from a local importer and a 250 watt grid-interactive inverter to suit. All up, the cost was well under $1000 for the 160 watt system.

The panels were mounted on the roof in a very simple way. As we live in a rental house, no permanent changes could be made to the house. The panels were attached to a couple of wooden bearers that were salvaged from some framing left in the garage by a previous tenant. I had to make up some simple right angle brackets from aluminium, and each bracket was bolted to one of the four mounting holes on each panel. Stainless steel pan-head self-tapping screws were then used to hold the panels to the bearers. To the underneath ends of the bearers I attached a 1 metre length of galvanised builders strap. This is available on the roll, 15 metres cost around $13 from the local hardware store.

Also mounted on one of the bearers was a sealed switch box so that the panels could be isolated at the array. While not really necessary for a 12 volt system, the powers-that-be seem to think that you have to have isolation switches at each end of almost every bit of wire in a system, so I thought I would see if it really was a good idea. It added around $35 to the cost of the system.

It's only a small system, but it also cost well under $1000!

Installation

The panels were lifted onto the roof and the roof tiles were lifted up at appropriate points and the metal strap slipped underneath them and bent downwards inside the roof around the battens. With the tiles pressed back into place, the array was fairly well secured, but I wanted to make sure it wouldn't move, so I went up into the roof to screw the straps to the battens. The only problem was, that part of the roof, which is the only north-facing roof area with solar access, was too low even to crawl through. It looked like it would be fine from outside, but the roof beams are so deep that there is very little space inside.

Being a 35 degree day, I decided to leave the roof adjustments until cooler weather. I will lift some tiles and gain access to the roof cavity that way.

Wiring

The cabling was pretty simple really. The panels came fitted with standard solar connectors, so some plugs and solar cable from Jaycar Electronics made for a quick assembly. The leads from each cable were fed into the sealed switch box and paralleled inside. The positive was then fed to the switch. The output of the switch and the array negative were connected to the down wire. At the moment I am using 2.5mm^2 twin core cable as it was all I had, but that will soon be replaced with 4mm^2 solar panel cable or another suitable double-jacket cable, or will be run inside 20mm conduit.

Power up!

The down wire was fed in through a window (remember, it's a rental house, so I can't make any holes in walls) and connected to the screw terminals on the inverter using a couple of crimp-on connectors for reliability. The inverter was then plugged into a power point and the switch turned on. Within seconds I was feeding over 100 watts into the grid.

Wow, that was easy, and I didn't have to worry about hassles with certification or about how many times the power company would screw up my next electricity bill before they actually pay me for the small amount of energy I was generating. I'm just happy that I'm offsetting some of the energy used in the home.

However, as we have a new smart meter that doesn't run backwards like the old meter does, we can't 'wind off' energy consumption. I suspect that this won't be a problem most of the time as there are a couple of permanent loads in the house, including a central low-power server for our files, an ADSL modem, wifi access point and security camera.

The system has been running for 89 days now and has generated 57kWh in that time. That's 0.64kWh a day, almost exactly four full sun hours a day.

I can hear some people saying 'but certification of systems is necessary for safety' etc. To be honest, while this may be true to some degree, in many cases it really makes no difference to the actual safety and operation of a system. I also have very little faith in electrical inspectors or electricians.

After our house was recently rewired, the inspector turned up and looked around for a couple of minutes and signed off on it. He didn't pick up that one of the newly fitted light fittings didn't work, or that old power points that should have been replaced, weren't. All he did was walk in, look at the main switchboard, have a quick look downstairs in the garage and that was it. Less than five minutes on site for his fee!

Getting back to safety, all grid-interactive inverters have an array of inbuilt safety systems, including anti-islanding (they turn off if the grid goes down), over and under voltage protection and various others.

Even the cheap inverter I used has these, and to all intents and purposes it is just another appliance. If it fails and develops a major fault, then the home's circuit breakers and RCDs will protect the user, in the same way as they will if any other appliance fails.

Really, the excessively heavy regulation in the electrical and similar industries only serves to retard innovation. It's one of the reasons Australia, despite being the source of many great inventions and ideas, is a complete backwater when it comes to implementation. Indeed, we are positively third world in many ways, and much of it is because of the mountains of red tape and regulations we have to wade through to get anything done. ✻

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.

If you 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, then send it in. 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 23 April 2010.

The winner of our previous DIY article competition is Peter Jackson for his solar caravan article.

Products

Widescreen monitors without the energy consumption

With the trend towards larger, widescreen computer monitors, computer energy use has been steadily going up. However, LED backlit monitors are becoming more common, which is helping to keep this energy rise in check.

The two latest offerings from Dell will certainly help in this regard. Indeed, they have to be about the greenest monitors we have seen so far.

Available in 22" and 24" (approx 560 and 610mm) sizes, their power-saving features include an ambient light sensor, what Dell calls 'PowerNap' and dynamic dimming. They also feature ultra-efficient power supplies which consume less than 0.15W when the monitor is in sleep mode. When in use, energy consumption is typically just 18 and 20 watts respectively—less than most of the old style 15" monitors!

Dell has also done considerable work on the materials used in these screens. They are free of arsenic, mercury, polyvinyl chloride, BFR and CFR (brominated and chlorinated fire retardants). Even the packaging has been greened up, with corrugated cardboard used instead of foam.

RRP: $299 for the 22" unit and $399 for the 24" model.

Available directly from Dell online at www.dell.com.au or ph:1800 812 393.

The highlighter that never runs dry

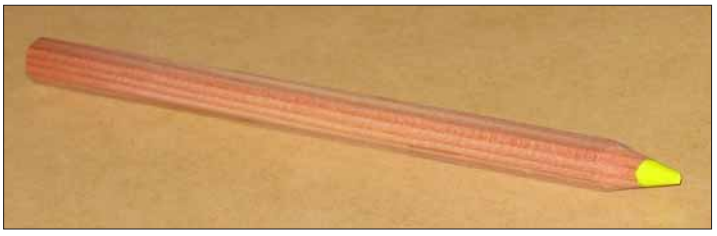
Highlighter markers are not the most exciting product, but many millions of them end up in the bin every year, usually after the caps have been left off and they have dried out. While each marker is small, this amounts to a huge amount of plastic—a million markers weighing 20 grams each (we weighed one) is 20 tonnes of plastic!

Going Green Solutions has a great alternative in their yellow highlighter pencil. It is a simple wooden pencil made from sustainably sourced wood, with a thick fluorescent yellow 'lead'. The pencil is used just like any other and produces a nice bright yellow mark. To make a thicker line, just do a quick scribble—it's actually very quick and easy.

The only downside with this pencil is that they only have it in yellow at the moment; fluoro orange and green versions would be great.

RRP: $3.95

Available from Going Green Solutions, 946 Main Rd, Hurstbridge VIC 3099, ph:(03) 9718 0126, email: info@goinggreensolutions.com.au, www.goinggreensolutions.com.au



Plug those holes in your ceiling

Downlights not only waste a lot of electricity, they also create holes in your ceiling insulation that increases heating and cooling costs due to unwanted heat transfer.

The Halogen Downlight Mitt from Efficiency Matrix is a flexible cone of insulating material (a mixture of fibreglass, latex and graphite) that fits over downlight fittings to provide insulation. Because it's fireproof, you can place roof insulation right up to the Mitt, producing a relatively sealed downlight fitting.

The Mitt is available in three sizes, from 160mm diameter to 295mm diameter, to fit most downlight fittings, although some of the Mitts should be used with the special halogen downlight bulbs sold by Efficiency Matrix (they are available as a Mitt and bulb package).

For more information contact Efficiency Matrix, ph:0434 195 792, www.efficiencymatrix.com

Insulate and help those in need

Insulating a home is a sensible thing to do, and polyester insulation is one of the best insulating materials. It is safe to handle as it produces no loose fibres, it is fire retardant and is a recyclable material.

However, Blue Sky Insulation is a polyester batt insulation with a difference: all proceeds from the sale of the insulation go to The Smith Family to help provide education and learning opportunites for disadvantaged children. So not only do you get your house insulated, but you help kids at the same time.

Blue Sky Insulation is available to insulation installers, so all you have to do is ask your installer to order it for you.

For more information, contact The Smith Family Commercial Enterprise, ph:(02) 9754 6355, email: blueskyinsulation@thesmithfamily.com.au, www.tsfblueskyinsulation.com.au. Available from Gerster Insulation, Factory 2, 93 Bayfield Rd, Bayswater VIC 3153, ph:1800 641 101, www.gersterinsulation.com.au

Inverter/chargers with heaps of features

Jaycar Electronics has just released a new range of sinewave inverters which are suitable for permanent installations in homes and businesses. They are complete power management systems that can provide power from a battery bank, as well as from the mains or a generator.

The SuperCombi Power Management System units come in several versions, from 1500 watt 12 volt units to 3000 watt 24 volt models. One of the most impressive features of these inverters is that they are rated to provide full output at up to 70°C, much higher than most inverters currently available, so they should be able to operate almost anywhere.

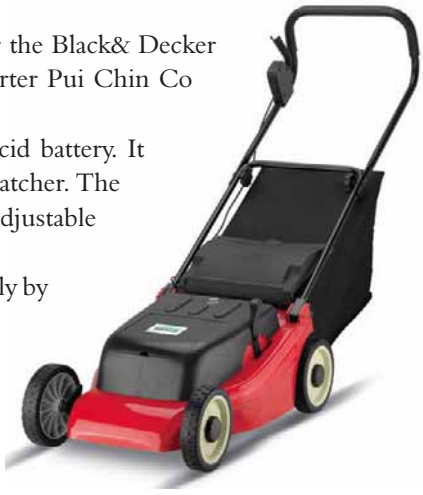
Other features include uninterruptible AC power transfer, stackability for output up to 90kW, and they can also be stacked to produce two or three phase power. They also have built-in battery charging, and can control multiple DC input sources and up to 700 amps of solar input with the optional DC-Gen/Switch load controllers and solar charge controllers.

