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Sustainable sheds competition

Summer innovations

Cool earth-covered homes

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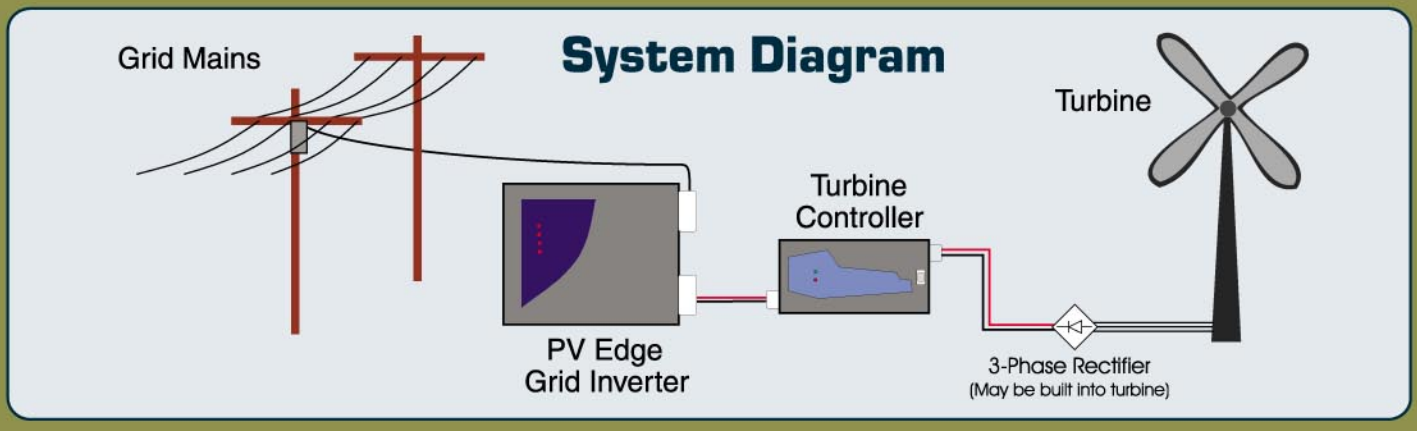

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features

Living in an earth-covered home doesn't mean rooms have to be dark and dingy. Page 26.

With summer here, now's a great time to try some solar cookery. See page 22 for some novel solar cooker designs.

A sneak peak at some entries to *ReNew's* sustainable shed competition. Check out what they're made from on page 18.

The ATA's International Projects Group has been busy! Find out about two IPG projects on page 58 and 60.

regulars

Cover: a green unit. This dwelling is part of a three unit development by Melbourne's Sunpower Design. Photo by John Liu.

Got two different solar arrays but want to use only one inverter? The Aurora Power One grid-interactive inverter can solve that problem. See Products page 88.

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 1981. *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.

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

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Next advertising deadlines: Booking 23 January 2009. Advertising copy due 30 January 2009. Next editorial copy deadline: 23 January 2009.

Better hot water supplies

It's strange to be so excited about this issue's solar hot water buyers guide but I guess you get a bit like that when you're in this job for a while. It stems from the fact that solar hot water is infinitely good; if we had more of it then household greenhouse gas emissions would be much lower.

Taking a closer look at the figures there's not as much joy to be had by the fact that only five per cent of Australian households have solar hot water systems installed. Hot water accounts for around a quarter of residential greenhouse gas emissions so it's a real shame there aren't more of these systems across the country. In China it's estimated that at least 30 million households have a solar water heater. They're relatively cheap there and to use anything but solar hot water is not cost effective. Basic systems in China start at under $400, so there's a fast payback time from the savings on electricity bills. The other option is to buy an electric system for around the same price as a solar hot water system and pay bills on top of that. It's an easy choice.

Ok, so this is not China. But we do need a way to bring down the price of solar hot water, because the greenhouse benefits of installing these systems on rooftops is worth it. Paying four to five thousand dollars for a solar hot water system, when an electric system costs substantially less, makes it difficult for low income households to make the switch when the old hot water system carks it.

The $1000 federal rebate when replacing an electric system with solar is a help, but hopefully there're signs of more stimulus in the form of low-interest loans and other incentives. The best thing would be to get rid of electric hot water systems altogether. The new demand generated might make solar hot water actually cheaper. Labor promised to phase out these electric dinosaurs during the last election campaign; over twelve months later let's hope that the starting date of 2010 is still on track.

A steaming hot shower all because the sun was shining has got to feel a lot better than using water heated by coal power.

Summer sheds

Don't forget to enter the *ReNew* Sustainable Shed competition this summer. Entries close 30 January. To see some of the entries thus far have a read of the article on page 18.

Jacinta Cleary

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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 prize is not redeemable for cash. Price includes GST.

(3) Earth Utility Pty Ltd reserves the right to change specifications without notice.

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

(5) The competition runs from 10 June 2008 to 5pm on 20 Feb 2009, and subscriptions/memberships must be paid by this time and date.

(6) The competition will be drawn at 5.30pm on 20 Feb 2009 at the Alternative Technology Association, Level 1, 39 Little Collins St, Melbourne VIC 3000.

(7) The winner will be contacted by phone and will be notified in writing. The winner's name will be announced in ReNew 107, released in mid March 2009.

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

(9) To enter, subscribe or join the ATA using the subscription form in ReNew issue 104, 105, or 106 (or a copy of it), or the form in Sanctuary 5 or 6, visit our website (www.ata.org.au), or call the ATA on (03) 9639 1500 to pay by credit card.

(10) The competition is only open to Australian entries and includes delivery and installation within 200 kilometres of Australian capital cities. Earth Utility will pay standard install costs in other locations.

(11) The winner must be eligible for the Solar Homes and Communities Plan, with the rebate to be paid to Earth Utility Pty Ltd. The Solar Homes and Communities Plan is means tested on annual income and you must not have previously received the rebate on your current property. If ineligible for the rebate the prize can be transferred to an eligible person. All Renewable Energy Certificates will be assigned to Earth Utility Pty Ltd.

(12) The PV system must be installed on the winner's primary place of residence with a north-facing roof. If the winner does not own an eligible property, then they may transfer the prize to the person of their choosing who has an eligible property. It cannot be installed on rental, investment or holiday properties.

(13) Prize includes the supply and installation of a 1kW solar power system with a brand nominated by Earth Utility at the time of redemption, including a solar inverter, mounting frames, meter, wiring and components, valued at $14,000.

The *ReNew*/Earth Utility Pty Ltd subscriber competition is proudly sponsored by Earth Utility Pty Ltd, Suite102 54-58 Foveax St, Surry Hills NSW 2010, ph: 1300 884 783 www.earthutility.com

Green loans

If you're looking to make sustainable improvements to your home then 2009 might just be your year. The government Green Loans program kicks off in the coming months, with $300 million to be allocated over five years.

The program offers assessments, green renovation packs and access to low interest loans of up to $10,000. The money could be put towards solar hot water, solar panels, rainwater tanks or any other initiative that will make your place less resource intensive. Participants will have a qualified assessor investigate their current energy and water use, with the assessor providing a tailored report on the best actions to take from an environmental and cost point of view.

The good news for some *ReNew* readers is that the program will be looking for qualified household assessors. Does this sound like you? Keep an eye on www.environment.gov.au/greenloans/index.html for more details.

Bag ban in South Australia

In early 2009 South Australia will become the first Australian state to ban plastic bags. Retailers will start to phase out their use in January, with a complete ban coming into effect on 4 May.

According to Clean Up Australia, the average Australian household uses 502 plastic shopping bags every year.

Plastic bags can take up to 1000 years to decompose. Most go to landfill, but some end up in our marine ecosystems. In the open sea, plastic bags can easily be mistaken for jellyfish and are ingested by dolphins and turtles. Thousands of marine animals die each year as a result.

Other countries have already reduced their plastic bag usage. In 2002, the Irish government imposed a plastic bag tax, which saw the use of plastic bags drop by more than 90%.

BP Solar take it abroad

Australia's only local producer of solar cells BP Solar has announced their Sydney solar power plant will close at the end of March 2009.

For solar power to be economically competitive it needs to be produced at a low cost to match the price of conventional electricity produced using fossil fuels. To do this, BP Solar will focus on manufacturing at existing plants in Spain, India, China and the US. According to BP Solar's chief executive Reyad Fezzani, other photovoltaic manufacturing plants are up to 20 times the size of the Sydney site, and there simply isn't room for such a large-scale expansion at its current site.

What next from Obama?

According to Barack Obama's election campaign we can hope to see much more action on climate change in the next four years.

In the lead-up to the election, Obama said the United States' carbon emissions levels would be reduced to 1990 levels by 2020 and $15 billion would be invested each year in 'clean' power technologies.

As part in his economic revival strategy, Obama intends to encourage green industry, supporting car companies designing fuel-efficient cars and rewarding consumers who buy green cars with tax credits.

Support will be given to renewable energy production. Currently 8% of the country's electricity comes from renewable sources such as hydroelectric dams and solar plants. Obama hopes this figure will be 25% by 2025.

We'll have to wait and see what impact the global financial crisis will have on these targets when Obama becomes President.

Hepburn share offer extended

In the last issue of *ReNew* we looked at Hepburn Wind, Australia's first community-owned wind farm. The latest from the board is that the opportunity to buy shares in the wind farm has been extended into December. Recent economic instability has made people quite

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reticent to invest, with the target of $9 million in public investment yet to be reached.

Once up and running, the two wind turbines at Leonard's Hill in Central Victoria will produce up to 4MW of power in total, supplying power to 2,300 homes.

To find out more about the share offer go to www.hepburnwind.com.au

Sailing with wind and solar

Some Chinese cargo ships will soon have solar-powered sails on their decks. The aluminium sails will be covered in solar panels, allowing them to harness the wind and generate solar power at the same time.

The 30 metre long sails were designed by Australian company Solar Sailor and are operated by a computer linked to the ship's navigation system.

The solar panels on the sails are linked to the ship's electricity supply, with the solar component meeting five per cent of the ship's energy needs, while the wind power will cut fuel costs by 20 to 40%.

Recycling—more to be done

Australia's first automated e-waste recycling plant has opened in Sydney. At full capacity, the plant will be able to recycle 20,000 tonnes of electronic waste each year.

Australia is recycling more and more but there's still some way to go. In total, only 4% of electronic waste is recycled, whereas in Europe the figure is 80%.

Nearly all of Australia's fluorescent light bulbs end up in landfill (or 98% to be precise). CMA EcoCycle is the only recycling plant licensed to deal with the small amounts of mercury contained in each fluorescent light bulb, but even it is not working at full capacity.

Planet Ark founder Jon Dee says the government needs to introduce nationwide initiatives to help recycle TVs, light bulbs and other electronic waste. The recycling facilities exist, but are not easily accessible to most Australians, and few incentives exist to encourage companies or consumers to make the effort.

Renewables at school

Renewable energy is a growing part of the school syllabus. For anyone interested in a year 11 course on photovoltaics, the University of New South Wales has designed a free pack that can be downloaded from their website. The pack includes experiment guides and worksheets and is available to anyone who wants to teach themselves the basics of photovoltaics. Go to www.pv.unsw.edu.au/estudies

Go fly a kite

Just a frivolous childhood pastime or the newest contribution to the world's electricity supply? Scientists at Delft University of Technology in the Netherlands have used a 10m^2 kite to produce 10kW of electricity. That's enough energy to power ten houses. As the kite is pulled by the wind it turns a generator back on the ground thereby producing electricity.

Kites can make use of high-altitude wind up to a kilometre above sea level. At this height the wind is much stronger and more reliable than at lower altitudes where conventional wind turbines operate.

The next kite the researchers plan to test should produce 50kW of power. They have called it Laddermill. If it works, the team proposes putting several kites together in a 'kite plant' that could potentially generate enough electricity to meet the demand of 100,000 houses.

Soaps and shampoos: it really does matter

Many households are using greywater as a way to conserve water and keep gardens alive during periods of water restrictions. While this is a great water conservation strategy, there are potential environmental and health issues that need to be addressed.

Excessive sodium, phosphorus and other chemicals found in many cleaning products have the potential to build up in soil and cause long-term soil structure damage. The Alternative Technology Association, in conjunction with students from RMIT, has commenced a research study on this issue. The project aims to analyse and record the ingredients, particularly sodium and phospho-

rus, of 45 readily available soaps, shampoos and conditioners. The aim is to help householders decide which bathroom or cleaning products are suitable for greywater reuse.

An easy way to mitigate the risk of soil damage is to choose products that are low in sodium, phosphorus and other potentially harmful chemicals. However, obtaining this information can be difficult, especially as some soaps and shampoos do not list their product ingredients.

The results will be available on the Alternative Technology Association website in the new year. Go to www.ata.org.au

Water tight

Melburnians will have voluntary water rations from December when the Target 155 campaign is introduced. Households will be encouraged to use less than 155 litres per person per day, which is probably not much of a challenge for most *ReNew* readers.

This year, Kumbia in Queensland had some of the most severe restrictions imposed. A Stage 7 water restriction banned all outside watering. If you dream of long showers, or hosing down your car, perhaps take a trip to Darwin, one of several cities in Australia where there are no restrictions on water use.

Compiled by Cat O'Donovan

A solar thermal collector at the Kimberlina plant in California.

If only...

There's a lot of interest in solar thermal technology at the moment, and so there should be. With the ability to provide baseload power through simple heat storage, solar thermal has the potential to replace coal fired power stations around the world.

Ausra, an Australian company, became tired of there being no interest in the technology here in Australia and moved to the US. Since then they have attracted considerable funding and have recently opened their first power plant based on their Compact Linear Fresnel Reflector (CLFR) technology, which uses parallel mounted, individually tracking flat mirrors to focus the sun onto a pipe at the focal point. The heat produces steam which directly drives a turbine to generate electricity. The Kimberlina plant, in Bakersfield, California, is rated at a modest 5 megawatts, and uses the same technology as their trial site, the Liddell solar thermal facility in New South Wales. Their next plant will be considerably larger, with a 177MW facility planned for Carrizo Plains, which will sell all of its electricity to energy utility Pacific Gas and Electric Company (PG&E).

It's a pity the Australian governments couldn't see the potential in this technology to not only reduce our greenhouse emissions, but also to generate a great many new jobs and to kickstart a flailing renewable energy industry.

Do the right RECs thing

Thanks so much to Mark Gilbert and Brad Shone for answering a question I had long been concerned about with Renewable Energy Certificates. After installing a solar hot water system, I hung onto my RECS form, thinking that in essence, cashing it in was giving away (or at least selling) the renewable component of my system to someone else. While I understand that this kind of trading is part of the big picture of getting carbon managed worldwide, on an individual basis it seemed wrong.

I filed away the forms and don't plan to ever cash them. I guess its cost me about $650 to be less of a polluter, but to me that's what its all about. At the heart of the paradigm change that the whole world is facing is that billions of people will die, beginning with the very poor and vulnerable in the deltas and coastlines of the world, but eventually all of us as the ocean acidifies and loses its ability to support planetary life. This is inevitable unless we peg back carbon emissions and this involves being selfless in a global system driven by self interest.

ATA's goals are admirable and we need to remember that underpinning them is not just saving money, but having happier, more self-reliant, simpler, more community linked lives.

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 limited space, 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

The magazine with its stories like community wind farms, is a beacon of hope in a very dark time.

Steve Biddulph
dpforest@bigpond.com

Biofuels and poverty

Your article *Running on Fish Shop Fuel* in *ReNew 102* was really fascinating! I also note that *ReNew 103* reported news from Sydney West ATA branch's talk, 'Is making biodiesel sustainable?' This report stated that biodiesel can be sustainable if carefully managed, using waste oil. In *ReNew 102*, Christine Lanham and Alex Thorogood describe their trek across the desert using waste cooking oil in their vehicle. Christine, Alex and Marcus's efforts, and those of others like them who devote their lives to raising awareness of the environment and eliminating waste, are to be applauded. Nevertheless, the whole question of biofuels needs to be examined very carefully and it would be good to see some more debate in *ReNew*.

No-one would dispute that putting waste oil to use is a wonderful idea. However, I'm not sure that promoting biofuels per se is necessarily a good thing, if practiced on a large scale using new vegetable oils or purpose-grown crops which displace food production.

A new briefing paper published by Oxfam GB in the United Kingdom claims that biofuels are neither a solution to the climate crisis or the oil crisis. Furthermore, biofuels are believed to be contributing to the global food crisis, which is causing poverty to increase at an alarming rate worldwide.

While Marcus Deuchar (*ReNew 102*) claims that "the use of vegetable oil as a fuel is carbon positive," the Oxfam report estimates that, rather, "by 2020, the emissions resulting from land-use change in the palm-oil sector may have reached between 3.1 and 4.6 billion tonnes of CO_2—46 to 68 times the annual saving the EU hopes to be achieving by then from biofuels."

Oxfam also state that, "in reality, biofuels are not GHG neutral. There are emissions associated with all stages of their lifecycle, particularly if the crops are grown intensively, using nitrogen-based fertilisers and machinery, or if the refining process requires large inputs of (fossil) energy." The use of nitrogen-based fertilisers for production of rapeseed (canola) oil for biodiesel production in the US had an unintended side effect. Emissions of nitrous oxide, a greenhouse gas with an impact 296 times more potent than carbon dioxide, adversely affects the life cycle of biodiesel production to such an effect that the use of canola-oil biodiesel may actually be increasing global warming overall!

Even more concerning is the prospect that people in wealthier nations such as the USA and European countries may actually be inadvertently causing widespread hunger by promoting or using biodiesel. Of course, this does not relate in any way to the efforts of pioneering do-it-yourselfers such as Marcus, Christine and Alex. However, it is alarming to read in Oxfam's paper that while first-world governments have set targets for biofuel production and use, "biofuels may explain 10% of recent food price rises… Research from the World Bank puts the contribution of biofuels even higher, at 65 per cent. The big losers from the rich countries' biofuel boom are poor people, at risk from spiralling food prices, and a 'scramble to supply' that places their land rights, labour rights, and human rights under threat."

According to Oxfam, "biofuels may already be responsible for dragging over 30 million people into poverty and similarly endangering the livelihoods of nearly 100 million." The biofuels debate is food for thought indeed.

For anyone who would like to read the Oxfam briefing paper *Another Inconvenient Truth—How biofuel policies are deep-*

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Trish Morrow
energysaving@engineer.com

I have to say I am not a fan of biofuels. Most biofuels are used in internal combustion engines, the efficiencies of which are generally below 30%. What's the point of producing a 'green' fuel and then wasting most of it in inefficient engines?

Lance Turner

EVs and EM fields

I refer to a letter from A&L Smith in *ReNew 105* about EVs and EM fields.

There are magnetic fields, caused by current flow, for example DC in this case. There are low energy electromagnetic fields, caused by radio transmitters and cellular phones. This is also known as non-ionising radiation.

Then there are high energy electromagnetic fields caused by the sun, decaying radio isotopes and X-ray machines. This is known as ionising radiation.

I suggest that anyone worried about any of the above never use a mobile phone, because the fields you will subject yourself to by using a mobile will be between 10,000,000 and 50,000,000 times (these are real, measurable numbers) stronger than anything you will subject yourself to living near a base station or sitting in an EV. Therefore it is complete nonsense to suggest a link to cancer by sitting in an EV.

Said claims by a group that the rear left seat of a Prius is not safe due to high magnetic fields is just rubbish and has no scientific basis. If you are concerned about the fields in the Prius, then never ever go near any house that has any sort of electricity at all, be it solar, wind or coal. In fact the currents generated by your body to fire muscles may be stronger.

The cancer might be caused by a chemical you once cleaned with or a pest spray you might once have used. These are things in the environment that are proven to cause harm. Magnetic and low energy electromagnetic fields have not been.

Glen English
glen@pacificmedia.com.au

Tefal Quick Cup

I bought a Tefal Quick Cup, featured in Products in *ReNew 105*, and am sorry to have to report that it is an environmental disaster. It does not boil the water, which by definition, any tea maker or kettle should do. Having made a few cups of tea, which all tasted awful, I measured the temperature of the water. It was 80°C at the spout and 70°C by the time it was in the cup. I telephoned the Tefal representatives in Sydney to see if this was a fault. They said it was not, that the Quick Cup is designed to heat the water to 80°C. This information is not on the box or in the instructions.

Fortunately my local Retravision store refunded my money, but I wonder how many of these things will be pushed to the back of the cupboard and, after a decent interval, finish up in landfill.

Products that claim to be environmental but don't perform adequately are a serious problem. It is hard work trying to persuade people to think green when making purchases. Experiences like the Tefal Quick Cup make it harder still.

Richard Stanford
richardandpenny@gmail.com

Thanks for that feedback, but it isn't possible to actually boil water on the fly like this as there is too much danger of a device spitting boiling water all over the place. When water boils it expands over 1000-fold, if it does this while in an enclosed system then the pressure increases tremendously and it can exit through a tap explosively. Also, these devices are sold all over the world, including areas a great deal higher above sea level than most of Australia. The boiling point of water at higher altitudes is lower, so they would have needed to build in a considerable safety margin. Maybe the Quick Cup should have been set to around 90°C, but this is definitely cutting it close in areas above a few thousand metres above sea level.

I have to admit that water at lower temperatures does change the flavour of a cuppa, especially tea, but there has to be some compromise in an on-demand system.

Lance Turner

Solar panel ratings

ReNew and other publications and books worldwide (except my own) perpetuate and reinforce the solar industry's promotional claims relating to the power that can realistically be expected from typical photovoltaic systems. Invariably a package or other system is described as (say) 1.0kW, yet the reality is 700-800 watts. When challenged, suppliers admit this is so. It is also confirmed in the solar industry's own technical literature and by its NOCT rating method.

Those knowing about electrics, but not the industry's worldwide spin on the relationship between volts and amps, are more likely to be fooled than those who do not. People with even a semi-technical grasp of electricity know as virtually revealed gospel that one amp times one volt equals one watt. They would never think of questioning that 100 watt modules sold for use in 12-volt (or multiples of 12 volts) systems produce other than 8.333 amps.

But measure it and you'll find it's about 5.88 amps—or 70.6 watts into a nominally 12 volt system. You don't even need a meter: a panel on the back provides this information.

The industry rates modules by plotting amps and volts and using whatever combination gives the highest number. In practice this happens at about 17 volts. As 17 times 5.88 is close enough to 100, that's how that 70-watt module becomes a '100-watt' module. Unfortunately 17.1 volt systems are about as common as sumo-wrestling goldfish with *ReNew* subscriptions. The MPPT

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The Future of Solar Technology

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devices used in grid-connect systems juggle volts and amps to optimise watts, but only partially remedy this.

Also not fully revealed is that all except amorphous modules lose about 5% output for every 10°C increase in temperature. Salespeople correctly claim modules to be rated at 25°C. But what they fail to reveal (or do not know) is that the quoted 25°C is not ambient temperature, but the temperature of those little black cells under glass and a hot sun. At 25°C ambient those cells are typically between 47-49°C. So there goes another 12.5% of the output.

In the process of writing my just-released book (that covers this issue in full) every supplier approached agreed the above is correct. All attempted to justify this gross deception by claiming it is "standard industry practice".

But so is thieving in the burglary industry.

Collyn Rivers
Broome 6725

Collyn, expecting a 12 volt solar panel to have its current output calculated for 12 volts is not realistic, 12 volts is a nominal figure and all 12 volt battery systems will regularly need to be charged to 15 volts. Add in the need to allow for voltage losses in wiring, regulators and protection devices, and you could easily need 16 or 17 volts. It's just the nature of the beast. If you expected your '12 volt' panel to be able to put out full current at even 15 volts, then you wouldn't have a 100 watt panel, but instead a 125 watt (8.33 x 15) panel. You can't have it both ways.

This can be seen with 'self-regulating' panels. They put out more current with a lower maximum output voltage for the same rating compared to a regular panel, but in some circumstances they simply couldn't fully charge a battery in a realistic amount of time.

However, I fully agree with your second point. The power output reduction seen with most crystalline panels should indeed be accounted for in the specifications. Testing them at 25°C cell temperature using a brief flash of light is completely pointless and needs to be addressed by the industry. Because of this issue I generally only recommend thin-film panels as, for panels with same wattage ratings, they will always generate more energy each year than crystalline panels.