All in all, these inverters can form the base for a large UPS or home/commercial renewable energy system and should have a great many uses. There are also simpler units called the CombiPlus, which have fewer features for installations that don't need the SuperCombi's level of control.

RRP: From $3199 for the 1500 watt models, $4399 for the 3000 watt units. The CombiPlus are $2899 and $3799 for the 1500 and 3000 watt models respectively. Charge controllers start at $389 and the transfer switch is $269.

Available from Jaycar Electronics stores . For more information ph:1800 022 888 or go to www.jaycar.com.au

Low cost rechargeable lawnmower



Rechargeable electric lawnmowers are finally starting to make a comeback (remember the Black& Decker Stealth?) but most so far have been rather expensive. The PC1000 from direct importer Pui Chin Co changes that.

The PC1000 features a 36 volt DC motor powered by a removeable sealed lead-acid battery. It features motor overload protection, a cutting width of 450mm and a large 85 litre grass catcher. The wheels use ball bearings instead of the cheaper sleeve bearings and the mower has adjustable cutting height.

But possibly the best thing about the PC1000 is the price. Because these are sold directly by the importer, they are similar in price to a petrol mower.

RRP: $299

Available from Pui Chin Co, PO Box 4403, Knox City Shopping Centre, Wantirna South VIC 3152, email: info@puichinco.com.au, www.puichinco.com.au or stores.ebay.com.au/PuiChinCo

Products

Finally, a safe alternative to dumping old lamps!

While fluorescent and compact fluorescent lamps can save a lot of energy and running costs, they contain toxic materials such as mercury and should not be simply thrown in the bin when they die. However, recycling facilities for them are rare in most areas and most people simply dump them as there is no alternative.

Well, now there is one. Sylvania Lighting Australasia now has a lamp recycling service. You buy a prepaid recycling box which is delivered to your door and when it's full of tubes, you simply call them to come and take it away. Delivery takes two to three working days for metropolitan areas or four to five days for regional areas. Collection times are around the same, and you can receive a new box at the time the old one is collected. Boxes are available in three sizes; for 36 (and 18 watt) tubes, for 58 watt tubes and a Lamp Box for compact fluoro, mercury vapour and standard incandescent lamps. Capacities of each box are 100 x 36 watt (or 200 x 18 watt) tubes, 50 x 58 watt tubes, or around 150 CFLs, respectively.

The lamps are delivered to CMA Ecocycle for the lamps to be recycled and a certificate is posted to you certifying your recycling commitment.

RRP: from $120 in metro areas to $185 in rural for each box, plus GST. Bulk quantity pricing is available on request.

For more information contact Sylvania Lighting Australasia on ph:1300 728 988, email: sylrecycle@sla.net.au, www.sla.net.au/?i=28075/sylrecycle

A much smarter pool pump

Love them or hate them, there's a great many private swimming pools in Australia, and every one of them has a pump that uses a great deal of electricity each day.

The Viron P300 pool pump from Astral Pool Australia replaces the standard AC induction motor in the average pump with a high efficiency variable speed DC motor drive system originally developed for solar cars. According to the manufacturer, this results in a huge drop in energy consumption—up to 70% compared to a regular pump. So you not only save a great deal on running costs, but the environmental footprint of your pool decreases as well.

Other advantages include reduced operating noise, reduced chlorinator size and reduced wear and tear on the filtration system.

The Viron motor is covered by a three year warranty on materials and workmanship.

Available from Astral Pool Australia, ph:1300 727 116, email: info@hurlcon.com.au, www.astralpool.com.au

Be a water hog

Rainwater tanks come in many shapes and sizes, but not many are modular—designed to be linked together. The Rainwater HOG is one such tank. It is an oblong-shaped tank with a capacity of around 180 litres. Rainwater HOGs can be grouped together and placed along walls and fences, or even under the house or decking, and being only 220mm deep, they take very little space.

There is also a version (effectively a capped-off Rainwater HOG) designed to be used as thermal mass in buildings, called the Ground HOG, which can later be uncapped and used as a rainwater tank if desired.

The Rainwater HOG measures 500mm x 220mm x 1800mm. It weighs approximately 18kg when empty and 200kg when full.

For more information contact Rainwaterhog, 58 Mitchell St, Bondi Beach NSW 2026, ph:1800 501 679, email: info@rainwaterhog.com, www.rainwaterhog.com

Printing on straw

While there are some recycled office papers available, a lot of office paper is made from forest timber, meaning it is far less than environmentally friendly, despite what the timber industry pretends.

Nature's Paper makes paper from a different source—waste straw from the agriculture industry. They convert wheat straw into copy/laser printer paper in their own factory, which is powered by waste from the process. The mill uses the waste hull from wheat and rice as a fuel which is then burned to generate heat which in turn is used to boil rainwater and recycled water. This water is used in the paper-making process as well as to produce steam to run turbines that generate 80% of the plant's required GreenPower.

The wheat-based paper (called Wheat Brand) is available in A4 and A3 sizes in 80gsm weight. There's also a whiter paper made from farmed timber pulp, called Supa White, for those who just can't live without a whiter paper. It's available in A4 and A3 80gsm sizes, as well as A3, A2 and A1 sized printers stock in several weights.

RRP: $4.95 per ream for A4, $14.85 per ream for A3, when bought in box (five ream) quantities.

For more information or to find your local stockist, contact Nature's Paper, ph:1300 400 976, email info@naturespaper.com, www.naturespaper.com.au

Zero VOC paints

There's quite a few low and zero VOC (volatile organic compound) paints around now, and the range from ecolour looks like one of the better ones.

The ecolour range of paints and polyclear coatings have been certified completely VOC free and certified carbon neutral, and so are safe to use around anyone chemically sensitive. They are water-based and contain re-refined recycled engine oil as a preservative and smoothing additive, helping to take mineral oil out of the waste stream.

Ecolour paints can be tinted to any colour from any paint chart and they perform in the same manner as mainstream paints. All ecolour paints can be washed up with water and the range comes with a 10 year guarantee.

Orders can be made by email, over the phone, by fax, or by visiting the factory showroom in Byron Bay (there will soon be a full ecommerce website where customers will be able to log in and order directly online). Delivery anywhere in Australia has a maximum freight cap of $20, regardless of the quantity.

For more information, contact ecolour, 6 Grevillea Street, Byron Bay NSW 2481, ph:(02) 6685 8555, www.ecolour.com.au

Seal those downlight air leaks

People just love downlights, but among the many problems they have, air leakage from the room into the roof cavity would have to be one of the biggest, as it can greatly increase heating and cooling bills. Because of the heat halogen lamps produce, downlight fittings can't be covered with insulation in the roof as it can cause a fire.

Tenmat fire-rated downlight covers solve this problem by providing an airspace around the fitting while sealing it off from the roof cavity. Once in place, insulation can be placed right up to the downlight cover.

All Tenmat downlight covers comply with the various relevant standards, including AS3000:2007, AS60598.1 and AS60598.2.2. There are three designs of Tenmat covers, with sizes to fit any domestic downlight fitting.

Available from Standard Solutions Pty Ltd, 7 Lakeview Drive, Parafield Gardens SA 5107, ph:(08) 8258 5950, email: info@tenmat.com.au, www.downlightcover.com.au

Product review

Flukso wifi-enabled household energy meter

Review by David Rowe

The Fluksometer is a wifi device that measures your household power using a sensor that clips over the mains cable in the fuse box. The Fluksometer then connects to your wifi network and automatically logs power data to the Flukso website. Your data can then be viewed via your account on the site at www.flukso.net, such as the data in Figure 1. When I see graphs like this I am shamed by my profligate energy use so I go stomping around the house yelling at children and switching off lights!

I am really interested in minimising my household energy consumption, so I bought one of the beta Flukso's as soon as they were available.

The kit, clockwise from bottom: power supply, cables, Fluksometer wifi device and current sensor.

Installing the Flukso

For €85 you get a full kit in a nice box with very simple, easy to read instructions on the outside. The Fluksometer is tiny—just sixty by ninety millimetres. The web-based user interface is extremely simple to use—just enter details of your wifi network and that's it.

You do need a powerpoint for the Flukso near the fuse box. In Australia, many fuse boxes are outside so this can be tricky. I extended the DC cable from the Flukso's power supply a few metres so that I could have the supply in the nearest room of the house. I'll get a powerpoint installed inside the fuse box soon.

Once the Fluksometer is configured an electrician needs to install it. The trick is to place the clamp-on current sensor around the correct wire in your fuse box to measure your household power. In most houses this is straightforward, but it's a little more complex for grid-connect solar households.

Figure 1: Graph of our household power consumption from the Flukso website.

As soon as the Fluksometer is turned on it starts logging data to the Flukso website. You can look at your account at any time (and from anywhere) to view graphs of your household power consumption. There are several views available. For example, the last hour, the last 24 hours, the last year and a special night-time view to track down those hidden passive loads that chew through the power while you sleep!

Next steps

For the record I currently use about 22kWh a day (a large house with a pool, five people, four TVs including one flat screen and four computers in daily use). I work from home so the house is in use during the day. An average of 6kWh is for our electric car. This is neatly offset by our photovoltaic system, which generates an average of 8kWh per day.

However the 16kWh balance annoys me. I am in the process of tracking that down by performing another power audit, this time with a more accurate power meter that can handle inductive loads. I am sure it's the kids fault, but another audit will no doubt point to my office like last time! My goal is 10kWh per day, excluding the EV.