Lance Turner

Bad technology

ReNew does a good job promoting elegant, appropriate technologies, but these new technologies are heavily outweighed by a host of consumer goods that flagrantly damage the environment.

We desperately need a government process in place that pre-empts and responds to environmental impacts of new consumer technologies that are put on sale in the Australian marketplace.

The Australian government responds to some of these dilemmas, but in a very ad-hoc way. Like the banning of incandescent light bulbs, equipment with high stand-by power and setting new standards for plasma TVs, including a possible ban on those that are too inefficient.

But for every technology they randomly attend to, a whole new batch goes onto the market that overwhelm any net savings that are made. Just go into the big department stores and you will see rows of patio burners for sale—what was once used for cafes, everyone now wants for their own barbecue area. You can even buy electric ones—the ultimate global warming device. No doubt these will have to be banned eventually.

There is also a real problem that in only dealing with environmentally bad technologies long after their damage has become apparent, a whole culture is built around them that is hard to overcome. Not to mention a distribution and service infrastructure that has a vested interest in the preservation of bad technology. The ubiquitous 4WD is arguably the most glaring case.

If anybody wishes to undertake a development on land, they are obliged to go through fairly comprehensive approval processes so that the environment (or society) is not harmed by the proposed development. By stark contrast, if you place something on the market there are virtually no regulations that require the business to ensure the commodity does not cause a major environmental risk (other than compliance with health and safety standards).

Yet, many goods have had immense environmental repercussions in Australia that could easily have been nipped in the bud. Again, taking the 4WD as an example, many dozens of children have been killed by them (from poor driver visibility), many dozens of pedestrians have been killed (from poor body design) and, worst of all, they have directly caused the efficiency of Australia's car fleet to plummet back to 1960s levels. This mostly happened since 1980 and it has never been dealt with. There's no market intervention to discourage this trend. No anticipation. It's deemed too hard to deal with now the 4WD culture is so firmly entrenched.

Two million good working televisions are due to go to landfill in Australia this year, owing to the massive consumer conversion to flat screen and digital TVs. In the next five years this is estimated to rise to some 7,000,000 TVs. These dumped TVs have mercury and lead in them. Lack of control over the marketplace means that there are no mechanisms in place to deal with this huge surge of toxic waste. And power consumption of large plasma TVs rivals that of refrigerators. Why did authorities not anticipate these problems before they became chronic?

It is clearly not feasible for all new goods to go through approvals processes, but we need a statutory body to examine market trends closely and to intervene early where it foresees (or is alerted to) products that may negatively impact on the Australian environment.

Chris Harries
Dynnyrne TAS

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What binds the shed—a look at materials and retrofits

Entries to *ReNew's* sustainable shed competition share one thing in common; they are made from a diverse range of materials, from mud bricks to recycled timbers and stuff found at the tip. Here's a peek at some entries to the shed competition as we try to find out what holds these structures together. Entries close January 30!

Jim Dowling's shed, Queensland

I answered an advert to remove an old shed for free from a used car yard in Brisbane. It was a 6 x 4 metre shed made from four untreated pine walls and hardwood, cliplock roof. The bottom plate was totally rotten, but the rest was fine. I borrowed a friend's big cherry picker truck and cut the walls into sections for removal. In the process I fell off a rotten beam (in the shed next to it) and was on crutches for months.

A bunch of friends helped me put it back together. We put it on low stumps which I scavenged from a demolition site, and a floor of treated pine flooring and hardwood joists which I bought for about $100 from a demolition yard. We reused the silver insulation that was already on the walls and roof and put a little new stuff on. I added a big roller door at the front, which I got for $40, and kept the old sliding door at the side. I replaced missing louvres on either side with toughened glass louvres that I had scrounged years before, left over from the Brisbane Jail construction. The shed has a lot of flow-through ventilation and with the silver insulation it is pretty good even in the hottest weather.

I painted it bright yellow with paint I found somewhere…who knows where?

It is powered totally by solar, with one lead coming from the house. We have a 650 watt system and no matter how much I have used the welder or other power tools, we have never had a power bill where we used more than our solar system created. The big roller door at the front and big sliding door at the back keep it pretty cool. Maybe being up off the ground on stumps helps too? The shed also collects rainwater.

Jim Dowling and his shed removed for free from a car yard. It is powered entirely with solar and has rainwater collection.

Eric Foulkes' shed, Queensland

The shed was nearly complete when we bought the Castle, except for the door and a small section of wall that I completed with home-made concrete bricks left by the previous owner. The timber was recycled from an old homestead that was demolished in Springsure. I have put a new iron roof on it before installing two solar water heater panels on top.

The shed is mostly as I found it. I've added two windows for better air flow and removed an old water tank and stand which was half inside and half outside. The shed is solar powered with 140 watts of photovoltaic panels plus a wind turbine and two 212 amp-hour gel batteries. The system runs all tools except

Eric Foulke's shed is made from home made concrete bricks and and recycled timber.

the welder and washing machine, for which we use a generator.

Mark Peterson's shed, New Zealand

We live on a lifestyle block 65km north of Auckland. Our shed/barn looks much the same as in did when we purchased the place 18 years ago. I am guessing that it dates from the 1950s. Construction techniques and materials range from rustic to alarming with a lot of recycled corrugated iron over farm-milled timber. You can see the wavy ridgeline in the exterior shot. In spite of all its failings it has survived 50 plus years of high rainfall and winds that reach 120kph on several occasions each year.

Over the years this building has served as the base for a dairy farm and then as the propogating facility for a commercial plant nursery. One of the vehicle bays in the shed housed chickens for many years. The building itself is a triumph of recycling and reuse.

We refurbished the glasshouse with paint and triple-skin horticultural film and it now provides food and herbs and allows us to grow things that would struggle outside. We also use it to raise plants for revegetating the place and to give to local fundraising sales. The glasshouse is on automatic irrigation timers supplied by a gravity feed from a dam on the neighbouring property.

Mark Paterson's barn in New Zealand.

John Hermans' shed, Victoria

John Hermans already has two sheds and is now working on his dream shed.

The first shed that I made was attached to our living space. It was a tin shed made from very old painted iron. It took me two weeks to make and was only 5x9 metres in size. We lived in it for 12 years and it was a great saving on rent.

My second shed was the back end of the earth-covered garage. It is 11x10 me-

John Hermans' old shed and living space of 12 years ago, now the site of his son's skate park.

To clean or not to clean

There's been some debate amongst entrants to the shed competition about what state to leave the shed in. Should it be left tidy or is it best to leave things where you place them, and never, ever attempt to clean up? Here's what some of them have to say about the issue.

"Never ever tidy it up, or you won't be able to find anything. Never throw anything too far away, or you will need to recycle it the following week." **Eric Foulkes**

"There is no point in spending a day cleaning up your shed when it will be in just as big a mess three days later. It is better to try to clean up a bit as you go along. Although I think I have learnt this second part of the lesson, I must admit I am yet to implement it. But I am confident the first part stands alone even if you cannot do the second." **Jim Dowling**

"Keep putting things away—if it's not tidy, it's not efficient." **John Hermans**

Best advice so far

"Never try and remove the dents out of a ping pong ball with a cigarette lighter, as they ignite like a molotov cocktail; when you drop it, it bounces like ping pong balls do, and will land amongst your most treasured trash under the work bench! Always have a fire extinguisher close by."
Eric Foulkes

tres but with a large glass skylight over the work area. It also kept me satisfied for 12 years, but I needed more space! Although the final 'perfect shed' is quite large, the materials used were not plundered or squandered. It was built with renewable energy and will last for many, many generations.

We'll look at John's third shed in more detail in the next issue of *ReNew*. It includes solar floor heating, recycled timbers, pressed earth bricks and will be earth covered, no less. Sounds good enough to live in! The space was previously used as a skate park by John's son Ben, until a bigger and better skate park was built elsewhere on the property. ✻

Steve Harrison's shed, New South Wales

My shed is made from mud bricks with a recycled iron roof. The part where the solar panels are was converted to zincalume because the panels are in an aluminium frame.

Shed prizes...enter now!

The best three entries to *ReNew's* Sustainable Shed Competition will receive a solar and lighting kit consisting of:
1 x 20W solar panel
1 x solar regulator kit to suit
3 x 4W LED light kits
1 x battery and fuse
Prize generously donated by Oatley Electronics **www.oatleyelectronics.com**
Each winner will also receive a copy of *Makers, Breakers & Fixers: Inside Australia's Most Resourceful Sheds* by acclaimed shed researcher Mark Thomson.
For full details about the shed competition see page 52 or go to www.ata.org.au

The great solar oven bakeoff

There's nothing better than a loaf straight from the solar cooker. Kat Taylor inspires chefs this summer to get out of the kitchen and into the back yard. Here's how to cook up a feast, Alice Springs style.

Pavlova, sun bread, cookies, stew, muffins, toast and fried eggs; the crowd gathered as more and more sun-cooked food was brought out and carefully presented. The heat was on to win the major prize in the Solar Oven Bakeoff, the Green Spoon Trophy.

Much to my relief the day had been clear and sunny. Although the sun usually shines in Alice Springs with monotonous regularity (around 300 sunny days per year), some ominous clouds had appeared a few days before the Bakeoff, causing diffuse, scattered light. Solar cooking works best in direct sunlight, with the bare minimum usually being 20 minutes of sun an hour to get a solar oven working. However, to produce the sort of feast being prepared for the judges, including gourmand Stephanie Alexander, the cooks needed every minute of sun they could get.

Luckily, the sun shone on Alice Springs' Sustainability and Desert Garden Fair, held in Olive Pink Botanic Gardens last September. People came to watch demonstrations of no-dig gardens, micro wind turbines and grey water systems, and to buy plants, browse stalls and check out the eye catching solar ovens in the Bakeoff. Spectators were impressed by the temperatures the solar ovens reached and how quickly food could be cooked. Sun bread, for example, takes about an hour and a half. They also loved sampling the solar-baked treats!

In the leadup to the competition a solar oven construction workshop was held a few weeks before. Designed by last year's bakeoff winner, Steve Sawyer, the Two Sun Ovens were made from plywood, recycled glass and re-used solar hot water panels. The aluminium from the hot water panel became the reflective inner sheath while the insulation was re-used in between the plywood outer and the aluminium inner. A single reflective panel attached to the glass top with a hinge also functioned as a handy lid to trap the heat if the sun disappeared for awhile. This simple model produced several winning entries. The internal temperature reached around 100°C to 120°C, although this could probably be increased with the addition of extra reflective panels on the sides and bottom.

Top: Cookers in the hot Australian sun. Left: Hans Pfau's super hot Solar Griller made from a TV screen lens. Above: Plenty of heat to cook an egg.

Clockwise from top: Steve Sawyer's award-winning solar oven that runs at 140 degrees; the Solar Steamer used for cooking spuds; the Two Sun oven made in workshops; the Two Sun oven has plenty of insulation.

The gentle temperatures of the Two Sun Oven made them perfect for cooking pavlova. Meredith Wyatt's pav topped with banana, blueberry and wattleseed looked divine and tasted that way too. Meredith won the Sweet category and shattered any misconceptions that solar cooking means roughing it.

Many of the other cookers used four reflective panels, including the winning oven from 2007, designed and made by Steve Sawyer. Features include wheels, the ability to fold panels down for transport, and the Manual Tracking Device, which is a screw with concentric circles drawn around it. Rotating the oven so that the screw's shadow falls directly on top of the nail maximises solar access. Steve's oven runs at a fairly constant 140°C and is large enough to cook an entire meal.

This year Hans Pfau won the oven design category for his Solar Griller, a simple but effective unit made from a recycled TV screen/fresnel lens mounted on an adjustable four legged frame. Hans demonstrated its power by setting a block of wood on fire followed by preparing some fried hamburgers and eggs for the judges. The temperature was modified by adjusting the food's distance from the focal point. The temperature at the focal point exceeded the range my temperature gun could measure, which was 250°C.

Hans' other entry was the ingenious Solar Steamer. Water was heated in a pipe running through a parabolic reflector, causing it to boil. The steam was released from the end of the pipe which protruded out of the back of the reflector. Hans placed an insulated tin can over the end of the pipe and used the steam to cook potatoes.