The Flukso website suggests this approach: "When the kids are asleep, pull out all electrical appliances, especially heavy users like your fridge. Then look at the reading on the 'hour' chart. Switch off the fuses one by one (except the one the Fluksometer is drawing its power from), while looking at the hour chart in between those switch-offs. You'll have to wait a couple of minutes to see the result. When you notice a big drop in consumption, you'll at least know which circuit the phantom load is on."

Managing energy use

Measuring household power use underlines a very important principle—if you can measure your power you can manage it. Reducing power consumption (negawatts) is by far the most powerful alternative energy technology we have today. We have slashed our electricity consumption by 50% and are now shooting for 70% (see *ReNew 105*, page 36). A 70% reduction is 3.5 times the Australian government's 20% renewables target by 2020! ✻

Measuring household power with a solar system

I have a grid-connect system which complicated my installation a little, as my house exports electricity during the day. The Flukso sensor can't sense direction so initially I could see my day-time electricity 'use' going up as the sun rose overhead and our PV system exported electricity. This is a common problem with similar devices.

What I really wanted to know is how much power the house was consuming. This is actually obscured by the PV system. For example, if the PV system is generating 1000 watts and the house is using 1200 watts, I will be importing 200 watts from the grid. My house electricity meter and devices like the Fluksometer will read 200 watts as they are measuring net power. I would get the same reading if the house was using 200 watts at night with no solar power being generated. So the problem is to separate out the solar power from the household power consumption by clamping the Flukso sensor over the right wire in the fuse box.

Photo: Andrew Moore

In my case some minor rewiring within the fuse box was required. An electrician should be able to work this out for you. The key is to arrange the fuse box wiring so that all the household power flows along one cable, and the solar power flows along another separate cable. The two cables should only meet at the main breaker. The current clamp is then installed along the household power cable, bypassing any electricity generated by the PV array.

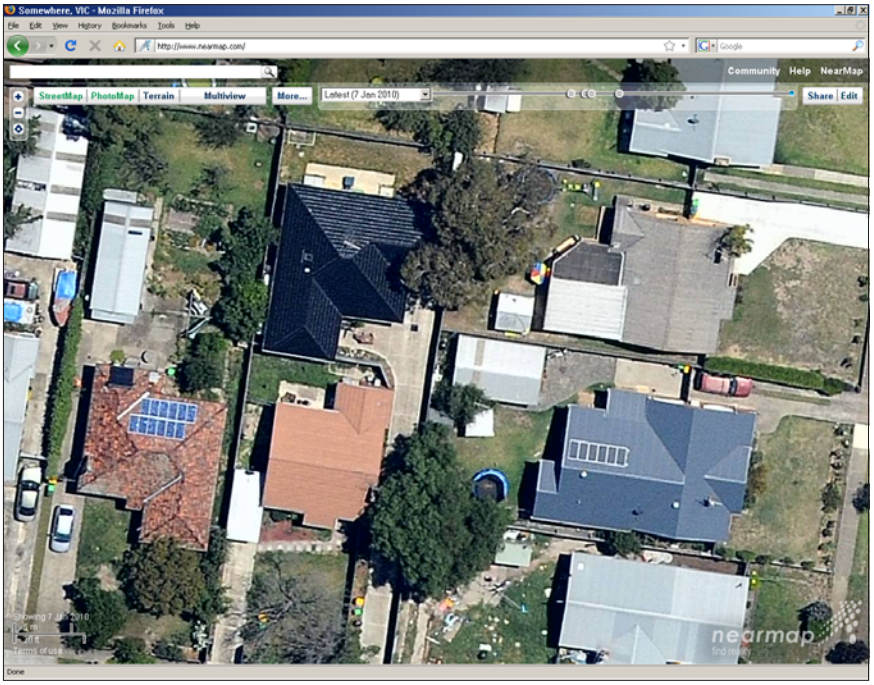
www.nearmap.com

Most people have used Google Earth or at least the internet version, Google Maps. While these tools are very useful for checking out properties from above, they lack a couple of abilities.

The first is enough resolution to see smaller detail on the images, such as physical attributes of a house like airvents.

The second is that they don't have a history system, i.e. they only have one set of images, often taken several years ago, so up-to-date images are not available for many areas.

Nearmap is much like Google Maps except that it uses aerial images rather than satellite images. This allows greater detail to be shown and the images are often much more recent. In the image above, the solar panels on two of the homes are clearly visible, as are other attributes as small as individual roof tiles or paving stones.



But the best thing about Nearmaps is the history system. For each view there is a pulldown list of available previous images, so you can just select a date and see what the view was like then. This is great for comparing the shading on a property over the seasons or to see how the neighbourhood has changed over time.

www.myzerowaste.com

MyZeroWaste is a great site dedicated to helping the average consumer produce less waste. It was started by a family of four (well, three plus a cat) and has grown since then to become quite a useful resource.

The site includes a blog from the family where they describe their solutions to waste problems in their daily lives, and where readers can leave comments on each entry.

There's also a separate articles section covering a wide range of topics, such as reducing food waste and household cleaner packaging. Some categories are empty, but there's plenty to read overall, and lots of reader comments that add to the articles.

There's also three sections on the old green adage, reduce, reuse and recycle, with useful ideas and articles in each category. Many articles have embedded videos, which makes the experience much more interesting.

There's also product reviews, although being UK based, some of these are less relevant to Australian audiences, but are interesting none the less.

The national picture

Alan Pears witnessed little progress during his visit to the Copenhagen Climate Summit, but he did unearth some interesting information on electric bikes in China.

THE COPENHAGEN Climate Summit has been and gone. While there was some progress, most were disappointed. More importantly, the anti-climate response movement has used the lack of progress as a basis for ramping up unjustified questioning of climate science to challenge efforts to put a price on carbon emissions. I was at COP 15, and my detailed review is online at www.rmit.edu.au/cfd/publications. But a few points may be of particular interest to *ReNew* readers.

China leading the way

One exciting area of innovation is electric bikes. Last year in China, electric bike sales exceeded 20 million—double new car sales. The Chinese are fast learners: they have realised in a few years that cars take up an enormous amount of space and that modern vibrant cities simply can't fit enough roads and parking for mass car use. So they are ramping up provision of public transport and bike infrastructure (and enforcement), while many people are finding electric bikes provide an ideal option for commuting up to 15 kilometres. Indeed, friends from the Netherlands who spent a year in Australia discovered on their return home that older Dutch people have also embraced the electric bike. It certainly makes riding into those strong headwinds much more feasible for the older cyclist!

The Copenhagen Wheel was launched at the COP. This is a drop-in replacement wheel for bikes with some remarkable features. It has an electric motor and battery and smart communication capability. With an iPhone mounted on the handlebars, you can send data to others and to traffic managers. So you can meet with friends and know where everyone is, while your data contributes to the bigger picture to help identify where additional bike lane capacity is needed and to document the levels of bike use.

Unfortunately adoption of electric bikes in Australia is undermined by our outdated regulations that require bikes with more than 200 watt motors to be registered and fitted with indicators. Almost all practical electric bikes have motors around 250 watts. It puzzles me why governments have failed to change this regulation when the problem has been raised repeatedly for over a decade. Maybe it's another example of lack of political priority?

Another interesting lesson for me at Copenhagen was how aggressively China is driving efficiency improvement. Not only are they strengthening building energy policy, but they are actually enforcing it: compliance is up from 21% to 82%. A building energy label was introduced in 2008. Tax incentives and exemptions, accelerated depreciation and other policies are being used. They must be serious.

Electricity sector changes

In the electricity sector and industry, there is also dramatic change. For example, 53 megatonnes of inefficient cement production capacity, 20 megatonnes of inefficient steel plant capacity and 20,000 megawatts of inefficient coal-fired power stations have been shut down. That's over 300 megatonnes of annual emissions avoided—over half of Australia's total emissions. In another session, I heard that coal power stations under 50 megawatts must be closed down and the threshold for closure will be increased to 100 megawatts in 2010. Fifteen types of small inefficient industrial plant will be required to be shut down over the next five years. New larger plants that use world best technology are being built. Nevertheless, emissions would be much higher without this planned phase-out of obsolete technologies. Is there a lesson here for Australian governments in relation to certain coal-fired power stations?

Environmental policy

My comments may well be out of date by the time you read this but I hope we will get an interim carbon levy, starting in mid 2011, when the CPRS was intended to begin. While I would prefer an emissions trading scheme, the CPRS is just too compromised and too rigid. It should be seen as one element of a range of strategies, rather than a silver bullet. In particular it must not be allowed to undermine voluntary action and innovation, as the present proposal does (see www.vcma.org.au for more detail on this).

There has been widespread criticism of the implementation of the national insulation scheme and the Green Loans program. Both programs are well-intentioned and are delivering large-scale benefits. But they have highlighted the lack of infrastructure and implementation experience in Australia's sustainable energy sector, including government capacity. They have also underlined a widespread problem: governments generally see enforcement of environmental performance as an op-

tional extra. Building energy codes, appliance efficiency standards, pollution controls and toxic leaks are all underenforced. This is a serious problem that must be dealt with. It seems environmental policy is believed by many in government as well as industry to undermine business success. So they simply don't enforce the laws properly. The reality is, of course, the exact opposite.

On a brighter note, it is now possible to buy a large flat screen TV without guilt. TV energy labelling began in October last year and already we have 7-star products on the market. The most efficient 100 cm flat screen TV uses 30% to 45% less energy than a typical large traditional CRT (with a set-top box for digital signals), and less than a third as much as some other flat screen TVs of the same size. Isn't technology development a wonderful thing? The big question is, if we had introduced these labels when we first realised there was a problem, how much energy would we have saved over the lives of the inefficient TVs sold over the past five years?