One of the highlights was a visit from the guest judge, food critic and writer, Stephanie Alexander, who was impressed with the solar ovens and the dishes produced—her first experience with solar cookery. She and the other judges had a tough job deciding the winners but enjoyed the tasting immensely. Special points were awarded for the incorporation of bush foods in dishes

such as Feral Dove Stew and Savoury Wattleseed Muffins. The winners of the bush food category were Delia Naughton and Emma Chessel for their Quandong and Apple Slice. They also scooped the overall prize, winning subscriptions to *ReNew* and the Green Spoon Trophy in their victory.

Submissions wanted

Some people at the Bakeoff were so keen they wanted to buy DKA COOLmob's solar cooking display books! They weren't for sale, but I did direct them to www.solarcookers.org. Whilst the site has some great resources, most are made in the northern hemisphere, which has prompted me to compile a new book, *Solar Cooking in Australia*. I'm currently looking for submissions of cooking hints and recipes, especially those using bush foods. Hopefully the first edition will be ready for the next Solar Oven Bakeoff in September 2009.

Email solarbakeoff@coolmob.org to submit your solar cooker recipes. ✻

Kat Taylor is project manager with DKA COOLmob, organisers of the Solar Bakeoff. More information is available at www.dkacoolmob.org or (08) 8952 0299. DKA COOLmob is a network of households committed to reducing greenhouse gas emissions. It is a joint project of the Arid Lands Environment Centre and Desert Knowledge Australia.

Top: a sun-cooked spread. Bottom: Stephanie Alexander (front) does the taste test.

Left: Emma at the solar cooker workshop; middle: Delia receives the Green Spoon from Stephanie Alexander; right: Steve's sun bread.

Subterranean summer

The hot weather drives some people underground, writes Jacinta Cleary.

This earth-covered home in the Adelaide Hills has a wind turbine, solar hot water and solar panels along with 150,000 litre rainwater collection—and it's temperate all year round!

Underground or earth-covered homes have been around for as long as humans have been building shelter. In more modern times earth-covered homes have been synonymous with passive solar and sustainable building; after all, earth provides ample thermal mass.

Underground homes became popular in the seventies when the oil crisis shifted some people to more self-sufficient living, although some might see it as the abode of choice for those sheltering from the end of the world. Regardless of what people think about these homes (dark, cold and damp are some of the misconceptions) they actually suit the hot Australian climate well. And they are very resistant in a bushfire.

Coober Pedy is renowned for its under-the-ground living. With close to half of the town's 3000 residents living underground it's certainly the place to learn the art of subterranean building. This is where Troy Ryan first helped build a dugout, otherwise known as an underground home. With summer temperatures often over 55°C in Coober Pedy, underground homes probably help maintain sanity in the outback mining town. Troy liked the temperature stability and the 'organic building style of making a cave to live in' so much that he and his partner Keirstie built their own underground home in the Adelaide Hills.

The challenge was to build underground in a place with 890mm of annu-

Top left: it was all concrete blocks to start with. Bottom left: steel reinforcing added strength to the roof. Right: It's all in the load-bearing domes when it comes to earth-covered structures.

al rainfall and clay soil. With the help of Energy Architecture to develop the design, Troy and Keirstie "spent a quiet four years massaging the idea" before moving tonnes of soil out for the dwelling.

The initial brief was for the house to be cave-like, cheap to build—hopefully with the owners able to build it themselves—small, energy-efficient and ultimately a house for life.

The architects gave advice on the type of construction, room size and use and added some interesting design features. This includes having the front door on top of the building with a staircase winding down, which acts like a thermal chimney.

The architects were also pivotal in getting the design through council, which took about two years due to engineering concerns. An experienced friend filled the role of civil engineer. He was working on a freeway tunnel at the time, which was quite relevant to the underground home. He was able to borrow some fancy modeling software, which certainly helped with the overall design of the home.

Construction

The first step was to dig a big hole like a quarry. The slab was layed as normal but curved around the edges to suit the unusual shape of the building.

The house was constructed with hollow concrete blocks filled with concrete and steel reinforcing. The roof was formed with ferro-cement shell (cement render into chicken wire). Steel reinforcing was laid over the top then sprayed concrete was used to finish the

Earth covered and underground building types

Earth berming

The roof may, or may not be, fully earth covered, and windows and openings may occur on one or more sides of the home. Earth is piled up against exterior walls and packed, sloping down away from the house. The building is above ground, with fewer moisture problems being associated with earth berming in comparison to underground/fully recessed construction.

In-hill construction

Keirstie and Troy's house uses in-hill construction, which sets the house into a slope or hillside. The most practical application is using a hill facing north. There is only one exposed wall in this type of home, which is the wall facing out of the hill, all other walls are embedded within the hill.

Underground/fully recessed construction

The ground is excavated and the house is set in below ground level, as commonly seen in Coober Pedy.

structure. The roof includes a series of domes, which are able to hold more of a load compared to a flat roof. Flatter sections and windows are strengthened with concrete beams hidden in the earth layer.

Water proofing

A major consideration for earth-covered buildings is water proofing. The domed rooftop means that water drains well, and water protection was further assisted with multi-layer water proofing—a bitumen layer then a drainage layer then geo textile then earth. The drainage layer creates an air gap between the earth and concrete, reducing water pressure on the concrete. Troy says that small leaks have occurred since back-fill but they are just damp patches and don't leak for more than one winter. 'I believe small cracks in the bitumen layer either heal or fill with silt and seal,' says Troy.

Light and air

When Troy is asked if the house is dark he says that it is…"at night with the lights off."

It's a common misconception that earth-covered homes are dark, unventilated places. Well, if they're built without addressing the issue of light and air flow they can be. Plenty of north-facing windows in the main room and bedroom help bring in natural light. In fact, there are 17 metres by 2.4 metres of north facing windows at the front of the house. The second bedroom, bathroom and corridor all face a southern courtyard, enabling them to have opening windows and natural light. Troy sees windows as a thermal compromise. 'We have more than ideal but far less than most modern designs,' he says.

Internal courtyards are a common feature in earth-covered homes; they let natural light in because they are open to the sky. Any building designer or architect specialising in earth-covered homes will most likely include internal courtyards, particularly in the rear of the house. Indeed, some above-ground homes have internal courtyards too, allowing more light into dark areas. The front of an earth-covered home should be as illuminated as any home with good orientation.

The windows are not double glazed because they are louvres. Troy says this is less efficient, but that the thermal mass copes with the heat leakage and the louvres improve the air flow on a hot day.

Top: the front door can be seen at the very top, which doubles as a thermal chimney. Bottom: north-facing windows allow lots of natural light into the home.

Performance

The home works best in summer. With 15 days over 35°C last year the house proved to be a bit of a haven. The highest temperature was 27.5°C, with the average around 24.5°C. In winter the average temperature is around 17°C, ranging between 14°C and 19°C for most of the season. The building is heated by sunlight warming the thermal mass, plus three to four hours from a wood fire on most days. This also heats the hot water. "You can have the fire roaring and only put two degrees on the air temperature but it lasts," says Troy.

Renewable power supply

Troy builds solar systems for a living with his business Adelaide Hills Solar, so needless to say, this house has an impressive solar set up. To connect to the electricity grid would have cost from $50,000 to $90,000 so they opted to stay off the grid with solar and wind. The

solar system is 2.3kW and the wind turbine produces 1kW. The power system includes 48V, 600Ah gel batteries, 6kW inverter/charger and a (bio) diesel back-up generator.

The RAPS solar system is worth around $70,000 but is a good investment as it runs all appliances within the house, and importantly, the shed, which includes a car hoist, compressor, lathe and a mill. The household electricity use is around 4kWh per day while the shed and business use another 3kWh per day.

The household also gets by with a Solahart 150L solar hot water system with wood fire backup.

Water saving and recycling

Earth-covered homes do pose some difficulty when it comes to rainwater collection. After all, the roof is made from dirt. Rainwater is collected from the shed with the five tanks having a 150,000 litre storage capacity in total. There are also two dams on the property.

Waste water is treated by a reed bed, however with the household water use so low at 120 litres per day, Troy finds that the reeds consume most of the water rather than offering any for sub-surface irrigation. South Australian health rules mandate that a waste water system needs to be able to cope with 900 litres per day, yet the household uses nowhere near that amount of water. "Recycling water is energy and machinery intensive. Catch more and use less are both much easier in my opinion," says Troy.

As for what to do with all that natural roof space? Troy says it is good for cultivating a range of things including "wallaby grass and anything else that will survive summer without watering including kangaroos." ✻

Why go underground?

- Cool in summer, warm in winter
- Save on heating and cooling—no need for an airconditioner!
- Constructed of concrete so will last over 100 years
- Low maintenance
- More room for a garden on top of the house
- Stands up well in bushfires and can offer protection from a fire front.

The ultimate shelter

Why so few earth-covered homes in such a fire prone country? Paul Mitchell explains how even indoor temperatures can be an asset in a bushfire.

Most houses are lost in a bush fire by sparks and embers entering the roof space. This is caused by the extremely high wind-speeds generated by the flame front that can dislodge tiles and loosen iron roof sheets.

Gutters and eaves are other areas that allow sparks and embers to enter the roof space and need to be kept clear and airtight to be effective.

The many hundreds of degrees of radiant heat that the external walls are subjected to is also a factor. This heat can make the exterior of the house ignite if built of combustible materials. Windows not protected by shutters are exposed to flying debris and once the glass is broken, the outcome is obvious.

Earth-sheltered homes eliminate the traditional roof completely and minimise the external wall surface area, so the risk of fire entering the structure is considerably reduced.

The roof and rear walls are buried just below the surface so there is absolutely nowhere for sparks and embers to enter. With air-locks and roller shutters the risks to doors and windows is minimal.

Earth-sheltered houses have three major benefits—temperature stability, environmental sensitivity and hazard avoidance. It's this last aspect that we are concerned with in this article, but when looked at as a total housing concept the advantages of the earth-sheltered house are clear.

One of the less obvious advantages of an earth-sheltered home is that occupants are in a better position to implement their fire plan during a bushfire.

Because the air temperature within an earth-sheltered home, even during

Paul's earth-covered house with the protective spark-arresting air-lock at the entrance and co-ordinated designed roller shutters on the windows. These features make the house virtually bushfire proof.

a bushfire, is still at a comfortable 24 degrees, the occupants are more likely to be able to think and act calmly.

By eliminating the roof as a possible problem, the occupants can concentrate on the things that need their undivided attention such as doors and windows.

Are the shutters down and the door seals in place? Is the fire fighting pump and fire hose reel ready and checked? Have all loose and combustible materials been removed and properly secured. Is the battery radio operating with fresh batteries? Is the bath full of water? And so on…there is plenty to do at that critical time without having the added difficulty of being in a house that is stinking hot and uncomfortable.

If proper precautions have been taken beforehand it is safer to stay inside the house when the flames approach. Every time the door is opened the risk of ember entry is increased. A non-combustible spark-arresting air-lock is a very sensible partner to window roller shutters.

Preparation

We occasionally see images of home owners dressed in thongs and shorts, with a garden hose vainly watering down the garden and walls with flames fast approaching over the back fence.

This is obviously not a sensible approach, but is what most people will be faced with if proper fire planning and implementation is not done long before the event occurs.

Well-maintained fire-fighting equipment, appropriate access for fire crews and fuel load reduction are all things that can be done long before a bushfire is on its way.

Embracing the concept of an earth-sheltered home is probably the most effective long-term way of minimising the risk of losing your home to a bushfire.

Earth-covered tips

The concept may seem simple but there are pitfalls to the inexperienced that should be avoided.

The structure needs to be engineered properly because there are stresses involved that far exceed the traditional house construction.

The detailing of the drainage and waterproofing should embrace the best-practice methods and not be skimped on in any way. ✻

Paul Mitchell specialises in the design of earth-sheltered houses. Over the past three decades he has designed and built earth-sheltered houses for himself and for clients in three states. He now operates a design service called Shelter Space www.shelterspace.com or 08 83898181.

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DIY water-efficient garden bed

This garden bed is watered below the surface, saving lots of water during a long hot summer. John Hermans shows how it's done.

Our daughter Jill was keen to have her own organic veggie garden, but the rental property she moved into with friends had little to offer. The backyard was small and thick with couch grass. We built Jill some wicked garden beds, which can be dismantled and taken to her next abode when the time comes. It was a house warming gift. The whole household love it.

For those who are unfamiliar with the term 'wicked bed' it refers to any garden bed that has a waterproof membrane at its base, with a small amount of ponding potential around the edges. Effectively it's a large version of a plant pot, but with the drainage holes part way up the sides. It is sometimes referred to as a bucket bottom and works by bringing the plastic membrane up around the sides so that a pool of water can be retained. Water applied to the bottom of the bed will then wick up into the soil layers above.

This wicked bed system is the most water-efficient garden bed I am aware of. With a good layer of mulch over the soil surface water evaporation is minimal. All artificial watering is done by adding water to the bottom of the bed. Nearly all the water loss is via transpiration (evaporation from leaf surfaces) rather than evaporation via surface soil watering.

Benefits of this system include:

- The whole garden bed can be watered evenly by applying water (fresh or recycled) into the open end of a short 100mm PVC vertical pipe. This can be located at any point in the bed.
- Being wetter at the bottom and drier at the top, with a heavy mulch layer, weed germination and growth is minimised.
- It is the perfect way to recycle household water—just pour it down the 100mm priming hole.
- The garden bed can be placed very close to other water hungry vegetation, even large trees, and not lose a single drop of water to those competitors.

There are two reasons for encouraging home gardeners to use this system. One is the production of more homegrown fresh organic vegetables with minimal water use. The second reason is for productive food gardens to replace lawn. These extra garden beds can be placed directly over the top of any existing lawn area. Provided that adequate sunlight is available and the area is fairly flat, then time and effort are the only things stopping you from setting up such a garden. I have a strong desire to see more urban gardeners convert their manicured front lawns into low water use organic vegetable sites. We all need to be more passionate, more alternative and more radical in this modern age.

Guidelines

The entire area that the garden is to cover needs to be level, preferably to within 1cm. This is quite achievable with sieved sand and a builders level. The edges of the bed can be formed with any material such as sleepers, concrete blocks, rocks or planks and stakes, with the bottom membrane being drawn up the sides to the top of the edges. This is important because it minimises rotting timber if using sleepers.

The waterproof membrane can be made of cheap black polyethylene, otherwise known as 0.2 mm concrete underlay. This is commonly available in four-metre-wide rolls, allowing quite wide beds. This waterproof membrane needs to be protected from any piercing no matter how small. It should therefore be placed over a sieved sand layer or some other protective layer such as old woven produce bags or old newspapers.

A drainage hole needs to be cut through the plastic membrane around 5cm from the bottom for any excess

1. The site needs to be as level as possible, use a builders level to check.

2. Sleepers, rocks or concrete blocks can be used to frame the garden bed.

3. Drill a hole 5cm from the bottom to allow excess water out.

4. Put down the concrete underlay.

5. Place layers of newspaper over underlay to protect it from stone layer.

7. Shade cloth, used as a highly permeable water distribution layer.

6. Add a layer of stone or gravel.

8. Carpet underlay goes next.

9. Layer upon layer ...

water to escape—this prevents any of your treasured produce drowning. Those rare events of excessive rain may come again, and are not that uncommon further north. Use a short length of PVC pipe, any size around 25mm will do, and make the hole in the black plastic a bit smaller than the pipe diameter. The pipe can be forced through the plastic as an extended overflow coming through the wall of the garden bed.

On top of the carefully positioned plastic membrane, place some form of highly permeable water distribution layer. This can be sand or 20mm screened stone, but be careful if you use fresh crushed sharp stone as it could pierce the poly membrane. Use lots of newspaper or old woven produce bags to protect the black plastic. This aggregate permeability layer needs to be only 20 to 30mm thick if the lower black poly membrane is very level.

Ensuring the stone layer is level is even more critical, but easy to achieve. Once the black plastic and stones are laid down, fill the stone void space with

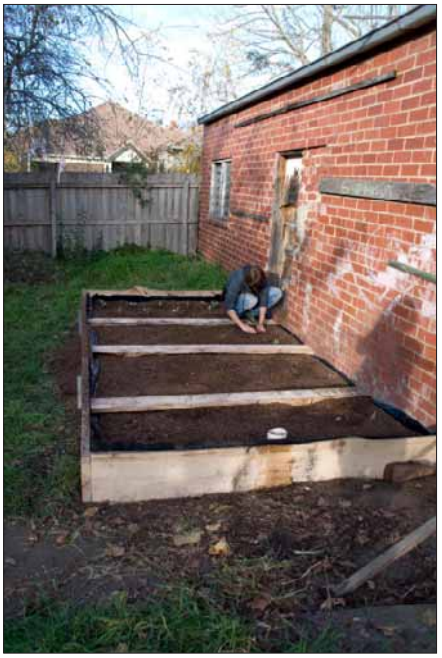
water. Simply use a rake or a one metre long old fence paling to drag the high spots into the low spots until the top of the stones are just above the water. This ensures that the entire bed is level and receives water in equal amounts.

Once the stones are level, lay down old carpet or carpet underlay to stop the soil from filling the void spaces in the stone layer.

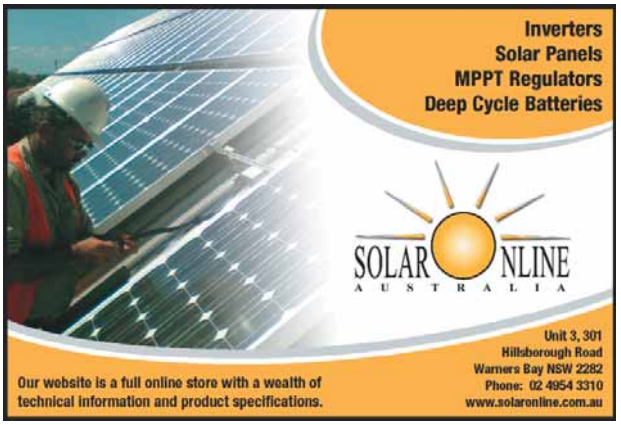
The soil can be any depth but over 20cm is preferable. More depth means extra nutrients for plants and less likelihood of piercing the lower membrane through gardening activity. And, you can grow longer carrots! The type of soil and mulch used and what you plant is up to you, but remember, the better the quality the better the veggies will look and taste. Go forth and garden.

10. Cut a hole 5cm from the bottom and insert 25mm PVC pipe.

11. This drainage pipe 5cm from the bottom lets out excess water, stopping the veggies from drowning in a downpour.

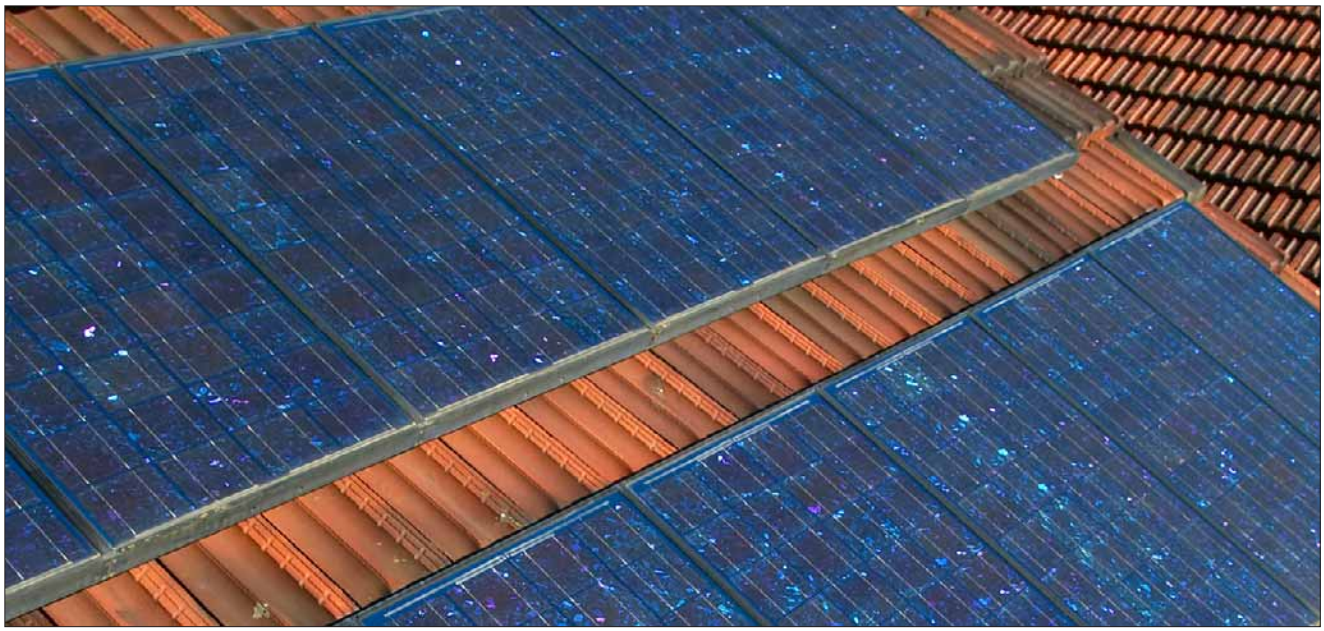


12. Add soil and plants. John recommends using a high quality soil and plenty of organic mulch.



Bulk buying: new ways to get solar on rooftops

Buying grid-connect solar with others to save money is gaining momentum. *ReNew* takes a look at what you should consider before signing up.



Noticed a few more homes in the neighbourhood with solar panels recently? Or maybe your place has recently made the switch, encouraged by generous federal government rebates and further discounts when buying with others. Some new grid-connect systems have been purchased as part of bulk buying groups. These groups can be organised by a company, a not-for-profit group, a community group or even the local council. The idea is that 10, 20 or 100 people all sign up to have solar panels installed at home. All banding together means that savings can made on the cost of installation and the panels, which can be shipped into the country by the container load.

Over the last twelve months *ReNew* magazine has received numerous questions about bulk buying schemes for solar. After all, with bulk buying bringing prices for 1kW systems down to one or two thousand dollars in some cases, interest in installing solar at home has soared. When the federal government solar rebate increased to $8000 in 2007 (or $8 per watt), a number of new companies emerged offering substantial discounts on the installation of solar systems. The catch was that the federal rebate would go to the company installing the solar system, hence, some new companies could sell systems for under $1000 in some cases, with the knowledge they would get $8000 from the government once the system was installed. Households earning over $100,000 can no longer get the rebate, yet bulk buying, for those who are eligible, is still going strong.

Bulk buying grid-connect solar systems is a unique practice that's arisen from generous government rebates. Here's what to consider before joining a bulk buying scheme.

What type of panels and inverters are being used?

One system doesn't suit all. Bulk buying generally works on the premise that one type of solar panel is imported by the container load. Without this there are no big discounts. If your roof is too small for the larger monocrystalline solar panels, the type heavily favoured in bulk buying schemes, then what are your options? Are smaller panels eligible? Also, can amorphous solar panels be used instead as part of the bulk installation or is this beyond the offer?

It's also important to know the brand

of solar panel and inverter being installed. Just like buying a new television, it's important to find out who made the solar panels that will hopefully operate successfully for the next 30 to 40 years. Some brands perform better than others. Similarly, the inverter, which converts solar electricity into 240 volt mains power, is an essential component that needs to last for many years. If the company selling the solar system can't tell you what type of panels and inverter are to be installed, take your business to a company that will.

How long will the installation take?

Organising a large group of households can take some time. Waiting for container loads of solar panels to arrive from overseas can also cause delays. Some companies say that installation will occur within six months of the government Solar Homes and Communities Plan rebate being approved. At the moment the standard wait for the rebate is ten weeks; add six months to this and the wait could be over eight months.

Not all bulk buy schemes are prone to long waits. The City of Darebin Solar Panels for Electricity Offer suggests that installation could commence within four months of registration. Rebate approval is included in this estimate, however, delays in rebate approval can always push out schedules.