TVs are the first appliance category that has had labels introduced since the early 1990s. This is an important information policy failure. At a focus group I attended a while ago, the consensus was that large TVs couldn't use much energy because, if they did, the government would have introduced energy labels years ago. I don't think policy makers have realised that energy labelling is a symbol for many people that warns them something might use a lot of energy.

Governments have dropped the ball on promotion of energy labelling over the past decade: they seem to have preferred mandatory standards, as they are cheaper and easier to argue for in a Regulatory Impact Statement. But they don't drive much cultural change or mobilise leading edge innovation. And conservative groups in industry, supported by economic fundamentalists in government, block and slow implementation. A combination of strong information programs and standards is a good package.

On another topic, many have been concerned about the 'phantom RECs' problem with photovoltaics. Unfortunately, a similar problem exists with solar hot water. ORER allocates RECs for most solar hot water systems based on a daily draw-off of around 200 litres per day. But a recent study published for the phase-out of high greenhouse impact hot water systems estimates that average daily hot water usage is more like 120 litres. So around 40% of solar hot water RECs are 'phantoms'. This is another reason to get them out of the Renewable Energy Target and to support them some other way. *

Alan Pears is an engineer and educator who has worked in the energy efficiency field for over twenty years. He is Adjunct Professor at RMIT University and is co-director of environmental consultancy Sustainable Solutions.

Q&A

Greywater advice

I have a query regarding greywater reuse. We'd like to use our laundry, shower and basin water for garden in a low energy use way. We were wondering if we simply connect a hose to the washing machine outlet would this have any negative impact on the function of the washing machine? We have heard that it can wreck the washing machine pump or siphon back into the machine.

Another option is to use a diverter system (tank with pump and inbuilt filter), however this will use power for a pump.

Can you recommend a good low tech system?

Ingrid Donald
Mount Victoria NSW

When it comes to greywater I agree that simple is best. Attaching an extension hose to the outlet of your washing machine is a simple solution as long as this does not stress the washing machine's pump. If you have a window next to the washing machine and you can run the hose straight out the window this is an ideal situation for adding an extension hose to your washing machine. You then just move the hose around the garden and water the plants as required. Most of the work is being done by gravity.

However, if the hose has to go up more than about 200mm to get outside or the outside pipe has to run uphill, this will put additional stress on the pump and may cause it to fail prematurely. In these situations it may be better to use a pumped system.

These systems consist of a container, pump, filter and controller. You run the water into the container via the filter. When the container is full the sensor turns on the pump which pumps the water out to the garden. Because the pump only operates for a relatively short period of time these systems do not use much energy.

You should also see the Greywater system buyers guide from ReNew 102 *which will give you more information on the options available.*

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 200 words.
Send letters to: *ReNew*, Level 1, 39 Little Collins St, Melbourne VIC 3000, renew@ata.org.au

Venting the roofspace

To reduce the temperature of our colorbond-clad house in summer, I've taken advantage of the Government rebate on insulation. I've also fitted Aircell Retroshield underneath the roof joists. While this has helped a lot, the roof space still gets very hot.

I have two questions. Is there a good solution for venting this heat? I've read that the typical whirlybird is just too small to be useful.

Will this make the house colder in winter? Is there a solution that can be turned off during the colder months?

James Robertson
Sydney NSW

The simplest solution is a mains-powered exhaust fan; they are readily available from many sources including hardware stores and electrical wholesalers. The main specification to look for is the airflow rate; you want one that will ensure that the fan will change the air volume of the roof space every 10 minutes or so. Remember that the airflow rating of a fan is with no outlet pressure, so if it is attached to ducting or venting you need to allow for that. Overspecifying by 20-50% should allow for most situations.

You can put the fan on a timer or a thermostat, but of course it needs to have a switch as well so that it can be turned off in cold weather. There are fans that have shutters that automatically open when the fan starts—they are a simple way to block the vent off when not in use—such as the TopHat from Advantec (see www.draftstoppa.com.au/tophat-240v).

You could also use a solar-powered fan. These are getting easier to get though they can be expensive, such as those from Rainbow Power (www.rpc.com.au). Again, you would incorporate a switch so that you can shut the fan down when not needed. There's no need for a battery in such a system, you can usually hook the fan directly to a suitably sized solar panel via a switch. Low cost smaller panels are available from a number of suppliers now, check out ReNew 110 *for the solar panel buyers guide.*

Lance Turner

Backup on a grid-interactive solar system

I hope that you can help me to understand the rules covering the supply of electricity for a private dwelling in the event of grid failure.

As the grid can be down for a week or more, in the event of a cyclone, Ergon Energy have encouraged householders to install a small alternator, sufficient to keep the 'fridge/freezer, water supply pumps etc. going (at one time they were marketing a package of genset plus installation up here).

As we recently installed a solar array of sufficient capacity to run the household, I assumed that we would not need to run the generator during the hours of sunlight. Although our new inverter is capable of providing sufficient power for the house and feeding some back to the power grid, I was very annoyed to learn that if the grid is off, so is the inverter! There is no manual override, as is the procedure when employing the generator.

This looks like a very anti-green government policy to me (with state-of-the-art electronics, I doubt that it is a technical limitation).

Having spent considerable money on this new system I intend to overcome this annoying impediment to a less polluting lifestyle.

John Williams

Your frustration is shared by many who would also like to use their grid-connected solar inverters as a backup power supply.

You're 100% correct that, from a technical perspective, only minor additions would be required to automatically isolate the inverter from the grid while allowing it to still supply your home.

Functionally this is no different to how an

off-the-shelf UPS (uninterruptible power supply) works and is similar to your existing back-up generator. The real constraints are safety and financially related.

Grid-connect solar inverters have 'anti-islanding' features built in to isolate (turn off) the inverter quickly when the grid fails. This is primarily for safety reasons: if a line worker is working on a section of powerline that they are expecting to be isolated they may be electrocuted if a solar inverter is generating onto the grid.

Also, the same feature allows the inverter to protect itself from poor power quality on the grid, such as voltage dips and spikes.

There is a solution to your problem, however the sticking point is that for homes with existing grid-connect solar, an inverter-based backup power supply requires the addition of:

- *a battery bank, usually prohibitively large (in your case, capable of storing your home's essential energy requirements for up to a week) at a cost of many thousands of dollars;*
- *a grid-connect approved interactive inverter charger such as a Selectronic SP Pro (see www.selectronic.com.au) and mains decoupling relay; and*
- *installation costs.*

All of which will, in most cases, cost significantly more than purchasing a backup petrol generator.

As your priority is environmental, unless you have a few thousand extra dollars to spare, you might want to consider sticking to a petrol (or diesel) generator for your backup power supply and purchasing carbon offsets to 'neutralise' the emissions.

Check out the EPA's Carbon Offset Guide at www.carbonoffsetguide.com.au. One offset per year should more than cover the emissions from using your backup generator for a week or two annually.

Craig Memery
Energy Advocate

Electric boost for SHW

Our new Apricus SHW system was installed today, and I'm not particularly happy with the setup as it isn't what I had asked for in terms of the boosting.

The tank is hardwired in to the power board—without any manual override for the booster. The installer told us that it was now illegal to install a manual switch because the tank had to be kept at 65°C. He even suggested keeping the booster on tariff 31 (super off-peak 11pm to 6am) which seems completely pointless for a solar system where you want to have maximum hot water at night and a cold tank in the morning.

I'd like advice on whether a manual switch on the booster is illegal in Queensland. If so, can the hot water switch in the power box be used simply as a manual switch?

Any suggestions very welcome.

Melina Miles
Toowoomba QLD

The way the system is wired may give you little contribution from your solar water heater.

A split system solar water heater has a controller that turns the pump on and off. The pump circulates the water from the panels on the roof to the tank on the ground. That system is completely separate from the electric boosting but I thought I should clarify its role.

The electric booster is operated by a time switch set by the electrician. If it is set up the wrong way it can have one of two results. The booster runs too long or at the wrong time and heats too much water. This means the solar panels make a lower contribution to your hot water needs.

Alternatively, if you do not have enough boosting you can run out of hot water or the water does not get hot enough. This means installers may set the time switch to minimise the chance of you running out of hot water which also means you will get a lower solar contribution.

Ideally a solar water heater only boosts the water temperature to compensate when the solar has not fully heated the tank or where the quantity of hot water in the tank is not adequate for your needs. This means if you boost overnight and start the day with a full tank of hot water then the only solar contribution you will get that day will be to replace the hot water used in the morning for showers and other washing.

What you really want is to start the day with a tank of cold water (after the morning showers) so the sun has the chance to heat all your water. The best way to do this is to do the boosting for a short period (an hour or two) at the end of the day (about 5.30pm). That way you end the day with a full tank of hot water, most of which has been heated by the sun. If the tank is correctly sized then this will be enough for your hot water needs in the evening and the following morning. However, the disadvantage of this is you can't access the off-peak tariff. It also increases the risk of running out of hot water.

A booster switch would be a good idea but I am not sure how the regulations apply regarding this in Queensland. The people who sold you the system should know about this.

There are regulations that state hot water has to be stored at over 65°C, however, my understanding is that with solar the tank is only required to reach that temperature once in a 24 hour cycle. Ideally at the end of the day when you have collected as much solar heat as you can you just boost the tank to get it up to the required 65°C.

You have two options to improve your solar contribution. The easiest is to have all your showers and use all your hot water in the morning. That way you start the day with a cold tank and the solar will do most of the work. The other involves adjusting the time switch settings, but that may not be legal. Certainly, boosting the system with off-peak power outside the off-peak time (11pm to 6am) would be illegal.