Some bulk buying models, although selling systems for one or two thousand dollars, require the household to cover the $8000 rebate upfront as well. The household is reimbursed by the government after the system has been installed. In this scenario it is imperative to know how long you might be out of pocket, so ask for a schedule.

Installers usually carry the financial risk associated with the rebate, that is, they pay the $8000 and then recover that from the government in the form of the rebate after installation. You are never out of pocket.

Is the company/installer reputable?

It's best to sound out a company's reputation before handing over your hard earned cash. Have they successfully delivered installations before? What happens if they go out of business? If they go out of business who will you consult if there are problems with your system? Will your money be refunded if your system is not installed? If the bulk buy is being negotiated by a council or community group, check that you are comfortable with the supplier they have selected.

Check that the scheme uses Clean Energy Council accredited installers. Is there an employee from the company that you can speak to, or are all your negotiations through a local neighbourhood rep? The rep or organising committee will undoubtedly do their best, but may not offer the same level of technical advice as an accredited installer.

What about warranty?

Check what type of warranty comes with the installation, the solar panels and the inverter. Compare it to warranties offered by other businesses, be it those offering bulk buy or just a regular solar package.

Can I keep my RECs?

Sometimes the cheaper price for the solar package is based on the householder assigning the Renewable Energy Certificates (RECs) to the retailer. RECs are a type of currency applicable to residential devices such as wind turbines or solar panels that generate renewable electricity. Find out how much the system costs if you decide to keep the RECs; keeping RECs offers the greatest greenhouse benefit.

If the bulk purchase you are signing up to doesn't allow the householder to retain RECs, explore options that do. Most should allow the householder to keep their RECs, although at a higher installation cost.

The City of Darebin Solar Panels for Electricity Offer encourages householders to hold on to their RECs, as stated in the information package given to prospective solar households:

'When RECs are generated and sold after installation of your 1kW solar PV system, they are then counted towards the target of the Federal Government's Mandatory Renewable Energy Target (MRET). The MRET requires an amount of electricity to come from renewable sources. This effectively means that someone else owns the greenhouse benefit of your solar PV system. By keeping or "surrendering" your RECs, your system is not counted towards the MRET and therefore someone else must install a renewable energy service. Thus, keeping or surrendering RECs encourages the growth of renewable energy, reduction in GHG emissions and care of the environment. You retain full ownership of the greenhouse benefit of your solar PV system.'

For more information on buying or keeping RECs see *ReNew* 105.

Can you organise your own buying group?

Yes, if you have the time and energy. Inevitably, there should be a central organising committee or individual to handle the administration. One not-for-profit Brisbane-based buying group, Local Power, signed up 150 households for solar electricity. They are using a well-known brand of solar panels with a 25 year warranty.

Sustainable Maleny community group took the plunge and organised their own group buy. The actual parts and installation is being organised by a

local renewable energy business.

As mentioned, some councils also offer bulk purchase solar electricity for residents. A buying group organised by a council gives people reassurance that they have somewhere to go if things go wrong, with council employees managing the process.

How long will the federal SHCP rebate last?

With the discounted bulk purchase prices heavily dependent on the government rebate, there's some debate about what happens if the rebate runs out. Many bulk buying groups recommend people sign up asap in case the rebate disappears. Check where you should go for system faults should the business you bought from close shop at the end of the rebate.

When the rebate increased to $8 per watt in 2007, twelve months of allocated funding was spent in the first eight months, leaving the government to draw on future years' funding. The signs were there that the popularity of the rebate could be its undoing. The means test was introduced last May to lessen demand, yet the very cheap 1kW systems offered by bulk buying solar groups means demand for the rebate has continued to soar. According to Alternative Technology Association Energy Policy Manager, Brad Shone, the entire $150 million allocated for three years of the program has already been spent.

No one knows how long the rebate can keep going in its current form, with speculation that the rebate could be replaced with feed-in tariffs (payment for each kilowatt-hour of electricity supplied to the grid), which is fortunate for those who got in early to purchase their solar panels.

Are there any hidden costs?

As mentioned earlier, some companies need the householder to cover the rebate for several months. If a loan is needed to do this, watch out for interest.

The advertised cost also might not cover the cost of supplying a new power meter, which is usually between $200 and $300. A new meter is essential to export electricity to the grid. There can also be extra costs for the electricity provider to connect the system to the grid.

Most advertised prices cover 'standard installation'. Anything that's not standard will incur extra costs, such as tiled roofs, double storey homes and extra work to guarantee correct solar orientation. ✻

How to use solar hot water *well*

It may come as a surprise, but solar hot water can still drive your bills up. Chris Mills shows how to get that solar hot water system working efficiently.

When discussing home energy use, many people think that solar water heating is free. Every solar hot water system, properly installed, reduces energy bills. Yet, if the system is boosted with off-peak electricity, then the savings fall way short of those from a well-managed system. Here's why, and how you manage your system to avoid this problem.

Let's use a typical household situation to illustrate. It's a fine and sunny day and the water in the solar hot water system is a piping hot 75°C. As the day draws to a close three people in the household each have a shower, a toddler has a bath and the dishwasher cleans the day's dishes—all from sun-heated water. The solar tank temperature drops to an average of 30°C, but as hot water is lighter and floats at the top of the hot water tank, nobody notices. At 11pm, after everybody is in bed, the off-peak hot water booster kicks in, heating the tank to the thermostat set temperature of 65°C. For a 300 litre tank, this requires about 12 kWh of electricity! The graph shows that the more people who shower, and the longer the showers, the more electricity (and cost) is required to bring the solar hot water tank back to the temperature set by the electricity booster.

Next morning the water is nice and warm as before. The only puzzle is when the electricity bill arrives. The home owners scratch their heads and say: 'But we are very careful with electricity, how can it possibly be this high?' The answer is that, silently in the middle of the night, the 'power saving' solar hot water system has consumed a large amount of electricity.

Here is an alternative. It's the same scenario, but with two small differences. At the meter box, the switch marked 'Solar Hot Water Booster' is turned off. Everybody has their evening showers and baths and the dishes are done, but in the morning no hot water is used. During the day, the sun shines and the solar hot water system captures the solar radiation to bring the water back to 70°C. This pattern repeats and as long as the sun shines regularly, everybody's showers will be as warm as they like.

The perfect energy roof. It faces due north at an angle of 36 degrees, the same as the latitude in Mallacoota. The 'Black Chrome' Solahart was installed in 1998 and has worked perfectly. The BP Solar 1550 watt system is producing up to 10.3 kWh per day. This was Mallacoota's first grid-interactive solar system.

An eye on the sky

In cloudy weather, how can the solar hot water system be managed to ensure everybody has a warm shower, and electricity consumption is minimised? The simplest rule is to be a 'cloud forecaster'. If less than three hours of solid sunshine is forecast, then turn the solar hot water booster on at the meter box. If the water is nice and warm at the end of the day and the next day is forecast to be sufficiently sunny, turn the solar booster switch off. If solar hot water management becomes popular, we could ask our weather forecasters to include the 'solar-sun' prediction in their daily report.

There is some relief to this management regime. Most off-peak power times include the entire weekend, so the solar booster switch should always be off over the weekend, regardless of the weather conditions. If a quick test shows the water temperature is too low for a comfortable shower, turn the booster on, wait for an hour or so, and try again. The 'recovery rate' of the water temperature depends on the power of the booster and the size of the tank,

so a bit of experimentation is required. Don't leave the solar booster on until the thermostat cuts it off, typically at 65°C, as this may be far more hot water than you need. A comfortable shower is around 40°C and 40 litres of water; you don't need the entire tank full of 65°C water. Some experimenting will soon find the right mix.

If you shiver at the thought of a cold shower, there is another option called the 'one shot' button. This is a timed booster that can be run at any time be it peak or off-peak. Typically, it will be a 30 minute timer that bypasses the off-peak connection and provides power to the heating element. The button can be installed anywhere convenient (such as the bathroom) and need not be inside the meter box. This is a sensible option for new installations, and one that can be added to an existing system. The 'one-shot' will heat until either the time is up, or the thermostat set temperature is reached, depending on whichever comes first.

Winter/summer demand

Winter and summer create quite different demands for hot water. In the cooler winter, an evening shower can be sufficient, but if nights are hot, a morning shower is a great refresher. If evening hot water usage is kept to a minimum then the morning shower will range from normal to tepid. As long as the chill is removed, this can be a great way to start a summer's day—without using any electricity.

Once the household is attuned to the way water is heated by solar power and electrical boosting, even more savings are possible, especially for washing dishes and clothes. The dishwasher typically requires water at 55°C, so if it comes from the hot tap below this temperature, the dishwater heats it—often using expensive peak power. One answer is to wash dishes when the solar heated tank

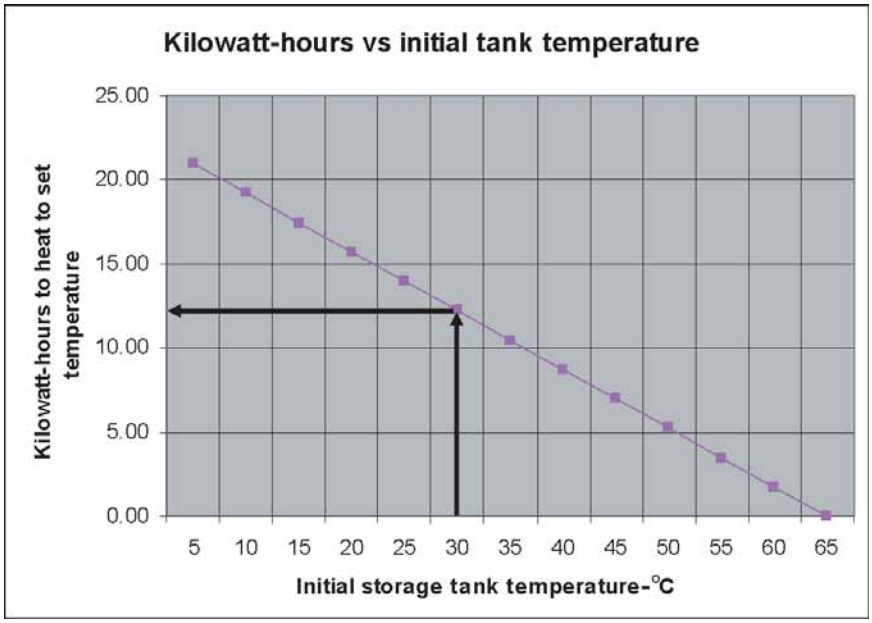


Figure 1: kilowatt-hours of electricity to heat a 300 litre tank.

is above 55°C. For working households this is more difficult, but if the dishwashing can be delayed until the sun heats the water, then the heating is free. If hot water is necessary for clothes washing, time the wash when the sun has fully heated the solar system, and it has had time to heat the washing water used. Some clothes washers use large amounts of water, so on a sunny day, washing at about 11am will give a hot wash and a fully recharged hot water tank.

When the next generation of smart electricity meters are released, smart solar management of hot water generation could become automatic. Regional forecasts would program smart meters to select electrical boosts only when necessary. Imagine how much electrical power could be saved across Australia with such a simple innovation? Here is a rough estimate: if smart-solar saves 5kWh per day for 300 days in 1 million households, and the conversion factor is 1kWh = 1kg of CO_2 emissions, then the equivalent annual saving is 1,500,000 tonnes of CO_2 emissions. That's a lot of gas folks!

So, if showers, dish and clothes washing can be scheduled and the household become experts in weather forecasting, a simple flick of a switch in the meter box can save huge amounts of electricity, money and greenhouse gas production. And with a simple 'one-shot' booster added to your system you can save electricity and never risk having a cold shower. ✻

Solar water heater buyers guide

Need a new hot water system and have decided it's time to go solar? We take a look at how solar water heaters work, the types available and how to choose the one to best suit your needs.

There are many reasons to choose a solar hot water system over a conventional gas or electric unit. Probably the most important benefit is that of greenhouse gas emission reduction. A solar water heater can reduce the greenhouse emissions of an average family by as much as four tonnes of CO_2 per year—the equivalent of taking a car off the road!

This benefit has been recognised by many state and local governments and is encouraged in the form of rebates. These vary from state to state, but can save you a great deal on the cost of a solar water heater, making them more economically viable. The initial purchase price will probably still be higher than a similarly sized non-solar water heater but the savings made in operating costs will generally pay for this difference in less than 10 years—in as few as four years in some cases. A solar system generally has a longer lifespan than a conventional unit, so financial returns can be considerable over the life of the system.

Photo: Genersys Solar Australia

The water tank doesn't need to be on the roof with a solar hot water system. Split systems are becoming more popular.

How does it work?

A solar hot water system usually consists of a hot water storage tank connected via pipework to solar collector panels. These collector panels are placed on a north facing roof and at an angle of no less than 15° to the horizontal. The tank can either be situated immediately above the panels on the roof, above and a small distance away from the panels within the roof cavity, or at ground level, in which case a pump is required to circulate water through the panels.

As the sun shines on the collector panel(s) the water in the pipes inside the collectors becomes hot due to conduction from the collector plate. This heated water rises through the panel and out through a pipe to the insulated storage tank. Cooler water from the bottom of the storage tank enters the panel at the bottom to replace the warmer water.

This is called the thermosyphon process, requires no pumps or other devices and is very simple and effective. However, it does require that the storage tank be situated above the collector panels.

The collector panel is the driving force for the circulation, so due care must be taken with its mounting and orientation to get maximum benefit from it.

If the tank cannot be located above the collectors, a pump and a differential temperature controller must be used to provide water circulation. The controller also turns the pump on when the temperature drops to 5°C as a frost protection function.

Some systems don't heat the water directly but instead heat a fluid similar to antifreeze used in vehicle cooling systems. This fluid flows through a closed loop system (through thermosyphon or pump action) and transfers the collected heat to the water in the tank via a heat exchanger.

Collectors

Most solar water heater collector panels consist of a collector plate to which a network of pipes is bonded. This arrangement is then placed in a metal box with insulation behind it and a glass cov-

er on the top.

The collector plate is usually copper or aluminium, however Solahart uses mild steel for most of its models. This plate is coated with special treatments to increase the absorption of the solar heat energy.

Bonded to this plate are copper pipes, or, in the case of the Solahart, steel collectors formed into many small channels. In all cases these pipes or channels are connected at the top and bottom to header pipes which also provide the connection points to the external pipework.

A recent new entry into the market is the evacuated flat plate collector from Genersys Australia. These are similar to a regular flat plate collector except that the space between the collector surface and the glass has the air removed and replaced with krypton gas. This is said to improve cold weather performance.

Most manufacturers are now using low-iron tempered glass in their collectors for its greater absorbency and reduced re-radiation. It is also stronger than normal glass.

In the last few years another type of collector has started to appear on the Australian market. These are known as evacuated tube collectors. In simple terms they consist of two glass tubes (one inside the other) made of borosilicate glass (the same glass used to make laboratory test tubes) which are bonded to each other at each end to form a sealed space between them. The surface of the inner tube is coated with a heat-absorbing coating, just like flat panel collectors.

The space between the two tubes has most of the gas removed from it (hence they are evacuated), which provides a high level of insulation. As solar radiation passes through the outer glass tube and heats the inner tube, it is trapped by the lack of gas, which would otherwise allow convective and conductive heat losses. As a result, the efficiency of these collectors is higher than flat plate collectors and evacuated tube collectors will even perform well on cloudy days.

GreenLand Systems have a different design of evacuated tube. Instead of an inner glass tube, the outer glass tube is bonded directly to the inner copper tube which is attached to a heat absorbing plate. A closeup of this new tube design can be seen on page 44.

Tanks

For mains pressure systems the tank must be strong enough to hold pressures of 1000kPa and above. This means they must be made of steel. Some companies use marine-grade 316 stainless steel while others use mild steel with a coating of vitreous enamel (glass). Solahart and Rheem use glass-lined tanks.

Glass-lined tanks must have a sacrificial anode fitted (a metal rod inside the tank, usually made from magnesium or aluminium) which is designed to be eaten away by galvanic (corrosive) action in preference to the tank material. These anodes should be checked at regular intervals to assess wear and be replaced if required; with good quality water this replacement time may be every five to seven years. If the water quality is poor then the replacement time will be much shorter. Failure to replace the anode when required will generally result in premature failure of the tank.

Sola-Kleen makes its tanks from copper and runs them at a reduced pressure using a pressure reducing valve on the inlet. This has the advantage of better supply pressure than a gravity-fed system while still giving the corrosion resistance and extremely long life of a copper tank.

Low pressure, gravity feed and constant pressure systems are all very similar and usually use copper tanks. These tanks are placed in the roof and are open vented. Being open vented allows them to be directly connected to the heat exchanger on a wood stove. They are suitable for most water conditions and give many years of service before failure, usually due to corrosion or failed seams. A heat exchange coil can enable a low pressure tank to deliver mains pressure hot water.

Mains pressure tanks can be set up as gravity feed systems by adding a header tank. This may be desirable where there is no available roof cavity but the incorporation of a combustion stove for boosting is planned.

Insulation

Mains-pressure tanks are usually insulated with polyurethane foam. The normal industry standard foam is CFC free. Some manufacturers build the horizontal tank such that the insulation on the top is thicker than on the bottom, which makes a lot of sense considering the hottest water is at the top of the tank.

Boosting

All heaters on the market incorporate some form of boosting for times of insufficient insolation (sunshine). People on remote area power supply (RAPS) systems use wood stoves or LPG for boosting. Townsfolk have the option of natural gas or electricity.

Electric elements are the most common, as they fit in well with night rate tariffs and are much cheaper to fit. If you opt for electric boosting and plan to buy accredited GreenPower, make sure that your night rate electricity is also GreenPower.

Gas burners and control equipment cost much more than an electrical element and this is reflected in the price of the systems. Environmentally, gas is preferable to coal-fired electricity, but not all systems have the ability to override the gas during the day so that the sun, not the gas, heats the water.

A solution to this problem is an in-

stantaneous gas booster. This type of heater can be installed between the outlet of a solar system and the rest of the hot water plumbing. It will contribute any additional heating required for the volume of water actually being used. Instantaneous heating may, however, require a higher capacity gas line as it burns a lot of gas to heat water quickly. Solar compatibility requires the booster to be able to operate with a low temperature differential between the hot water coming in from the solar system and the final hot water temperature desired at the taps. Some instantaneous heaters are now designed specifically for solar boosting.

Frost protection

All manufacturers offer frost protection on at least some models. This is important for anywhere that a frost may occur. One system involves dump valves which open when the temperature drops to around 4°C. As warmer water from higher in the system passes out through the valve it closes again. This process is repeated until the temperature rises again.

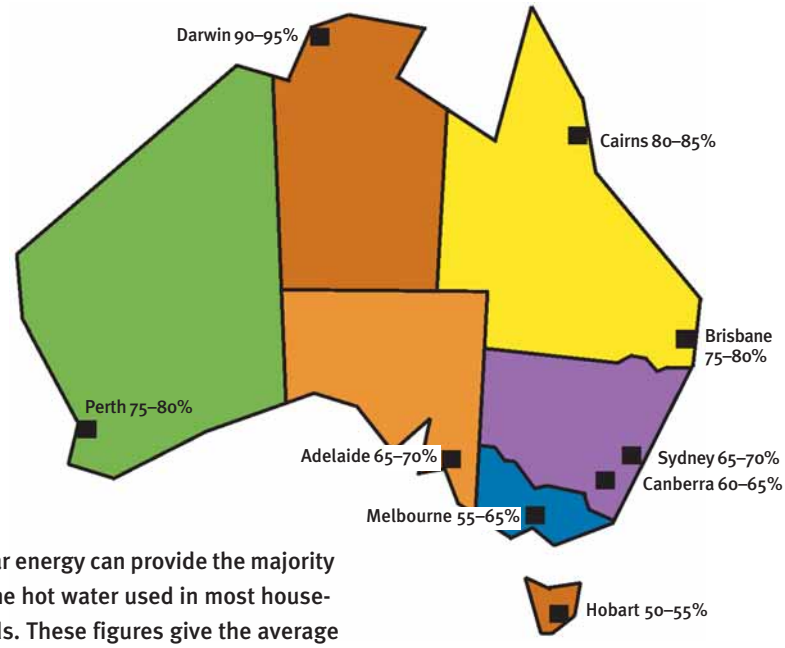
Many systems now use a heat exchange fluid which flows through the panels and into a heat exchanger in or around the main storage tank. The fluid in this outer circuit contains propylene glycol (or a similar glycol), an antifreeze additive, and does not require dump valves. However the level of fluid in this circuit must be checked regularly and replaced after an interval as recommended by the manufacturer. This fluid is more slippery than water and has been known to slip right out through the panel connectors. Owners should look out for this and replace the seals and fluid before irreparable damage is done to the collector panel.

What size will I need?

Systems are usually sized the same way as off-peak electric hot water systems, as they have a similar window of access to the booster, be it the sun or off-peak electricity. The sun is most effective during the six hours in the middle of the day. Night-rate tariffs commonly run for six hours, from 1am until 7am. Check with your electricity retailer if you are not sure.

For a one or two-bedroom house a 180 litre system is recommended. For a three-bedroom house a 300 litre system is desirable. Four to five bedroom homes should have a 440 litre system. This sizing looks at the potential maximum number of residents rather than the actual number, as the hot-water service is a fixture in the house but the residency can easily change.

We should briefly mention combined systems, which supply both potable hot water and hot water for hydronic space heating. These use much larger tanks and usually contain independent heat exchange coils for the different uses. An example of such a system can be seen in *ReNew 95*.



Solar energy can provide the majority of the hot water used in most households. These figures give the average annual solar contribution of a correctly sized flat-plate collector system.

What about heat pumps?

A heat pump is a process used in refrigeration where heat is moved, or 'pumped', from one medium into another. Air conditioners and refrigerators are the most common forms of heat pumps. In a refrigerator we pump heat from the food and dump it to the air outside the fridge through the coil at the back.

Heat pump water heating systems pump heat from the air and dump it into the water storage tank. They are very efficient heaters, having a coefficient of performance (efficiency) of around three (for every unit of electricity used, they move three times this much energy into the water), although some can be considerably more than this. It is possible to put your heat pump system on a timer so that it only runs during off-peak periods so it will be cheaper to run. Alternatively, it can be run only during the day if the compressor noise

is a problem for you or your neighbours.

In situations where shading is a big problem for conventional systems, and drastic tree surgery is not an option, then heat pumps deserve strong consideration.

Temperature control

Under the plumbing code AS3500.4 it is a requirement that all water heaters connected to an uncontrolled heat source (solar collectors and wood stoves) must have a 'tempering' valve fitted. This valve limits the maximum temperature for hot water to sanitary fixtures (bath, shower and hand basin) to a maximum of 50°C by mixing cold water with the hot water coming from the solar water heater.

Installation

The installation of any system should be carried out by appropriately qualified and experienced tradespeople. Unfortunately, too many systems have been badly installed in the past, resulting in poor performance and a loss of faith in solar water heating technology by the owners. Solar hot water systems work brilliantly if properly sized and installed. For more information on accredited installers, contact your state government energy advisory centre.

Getting the most out of your system

To optimise the performance of your system, hot water usage should occur in the morning as much as possible. This means showers in the morning and possibly putting on a load of washing (assuming you use hot water), as well as the dishwasher (if you have one) before going to work. This way the sun has the first go at heating the water before the booster kicks in at night. If the sun has done its job well the booster may not be required. *

Evacuated tubes are becoming more popular due to their better performance in cold and cloudy conditions compared to flat plate collectors. This new design from Greenland Systems is different from most evacuated tubes in that it doesn't have an inner glass tube, but instead has a metal tube and collector plate arrangement with a selective coating to improve heat collection efficiency.

Retrofitting existing systems

It is possible to retrofit an existing electric storage hot water system to use solar heating, providing it is in good condition (five years old or less). For a ground level mains pressure system, a special fitting can be installed on the cold water inlet. A pump circulates water from the bottom of the cylinder to the solar collectors. The hot water is injected through a small diameter pipe back into the cylinder and rises (by convection) to the top of the cylinder, where it is drawn off for normal use.

A controller switches the pump on whenever the solar collector(s) are hotter than the water in the bottom of the cylinder, as well as in near freezing weather to prevent the water in the collectors from freezing, which would otherwise damage the collector.