If the tank has a 'middle' element position, moving the element to this position instead of at the bottom should solve your problem as the element can then only heat half a tank of water.

The hot water switch in the power box should work as a manual off-switch for the booster, assuming the electrician actually wired it to this switch!

Mick Harris

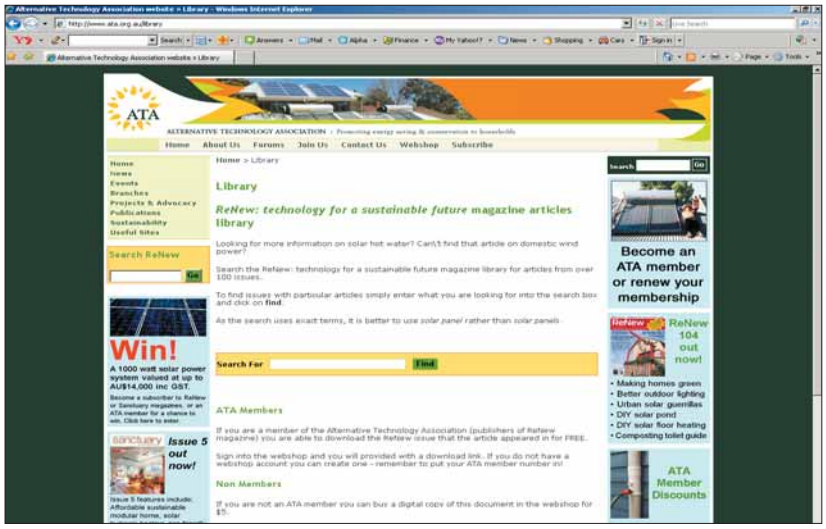
Notes and errata: Issue 110

The article titled *Low-cost independent remote power supply using a UPS* failed to explain that many cheap UPS units don't have electrical isolation between the mains and the battery system. As such, they represent a severe and potentially fatal electrical shock hazard and should not be used in a solar power system. Only UPS units with proper electrical isolation should be used in such a way.

Practical solutions for sustainable living

Support the organisation that publishes ReNew.

Search and download all the back issues of **ReNew** magazine for FREE!



Become a member of the Alternative Technology Association (publishers of *ReNew*) and you can search the *ReNew* library database for articles and download the issues they appeared in.

ATA membership provides a range of personal benefits:

- Free advice service
- Membership discounts
- Local branch events
- Quarterly issues of *ReNew* magazine
- Quarterly members' newsletter - *The Sun*

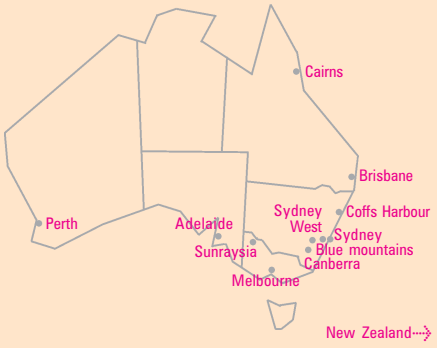
Plus regular updates on the local, national and international projects that your membership helps to make possible.

To become an ATA member or supporter go to the ATA website: www.ata.org.au or call (03) 9639 1500. Alternatively, fill out the order form on page 90.

Member discounts

Advanced Eco Technologies 10% • Australian All Electric Vehicles 5% to 10% of specific products and services • Australian Correspondence Schools 5-10% • BP Architects free Green House Plans book • Dr Bob Rich 10% • Earth Basics 10% • Eco-Options 3-10% • Ecolibria 5-10% • Ecological Design Solutions 10% • EcoSouth $250 off power systems • Ecospecifier 20% • Endless solar $200 off • Energy Renovations P/L $100 off assessor training • F2 Design Free energy rating with new house or alteration design • Global Export Solutions $100 off • Going Green Solutions 10% off of all retail items • Going Solar 10% • Golden Cypress Timber Sales 5% • Insight Architecture 10% • Livos 10% • Metcalf Building Consultants 10% • Native Growth Holdings 10% • Natural Paint 10% • Pritchett Electrical 10% discount on any solar power installation • Q-Solar 15-30% • Sandford Electronics & Solar 10% • Skydome Skylight Systems 5% discount off all Quicksilver reflectors and plantation timber storage stairs • Smartflo 10% • Solair 5% off Solarventi thermal panels • Solar Lord 5% • Solar Tasmania 10% • Sunergy Design $250 off house design services • Sustainable Building Resources 3% • Sustainable Impact 5% plus 5% donation to ATA • The Environment Shop 5-10% • The Owner Builder magazine free CD • Todae $250 gift voucher with every 1kw solar installation.
NB: the ATA website has full details of member discounters outlets.

ATA branches



ATA shop by mail

Sanctuary magazine

Price: $9.95 plus $2.50 postage

Or subscribe 12 months (4 issues) $36 or 24 months (8 issues) $70

Issue 10

49 pages of green home profiles, Windows and double glazing guide, Build your own sustainable home: tips from the experts

Issue 9

Size matters! 40 pages of inspiring smaller homes, Green rebates guide - govt money for solar power, hot water and more, Sustainable prefabs - quality designs that cut no corners

Issue 8

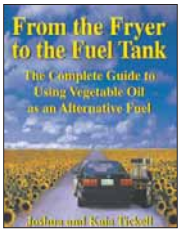
Style secrets: the latest in eco-homewares, Free home health checks, Green bathroom renovators guide, Recycled timber, plus 50 pages of our our favourite sustainable homes.

Issue 7

Musician Xavier Rudd's symphony in straw bale, Houses with advanced solar hydronic heating systems, Green bathroom renovations, Beautiful rammed earth homes, plus eight stunning sustainable homes from across Australia.

Issue 6

Cool treatments for a hot house, chemical-free pools, 10 tips for sustainable design, solar air-conditioning, taming the sun, plus beautiful sustainable homes from across Australia.



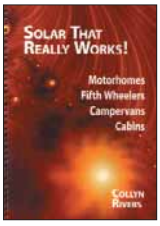
From the Fryer to the Fuel Tank

Author: Joshua Tickell

Price: $34.95 plus $8 postage

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*



Solar That Really Works!

Price: $42.50 plus $8 postage, 82pp

Whether for motor homes, fifth wheelers, caravans or cabins, solar energy is silent, clean and increasingly affordable. This book is a down-to-earth guide to getting it right the first time.

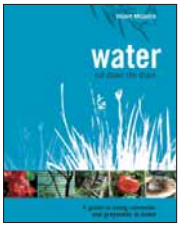
Item code: STRW

Water Not Down the Drain: A guide to using rainwater and greywater at home

Author: Stuart McQuire

Price: $29.95 plus $8 postage

A comprehensive guide to sustainable water use around the home. Consult this book before you install rainwater tanks or a greywater system, or even if you just want to reduce your daily water use. *Item code: WNDD*

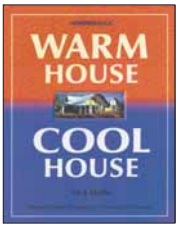


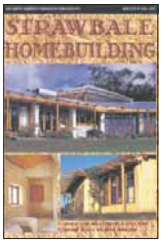
Warm House, Cool House

Author: Nick Hollo

Price: $33.00 plus $8 postage, Paperback, 172pp

An easy-to-read introduction to the principles of energy-efficient housing design. Covers a broad range of topics and contains an abundance of drawings, plans and photographs. *Item code: WHCH*



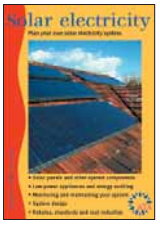


Strawbale Homebuilding

Price: $19.95 plus $8 postage, 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



ATA Booklets series: Solar Electricity

Price: $10 each plus $2.50 postage

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.

ATA Booklets series: Solar Hot Water

Price: $10 each plus $2.50 postage

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 plus $2.50 postage

In this booklet you will find all the information you need to get an understanding of wind-powered 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.

Renewables on CD ROM

ReNewROM

Price: $65 plus $2.50 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*

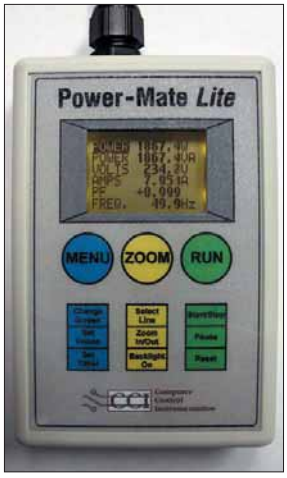
ReNewROM II

Price: $65 plus $2.50 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 III

Price: $45 plus $2.50 postage. The fourth CD ROM in the series, and covers issues 90 to 99 of *ReNew* back issues, many of which are no longer available. This disk is fully searchable with 10 complete magazine issues in PDF format, so it can be used on PCs, Macs and Linux boxes. *Item code: RENEWROM3*

Kits, LEDs and energy-efficient devices



Power-Mate Lite energy meter

Price: $119.95
This new meter features a new multi line backlit LCD display, intuitive three-button operation, simplified menus and non-volatile memory, so the meter resumes after a power interruption without loss of data. As well as instantaneous power it displays energy used and the cost per hour, quarter and year, greenhouse gas production and some more technical figures such as power-factor, frequency and VA (volt-amperes). The meter also has preset measurement period timer choices of 1, 8, 12, and 24 hours and 2, 5, 7, 14, and 28 days. Even better, unwanted display screens can be suppressed from view.
Item code: POWERMATE-LITE

Non-contact thermometer

Price: $102.50
This non-contact infrared thermometer can measure from -50 to 650 deg C, making it ideal for measuring the surface temperature of your solar panels or checking for thermal leaks in your home.
The unit features dual laser targeting to help get an accurate temperature reading and backlight so the temperature can be read in low light conditions. The thermometer also has adjustable emissivity from 0.10 to 1.00 so the unit can be adjusted to more accurately measure the temperature of the surface.
It is supplied with a holster and battery. See our webshop for specifications. *Item code: THERMO_INFRARED_ED72*

Digital lux meter

Price: $51.65
A handy digital light meter which will measure light in three ranges, from 0.1 to 50,000 lux. The photo detector is wired on a curly cord, allowing the user to take light measurements at the optimum position. A sensor cover is included.
This meter is ideal for measuring light levels when replacing incandescant lamps with more energy-efficient alternatives, or for checking light levels on solar panels etc.
Item code: METER_LUX_50K

LED Replacement Bulb: cool white and warm white

Price: $29.95
This LED lamp has been designed as a direct drop-in replacement for MR16 halogen lamps. Its 5W power rating ensures a high level of brightness that is the equivalent to a 20W halogen MR16 lamp. Also, unlike the halogen equivalent that generates high levels of heat, these LED type MR16 lamps generate very little heat and are therefore safer. The body is made of aluminium for good heat dissipation, to keep the LEDs running as cool as possible.
Power consumption is around 5 watts at 12 volts, either AC or DC, so can be plugged straight into most halogen sockets without changing the transformer.
Typical applications include kitchen/bathroom lighting, entertainment lighting, architectural lighting, landscape lighting, bollards, security and garden lighting, and interior commercial lighting.
Note: some electronic transformers may cause flickering due to this lamp drawing insufficient power to load the transformer adequately.
Available in cool, neutral and warm white, in 38 and 60 degree beam angles.
Item code: LEDHAL_5WMR16_XXYYCLR — replace XX with CW (Cool White), NW (Neutral White) or WW (Warm White). YY is the beam angle (38 or 60)

Power-Mate energy meter

Price: 10 amp version is $295; 10 amp heavy duty version is $345 and the 15 amp version is $405
If you are looking for a professional and robust device for energy auditing or use on the workshop floor, then the Power-mate is the meter to use!
It 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, with minimum, maximum and instantaneous readings. The meter can also tell you the 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. There are three versions available: the 10 amp, the 10 amp heavy duty, and the 15 amp unit (which has 15 amp plugs with the large earth pin). *Item code: POWERMATE-10A/10AHD/15A*
We also have a Power-Mate for hire (for ATA members only) for $30 a week including express post to you.

Mains Outlet - Foot Operated Switch

Price: $28

Some power outlets are very inconvenient to get to—you have to crawl under tables or reach behind furniture to turn them on and off.

Solve the problem easily by operating your power outlet with this convenient footswitch. (Can also be used on a bench to avoid those inconvenient foot-tapping mistakes!) Simply connect any mains operated device to the GPO and turn it on or off remotely from up to 2.8m away. Ideal for the elderly or disabled and to turn off those hard-to-get-at phantom loads.

When off, this unit draws no power of its own. When on, it draws a miniscule 0.5W.

Please note: the GPO is rated for 10A but it is probably a good idea to avoid switching large inductive loads due to the surge currents involved. *Item code: FOOT_SWITCH*

ATA members now receive a flat 15% discount on ATA products, except for booklets and where noted. Ask for your discount when you order! Postage is a flat rate of $8, regardless of the number of items, or $2.50 for booklets/magazines/CD ROMs.

6 amp maximiser kit

Price: $45

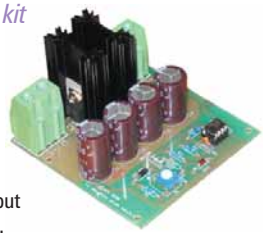
Our popular mini-maximiser kit will handle pumps up to 6 amps. The kit allows you to build the unit for use on either 12 or 24 volts. When used with pumps, the maximiser can provide up to 40% more pumping per day.

Note: not suitable for battery charging use!

Item code: MAXIMISER_6AMP_KIT

12 amp maximiser kit

Price: $70



This device allows you to drive pumps and other motor-driven devices directly from a solar panel or panels, without the need for batteries.

When used with pumps, the 12 amp maximiser can provide up to 40% more pumping per day.

Note: This kit is not designed for use as a battery charger, and must only be used with solar panels and motors/pumps.

Maximum current: 12 amps.

Item code: MAXIMISER_12AMP_KIT

30 amp speed controller kit

Price: $49.95

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: SPEEDCONKIT

Fridge/Freezer Thermometer

Price: $18

Use this to help you keep your fridge at the right temperature all year round. Simply attach the sensor to the desired position in the fridge or freezer and the thermometer on the outside with the attached magnets or enclosed Velcro strip (note that the sensor lead has to pass through the door seal, which may have a small effect on fridge efficiency).

Set your preferred reading of °C or °F and then set the minimum and maximum temperatures with the alarm. If the fridge goes below or above these set temperatures the alarm will sound until you manually turn it off to investigate the problem. Also shows room temperature at the touch of a button.

Specifications: Room temp range -10 to 50°C; Fridge/freezer temp range -50 to 70°C; Display size 26(W) x 13(H)mm; 1m fridge sensor cord; Requires 1 x AAA battery (supplied); Dimensions: 67(W) x 39(H) x 15(D)mm.

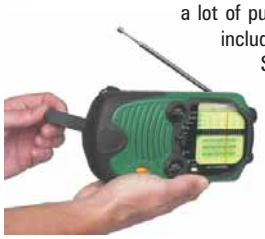
Item code: THERMO_FRIDGE_FREEZER

Dynamo multiband radio

Price: $59.95

Housed in a sturdy rubber and plastic casing, this radio is great for any outdoor activity that requires a heavy duty radio which will withstand a lot of punishment. Features include FM, MW, LW and SW bands and an alarm. It can be self-powered by dynamo operation or two AA batteries.

Item code: RADIO_DYNAMO_SW



Simple 1 amp rectifier kit

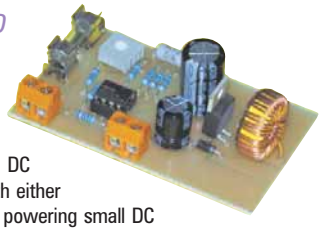
Price $6

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.

Item code: SIMRECTKIT_1A

Switchmode LED driver kit

Price: $30



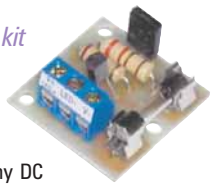
This kit allows you to build a simple switchmode DC to DC converter with either voltage limiting (for powering small DC appliances from up to 30 volts DC) or current limiting (for driving LEDs directly from up to 30 volts DC). The voltage or current is fully adjustable, allowing the one design to be 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: SWITCHMODEKIT

Constant current circuit kit

Price: $9



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: SIMCCKIT_XXX where XXX is the current rating in mA (020, 050, 300 or 650)

Expand your *ReNew* collection

Want to add to your collection of *ReNew* back issues? Then see the ATA's webshop at shop.ata.org.au (no www). There are limited printed back issues available, but every issue of *ReNew* and *Soft Technology* magazines is available as a download for $5 each. What's more, if you are an ATA member, put your member number in your webshop profile and you can download all of the back issues for free!

ATA order form

Staple payment here

Name Date of birth:

Address

State P/C

Phone: (BH) (AH) Fax:

Email: Mobile:

Join me up as an ATA Member

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

Includes *ReNew* magazine.

❒ Individual membership Aust/NZ $65
❒ Concession (proof of entitlement required) ... $40
❒ Household membership Aust/NZ $80
❒ Individual rest of world membership $85
❒ Schools and universities $120
❒ Business/Industry $200

I just want to subscribe to *ReNew*

❒ Australia $30; ❒ Australia 2 years $58;
❒ NZ & PNG $39; ❒ Rest of world $46

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

Sanctuary subscription (Australia only)

❒ Begin my subscription with the current issue

❒ 12 months (4 issues) $36
❒ 24 months (8 issues) $70

Send me books or products

Item or code	Qty	Price $
Member discount (15%)		– $
Postage Postage is $8 (regardless of the number of items) for all items, except booklets, some books and CD-ROMs, which are $2.50 per order.		$
Please accept my donation Donations are tax deductible. ❒ Send me a tax deductible receipt.		$
Total (NB. All prices in $AUD. Prices subject to change)		$

Please send a gift membership/subscription to:

Name:

Address:

Postcode:

Phone:

Email:

I want to be an *ATA Supporter*

As an ATA Supporter you receive an annual tax deductible receipt.

EACH MONTH, I would like to donate
Amount: ❒ $20 ❒ $50 ❒ $100 ❒ Other (min $10) $ ____
❒ Debit my credit card (enter card number below)

Payment details

Attached is my: ❑ cheque ❑ money order

Credit Card payment

Card type: ❑ Visa ❑ Mastercard ❑ Bank card

Cardholder's name

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

Expiry ___/___ Signature

Save paperwork—renew automatically!

❑ Please renew my membership/ReNew subscription every year by automatically charging my credit card.
❑ Please renew my Sanctuary subscription every year by automatically charging my credit card.

Send to

ATA, Level 1, 39 Little Collins St, Melbourne VIC 3000
fax: (03) 9639 5814 **Note: Please allow up to 21 days for delivery.**

We do not disclose private information to anyone unless legally obliged to do so. To view our privacy policy, see our website.

11/10

Classifieds/ Suppliers Directory

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

ARCHITECTS FULTON + SALOMON for ECO-GREEN shipping container building architecture; including DIY with our design manuals. Our DARE HOUSE will feature on **TV's GRAND DESIGNS** and on www.fultonsalomon.com T: +61(03)52619422 e:thearchitect@internode.on.net

Chip Heaters, - yes we are still making them, original style, (but smaller to post) - designed to heat water for a bath, $429; plus postage, Advanced Wind Technologies 07 4096 6864.

Wind Turbines, up to 30kw Grid Connect, up to 1 megawatt Stand Alone. Full System Design, Supply, and Install. Experienced, 80kW Grid-connect, Victoria, 75kW NT Advanced Wind Technologies 07 4096 6864.

BEAUTIFUL 30 acres near Kyneton $250,000. A secluded 30 acres of beautiful land adjoining 350 acre nature reserve, some cleared, some pristine bush. Current building permit in place to build dream home. Call Helen 0439 700 800.

ARCHITECT: BP ARCHITECTS: Innovative Award Winning Sustainable Homes; architecturally designed for comfortable, energy efficient, low allergy, Healthy Living. Bridget Puszka MSc(Lon), BArch(MelbUni), St Kilda. *Ph: (03) 9525 3780, bp@bparchitects.com.au www.bparchitects.com.au* §

EcoInnovation: Manufacturer of cost effective water and wind turbines using converted Smart Drive motors. Our manual details the conversion of Smart Drive motors to generators. *enquiry@ecoinnovation.co.nz www.ecoinnovation.co.nz*

NSW

Drafting Services & Sustainable Building Design: Detailed drawings, 3D modelling perspectives, shadow diagrams, sustainable building advice. Suit owner builders, renovators and building contractors. Member of BDANSW. Contact Tony on 0403 170 262 or tonypapageorge@yahoo.com.au

PAINTS & OILS: Livos: Made from renewable raw materials. Treatments for internal and external timber, concrete and cork. Cleaners, waxes, paints and pigments. Livos Australia P/L, *ph:(03) 9779 3405, www.livos.com.au, info@livos.com.au* §

EcoWatch: Australian agent for Davis Instruments, Weather Stations. Wind, Rain, Humidity, Temperature, Barometer, Optional UV, Solar Radiation and PC Link. Evapotranspiration and Soil Moisture option. Free Catalogue and Price List. *Ph:(03) 9761 7040, fax:(03) 9761 7050, www.davisinstruments.com.au*

Bunya Solar: Design, Installation and Maintenance of Renewable Energy Systems. Full BCSE Accreditation. BP Solar Sales & Service. *PO Box 369 Moruya NSW 2537, Ph:(02) 4474 0911, bunyatrade@bigpond.com*

GREENSEEKERS - FREE ADVERTISING During Launch. Green Jobs, Volunteering, Internships, Education, Contracts, Tenders and a Green Directory for all services. Make the right green connection today. www.greenseekers.com.au

Third Ecology - multi award winning sustainability architects - provide design and construction services, sustainability advice and ratings. Functional, practical and beautiful homes - visit www. thirdecology.com.au or call on 03 5229 8361.

EXIDE RAPS BATTERY PACKS 6RP1080 6V 1080Ah $1670 / pay CASH inc gst. Other sizes on request. Free delivery to most places. *CHECK A to Z BATTERIES 0417 652 549 www.atozbatteries.com.au*

North Coast Power & Water: Design, Supply and Installation of Solar power, grid connect and RAPS. Supply of Apricus Solar Hot Water, Water tanks, Pumps, Irrigation, Water filtration. *13 GDT Seccombe Cl, Coffs Harbour. Ph: (02) 6651 4333. info@ncpw.com*

Kialla, Shepparton area. Mudbrick loft house set on 2 acres surrounded by farm land. House has solar electricity and grid connected. Also solar hot water. Delightful gardens and paved areas with mainly native plants. Good size vege garden and dam. Ph Chris 0438 929 172 or email chrisweatheritt@hotmail.com

WATERLESS TOILETS: *ROTA-LOO* composting toilets for domestic & public sites, *ONZITE* Gravity Wormfarms to process all household waste, Designed & manufactured in Australia. Call Environment Equipment: *Ph: 1800 250 950, www.rotaloo.com*

Latronics: Reliable and performance enhanced true sinewave inverters. Stand alone and grid connected inverters from 400W to 7000W. Designed and Manufactured in Australia. *Ph: 1300 550 204, sales@latronics.com, www.latronics.com*

NSW/ACT solar energy, grid connections, stand alone P.S., wind, Apricus hot water systems, all rebated. BCSE licensed and insured installer maintainer. solarwayne@bigpond.com ph:0427 625 650.

Low Speed Diesel Gen Set: Good back up, cheap and reliable. Also timber slabs, air dried 15yrs. Lovely furniture and cabinet timber, 52mm thick by up to 800 wide and 3m long. Large quantity at Bairnsdale VIC. *Ph: 03 5157 9141*

Renewables National

Solco Choice Electric Co: Wholesale Distributors for: SHARP Solar, Fronius IG Grid Inverters, Latronics, UniRac PV Mounting Frames, SHURflo Solar Bore and Pressure Pumps, Enersun Solar Batteries, Choice D.C. Lighting and Electronic Ballasts. *Freecall: 1800 074 007, sales@choiceelectric.com.au*

Regional Solar Systems: Design, Supply, Installation and Maintenance of Solar, Hydro and Wind power systems. BSCE Accredited. Wal Clothier *Mob:0408 287 984, PO Box 8334 Kooringal, Wagga Wagga 2650. w.clothier@bigpond.com.au*

Home in/exterior

CARBON OFFSETS: CCF is a non-profit organization tackling climate change with community spirit. Visit www.carboncommunity.org.au to CALCULATE your emissions and choose an OFFSET PLAN which will also deliver sustainable development projects in Africa

Sustainable Building Resources: High quality sustainable building components: German double glazed tilt/turn window & door systems. Old world quality German house kits: Post & Beam Houses (Fachwerk), Solid Log Houses and Bio Kit Homes. *Visit us at www.sbresources.com.au* §

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

Seymour Solar: Design, Supply and Installation of Stand Alone and Grid Connected Solar Power Systems. BCSE accredited. Licensed Electrical Contractor. Remote area specialist. *PO Box 535 Moss Vale NSW 2577, Ph: (02) 4869 3643, Mob:0418 480 096, russell.seymour@bigpond.com.au*

EcoSouth Solar: Grid-feed or Stand-alone. Install or supply-only: we work with you. RECs, Solar Credits and Green Loans. CEC accredited and member. $250 ATA member discount. Call Simon or Bill for details and free info pack. *Ph:(08) 8371 5655 info@ecosouth.com.au www.ecosouth.com.au* §

MARK THE SPARK ENERGY SAVER. Specialist Electrician #C481. Renewable Power Solar Accreditation #F594. Solar Hot Water. *Saving you energy since 1985. MARK THE SPARK ph:0428 390 393 www.markthespark.net.au*

Harmonic energy: consult, design, supply and install solar electricity, hot water and energy efficiency solutions for domestic, commercial and community applications, using quality products and in-house installation. *54 Hope St, Brunswick VIC 3056. 1300 766 199 info@harmonicenergy.com.au www.harmonicenegry.com.au*

NT

Solaris Technology: RAPS and Grid-connect, Solar Hot Water. Solar Panels, Wind, Inverters, Batteries, Lights, Generators and Fridges. BCSE Accreditation, 20 yrs exp. *426 Churchill Rd, Kilburn SA 5084, Ph:(08) 8359 1900, sales@solaris.com.au www.solaris.com.au*

SolarWinds Energy Supply in Lauderdale: BCSE Grid Connect Design and Install PV, Electrician, Consultation, Apricus Solar Hot Water, WECS, RAPS and Maintenance. Clean Energy Council Member. Phone Carl Hippman on 0418 448 609, or email: renew1enquiries@netspace.net.au. Where friendly service is a priority.

Solar Charge: 35 years experience servicing Victoria. Grid Connect Specialists. BP Solar Authorised Distributor with Certified Installers.
Working Display Showroom:
Unit 12/19-23 Clarinda Rd, Oakleigh South VIC 3167
Ph: (03) 9544 2001
www.solarcharge.com.au

Eco options: Skylights, solar powered roof vents, Rota-Loo products, Modwood Decking, Solacoat reflective coating, Bokashi Buckets and more... Unit 1, 51 Albatross St, Winnellie NT 0820 Ph:(08) 89474373, admin@eco-options.com www.eco-options.com §

TAS

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

Solar Power - Pritchett Electrical P/L**.** Grid connect design and install. Full BCSE accreditation. Solar packages tailored to suit your home and your budget. Geelong region. Ph: 03 5243 5235 / 0424 466 858 www.pritchettelectrical.com.au info@pritchettelectrical.com.au

QLD

Brett Carter Solar Energy: Renewable energy consultant, designer and installer of remote and grid systems. System maintenance and power audits. Full BCSE accreditation. *Ph:(03) 6295 0842, mob: 0419 528 048 brett.carter@activ8.net.au*

VIC

WA

Affordable Solar & Wind Power: Remote power specialist, Grid systems also. Top Quality work for the best possible price. We service S/E QLD. Free information & consultation. Gov. rebates, 25 yrs experience. Glasshouse Mnts area. Ph:(07) 5497 4117 or 0439 974 649.

Harmonic energy: consult, design, supply and install solar electricity, hot water and energy efficiency solutions for domestic, commercial and community applications, using quality products and in-house installation. *1300 766 199 info@harmonicenergy.com.au www.harmonicenegry.com.au*

Going Solar: Design supply and installation of solar electricity and solar hot water systems. Renewable energy components, energy efficient lighting, insulation and Bio non-toxic paints. Thirty years industry experience. *Ph:(03) 9348 1000, retail@goingsolar.com.au www.goingsolar.com.au* §

Solarwest: Design, supply, install & maintain Solar, Wind and Hydro renewable energy systems. We also do Water Pumping, Automatic reticulation & Telemetry systems. Bruce is a qualified electrical contractor and RAPS Technician. *Ph:(08) 9756 3076 or email*

SA

Looking for an article from *ReNew*? Check out the ATA's online library!

The Alternative Technology Association, publishers of *ReNew* magazine, has a great resource for members. Every issue of *ReNew* (even the very first one published in 1980) is available for download from the ATA website. Downloads are free for members, or range in price from $2 to $5 for non-members. That's 111 magazines for you to read through. Imagine all the DIY tips you can pick up along the way. Go to www.ata.org.au/library

ATA membership costs $65 a year for individuals and includes a subscription to *ReNew*. Subscription only costs $30, but doesn't include free online access to back issues.

Too good to throw out

Toys from the junkyard

Johnathon Thwaites' Sustainable Interactive Toys are made from recycled materials such as old washing machine generators and recycled paint.

I FIRST made Sustainable Interactive Toys for the Perth Sun Fair so that kids and adults could have some interactive fun. The particularly memorable fairs and shows of my childhood were those where I actively participated in the event rather than visited it as an observer.

The bikes have been the most popular toy. Importantly you can feel the load increasing as more appliances are switched on. A kettle, for example uses so much power it can make the pedals near impossible to turn. I have put a number of standard power point outlets on the handlebars. The output is 100 volts DC and a total of about 200 to 300 watts can be generated by one pair of legs. This can run most household appliances made for 240 volts AC and can run brushed AC motors (such as drills, sanders, food processors and hair driers) incandescent lights and CFLs. The bikes can run appliances with switchmode power supplies (which includes most electronics equipment these days) such as laptops, PCs, TVs, CD and DVD players, LCD TVs and computer screens.

Some schools and primary health care workers have used the bikes with young boys who tend to watch too much television or play computer games endlessly; they have to pedal to power the television or game.

Top: a set of bikes able to power household appliances; below: toy trains run on solar power.

The toys are built from recycled household equipment and machinery as much as possible, with most materials sourced from bulk waste disposal days in the suburbs. The main cost in their manufacture is my time. Material costs are for paint (which is often also recycled), welding rods, electricity and occasional replacement of tools. Many of the toys use old Fisher and Paykel washing machine motors as generators, making them a great example of 'reduce, recycle and reuse' philosophy.

Toys made using washing machine motors:

- exercise bike generators
- wind turbine generators
- computer games running off exercise bikes
- TV running off exercise bikes—it's hard work and helps slim those kids down

Solar power devices:

- solar electric model train set
- solar water pumping display

So far the toys have been to the Perth Sun Fair, the South Bound Concert, Womadelaide, the Solar Cities opening in Perth, lighting shows at Circular Quay in Sydney as well as shopping centres, schools and other community events and festivals.

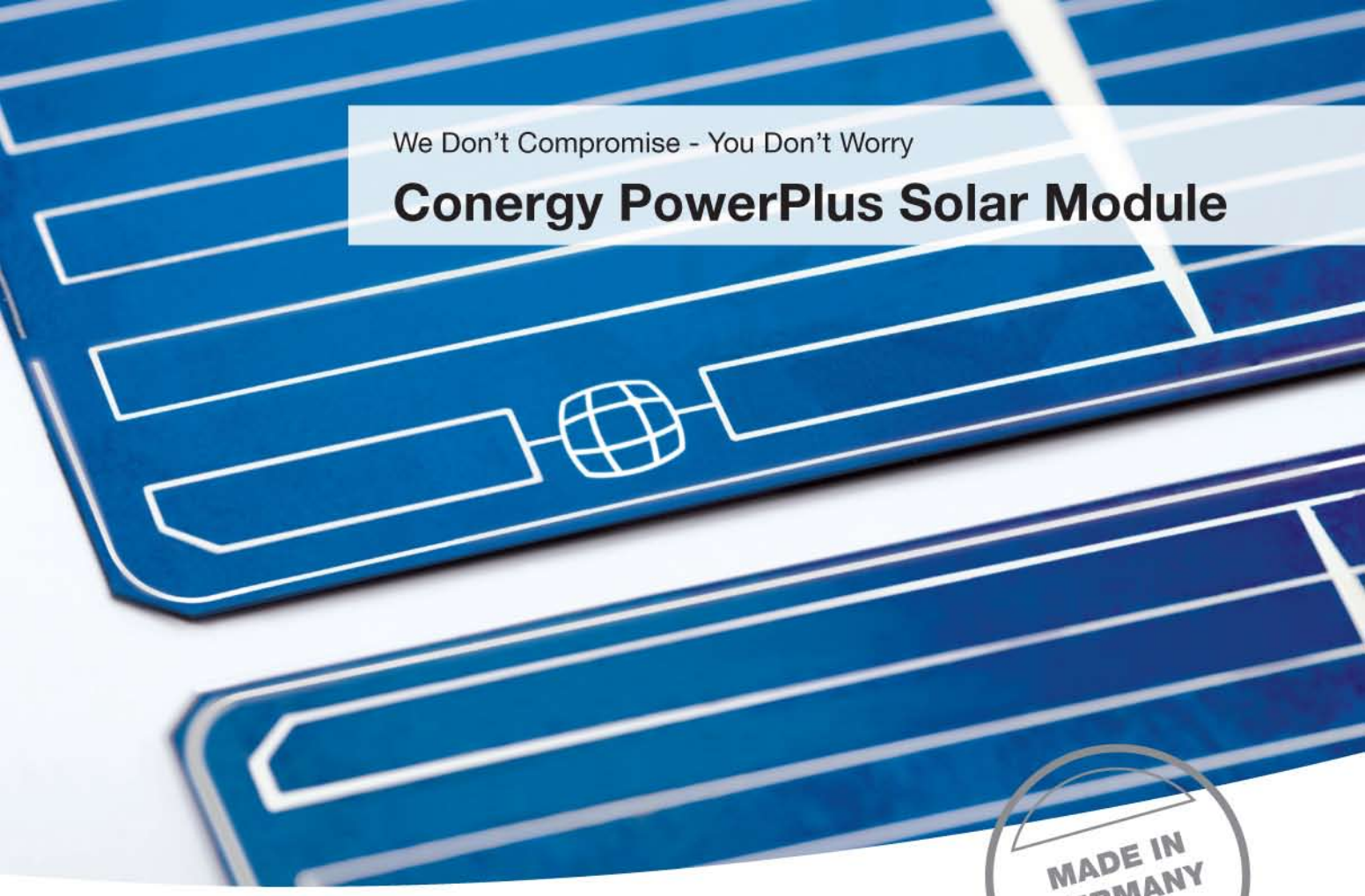
The toys will be on show at the Perth Sun Fair at the University of Western Australia on Sunday 28th March. Go to www.perthsunfair.com.au or to find out more about toys for hire go to www.perthsunfair.com.au/toys/

Email your 500 word stories about useful items made from rubbish to renew@ata.org.au

Common materials

- Paint available from chemical waste collection at the municipal tip (1000s of litres are received each year for disposal, including plastic paints and oil base, bright colours and dull colours)
- Exercise bikes, motors, rectifiers, steel framing, wires, plugs from bulk waste collection
- Power points from the salvage yard.

Advertisers' Directory



We Don't Compromise - You Don't Worry

Conergy PowerPlus Solar Module

MADE IN GERMANY

GET MORE POWER OUT OF THE SUN WITH CONERGY POWERPLUS

If your home or business is installing solar power, it pays to demand quality. Manufactured at our state-of-the-art German solar module plant, the Conergy PowerPlus delivers market leading yields and long term performance guarantees.

At Conergy, we know what we are talking about when it comes to photovoltaics: Worldwide, every tenth module is manufactured, sold or installed by us and our products supply over 1.7 million people with clean, renewable energy. We place the highest demands on ourselves to ensure that you get the most out of the power of the sun for many years to come - guaranteed.

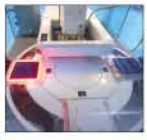
From silicon block to finished module, all production processes are in our hands. This means you can be assured that the strictest of standards are applied to each and every Conergy PowerPlus module.

Our modern, fully automated production facility means consistently high quality output with innovative features that put our product head and shoulders above the competition. Tests are continuously performed alongside production so you can be confident that when you are buying Conergy, you are buying performance and durability you can rely on - with no compromises!

Get the most out of the sun - contact your Conergy partner today:

Ph 1300 551 303 | www.conergy.com.au






CONERGY

OUR WORLD IS FULL OF ENERGY.

LORENTZ

GERMAN ENGINEERED SOLAR TECHNOLOGY SINCE 1993

SUBMERSIBLE PUMPS

- ▷ lift up to 600 m
- ▷ maintenance free
- ▷ 316 stainless steel
- ▷ variable pump speed
- ▷ remote switching
- ▷ AC back up solutions

ETATRACK

- ▷ up to 45 % more output
- ▷ fully automatic
- ▷ maintenance free
- ▷ manufactured to European standards
- ▷ DIY kits available

SOLAR PANELS

- ▷ highest efficiency cells
- ▷ low voltage temperature co-efficient, yields better output at high temperatures
- ▷ excellent low light and battery charging performance

SURFACE PUMPS

- ▷ swimming pool filtering
- ▷ water transfer
- ▷ domestic house pressure
- ▷ in-built battery charger

B/W SOLAR

1300 554 307
www.bwsolar.com.au

Sun. Water. Life.

For more information:
www.lorentz.de