Gravity feed cylinders in the ceiling can have solar collectors connected to them, as long as the cylinder is above the collectors. If there is not a pair of unused connections available on the cylinder, an extra pair can be attached by a competent installer in about two hours. Combustion cookers used for hot water are also attached in this way, but it is not a good idea to connect a combustion cooker and solar collector pipes to the same cylinder outlets.

It is not really advisable to connect solar to gas storage hot water systems because they are designed for the gas to reheat the water as soon as some is used, so the sun can't really contribute any heat. However, the Aquamax system is designed to have solar collectors fitted if desired.

There are tank retrofit packages available that include the collectors, pump and controller such as the kits from Albury Consolidated Industries.

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Solar hot water rebates

There have been quite a few changes to the various state rebate schemes since our last solar water heaters guide. Below we have outlined what rebates are still available, how much they are, and how to get more information. The federal government scheme, Renewable Energy Certificates (RECs) still applies to solar water heaters and is available in all states. RECs are applicable to all installations of solar water heaters in new buildings.

Australian Capital Territory

No additional rebates are currently available in ACT.

New South Wales

The New South Wales government offers a rebate of between $300 and $1200, depending on the size and type of five star, solar or heat pump hot water system installed when replacing an existing electric hot water system. This rebate expires on 30th June 2009 and applies to solar and heat pump hot water systems with a minimum of 20 RECs.

Northern Territory

No additional rebates are currently available.

Queensland

No additional state rebates are available for solar and heat pump systems.

South Australia

The South Australian Government's Solar Hot Water Rebate Scheme will now target low income households to help them comply with new water heater performance standards effective from 1 July 2008. The new standards aim to increase the uptake of high-efficiency gas, heat pump and solar water heaters. A $500 rebate will be available to applicants who meet the eligibility criteria. For more information go to www.sustainable.energy. sa.gov.au/rebates_and_grants/solar_hot_water

Tasmania

No additional state rebates are available from the Tasmanian Government. On a local basis however, Hobart City rate payers may be eligible for a rebate after installing a solar hot water system. Anyone outside the boundary of Hobart City council is ineligible. The rebate is for a maximum of $500.

Victoria

There are currently two Victorian state rebates on offer—one for metropolitan Melbourne systems and the other for regional Victorian installations. These rebates are available as a point of sale discount only. The metropolitan Melbourne rebate ranges between $900 and $1500 depending on the size of the system and its performance (i.e. solar contribution). This rebate is offered on eligible systems until 31 December 2010. The regional Victoria rebate ranges between $1900 and $2500 depending on the size of the system and its performance. This rebate is offered until 31 December 2010.

Western Australia

'Subsides are available for up to $500 for natural gas-boosted solar water heaters and $700 for bottled LP gas-boosted solar water heaters used in areas without reticulated gas are available. For requirements, see www.sedo.energy.wa.gov.au/pages/subsidy.asp

More information

For the most comprehensive information on all solar hot water government rebates go to www.hotwaterrebate.com.au

Renewable Energy Certificates

Owners of eligible solar and heat pump water heaters can create and sell renewable energy certificates (RECs), or can assign their right to create RECs to an agent, usually the water heating system supplier, in exchange for a discount on the purchase price of the system. However, there can be some negative aspects associated with giving up your RECs. See *ReNew 105* for more details.

Each REC is equivalent to one megawatt-hour (MWh) of energy consumption saved compared to an electric water heater.

To be eligible for this scheme all solar hot water systems are required to be certified to Australian Standard AS2712:2002 for design and manufacture.

Owners can create RECs themselves through the REC Registry website at www.rec-registry.com. A list of registered agents can be found at the ORER website at www.orer.gov.au/publications/agents.html

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Make	Model	Capacity (litres)	Type	Tank material	Insulating material	Total collector area (m²)	Number of collectors	Collector material	Glass type	Boosting	RRP	Comments	Warranty
Apricus Australia Pty Ltd ph:1300 277 428 www.apricus.com.au	Apricus failed to provide updated data for the guide. For previous data, please see the table in *ReNew 97*.												
Aquamax Pty Ltd ph:1800 676 000 sales@aquamax.com.au www.aquamax.com.au	Aquamax failed to provide updated data for the guide. For previous data, please see the table in *ReNew 97*.												
BP Solar Pty Ltd ph:1800 802 762 www.bpsolar.com.au	D3T136W2AC	322	Open circuit, split system, mains pressure	Vitreous enamel lined mild steel	Polyurethane	4	2	Copper	Low iron	Electric	POA	Includes system frost protection and tempering valve	10 years on collector and tank
	D4T136W2AC	415											
	D1FNP3W2AC	170								Natural Gas		Includes system frost protection and tempering valve, first hour delivery 305 litres	5 years on collector and tank
Chromagen Pty Ltd ph:1300 367 565 info@chromagen.com.au www.chromagen.com.au	8202VOBP10G20	200	Split System	Vitreous enamel lined, low carbon mild steel	Polyeurethane	4	2	Copper	Low iron tempered	Continuous flow gas	$4,800.00	-	7 years
Conergy www.conergy.com.au Ph 1300 551 303	AS250/25/O/EXX/E25BC	250	Mains pressure, open circuit, split system	Vitreous enamel lined mild steel	Polyurethane Foam	2.5	1	Copper water ways	Toughened Solar Safety glass	Electric or gas, depending on model	POA	Collectors only on roof with storage tank at ground level	Either 5 or 10 years
	AS250/4/O/EXX/E20SB	250				4	2						
	AS315/25/O/EXX/E25BC	315				2.5	1						
	AS315/4/O/EXX/E20SB	315				4	2						
	AS315/5/O/EXX/E25BC	315				5	2						
	AS315/6/O/EXX/E20SB	315				6	3						
	AS400/4/O/EXX/F20LC	400				4	2						
	AS400/5/O/EXX/V/E25BC	400				5	2						
	AS400/6/O/EXX/E20SB	400				6	3						
	AS250/25/C/EXX/E25BC	250	Mains pressure, closed circuit, split system			2.5	1						
	AS250/4/C/EXX/E20SB	250				4	2						
	AS250/6/C/EXX/F20LC	250				6	3						
	AS315/25/C/EXX/E25BC	315				2.5	1						
	AS315/4/C/EXX/E20SB	315				4	2						
	AS315/5/C/EXX/E25BC	315				5	2						
	AS315/6/C/EXX/E20BC	315				6	3						
	AS400/4/C/EXX/F20LC	400				4	2						
	AS400/5/C/EXX/V/E25BC	400				5	2						
	AS400/6/C/EXX/E20SB	400				6	3						
	TS180/2/O/V/E24/E20BC	180	Mains pressure, open circuit, roof mounted thermosyphon system			2	1					Thermosiphon system - both the tank and collectors are coupled on roof	
	TS300/25/O/E24/V/E25BC	300				2.5	1						
	TS180/2/C/V/E24/F20LC	180	Mains pressure, circuit circuit, roof mounted thermosyphon system			2	1						
	TS300/25/C/E24/V/E25BC	300				2.5	1						
	250/HP/S	250	Mains pressure split system heat pump			N/A	N/A	N/A	N/A	N/A	POA	Heat pump module and tank can be separated	2 years
	315/HP/S	315											
	400/HP/S	400											
Douglas Solar ph:(03) 9764 8433 david@douglassolar.com.au www.douglassolar.com.au	DS 250 17	250	Mains pressure, split system	Stainless steel	Polyurethane	4	2	Copper with CSIRO nickel black surface coating	Toughened glass	Gas	POA	Australian made	10 years
	DS 250 21	250											
	DS 315 21	315											
	DS 315 26	315											
	DS 250 E	250								Electricity			
	DS 315 E	315											
Dux Hot Water ph:1300 365 116 www.dux.com.au	D2F136W2AC	259	Split system	Vitreous enamel lined mild steel	Polyurethane	4	2	Black Chrome selective surface	4mm Low iron	Electric	POA	Open Circuit	5 years
	D3F136W2AC	322				4	2						
	D4F136W3AC	415				6	3						
	D2FN26W2AC D2FN26W2BC	259				4	2			Natural gas		Open or closed circuit	5 years
	D2FL26W2AC D2FL26W2BC	259				4	2			LPG			
	D3FN26W2AC D3FN26W2BC	322				4	2			Natural gas			
	D3FL26W2AC D3FL26W2BC	322				4	2			LPG			
	D4FN26W3AC D4FN26W3BC	415				6	3			Natural gas			
	D1FNP3W2AC	170				4	2					Open circuit	
	D2FH00000C	259	Compact heat pump			-	-	-	-	-		-	

Make	Model	Capacity (litres)	Type	Tank material	Insulating material	Total collector area (m^2)	Number of collectors	Collector material	Glass type	Boosting	RRP	Comments	Warranty
EcoSmart Hot Water ph:133 326 www.ecosmart.com.au	E2F136W2AC, E2T136W2AC	259	Split system	Vitreous enamel lined mild steel	Polyurethane	4	2	Black Chrome selective surface	Low iron	Electric	POA	Open or closed circuit	5 or 10 years
	E3F136W2AC, E3T136W2AC	322				4	2						
	E4F136W2AC, E4T136W2AC	415				4	3						
	E4F136W3AC, E4T136W3AC	415				4	3						
	E2FN26W2AC	259				4	2			Natural gas			5 years
	E2FL26W2AC	259				4	2			LPG			
	E3FN26W2AC	322				4	2			Natural gas			
	E3FL26W2AC	322				4	2			LPG			
	E4FN26W2AC	415				4	2			Natural gas			
	E4FL26W2AC	415				4	2						
	E1FNW2AC	170				4	2					Open circuit	
	E2FH18000C	259	Compact heat pump			-	-	-	-	Electric		-	
	E1F124W1CC	180	Close coupled	Stainless steel		2	1	Black Chrome selective surface	Low iron	Gas or electric		Open circuit	10 years
	E3F124W2CC	330				4	2						
Endless Solar ph:1300 889 585 info@endless-solar.com www.endless-solar.com	EB-160-E-10	160	Mains pressure, split system, pump assisted, evacuated tube	Marine grade stainless steel	Polyurethane	1.77	10 tubes	Evacuated tube with copper heat pipes and stainless steel framing	High impact resistance borosilicate glass tubes	Electric (3.6kW standard)	$3,434	Frost protected to -15°C. Very effective in winter and colder climates (does not require glycol)	10 years on major components
	EB-250-E-22	250				3.69	22 tubes				$4,086		
	EB-315-E-30	315				4.97	30 tubes				$4,767		
	EB-315-E-40	315				6.74	40 tubes				$5,605		
	GB-250-21NG-22	250				3.69	22 tubes			Natural Gas (LPG option also available)	$5,784		
	GB-250-21NG-30	250				4.97	30 tubes				$6,256		
	GB-315-21NG-30	315				4.97	30 tubes				$6,466		
	GB-315-25NG-30	315				4.97	30 tubes				$6,622		
	GB-315-25NG-40	315				6.74	40 tubes				$7,460		
Edwards Solar Hot Water ph:(08) 9351 4600 www.edwards.com.au	L180-1	180	Mains pressure close coupled. Suitable for non-frost areas	Stainless steel	Polyurethane	2	1	Australis Series 2 or Titan Series 2	Low iron tempered	Electric	POA	Australis collector: aluminium with copper tubing. Titan collector: titanium coated copper with copper tubing	6 or 10 years on cylinder depending on system
	L305-2	305				4	2						
	L440-3	440				6	3						
	L180-1 GS	180				2	1			Instantaneous gas using Edwards Comfort 200.			
	L305-2 GS	305				4	2						
	L440-3 GS	440				6	3						
	LX180-1	180	Mains pressure close coupled. Heat exchange frost protection			2	1			Electric		*Australis collector - aluminium with copper tubing. *Titan collector - Titanium coated copper with copper tubing.	6 or 10 years on cylinder depending on system
	LX305-2	305				4	2						
	LX440-3	440				6	3						
	LX180-1 GS	180				2	1			Instantaneous gas using Edwards Comfort 200.			
	LX305-2 GS	305				4	2						
	LX440-3 GS	440				6	3						
	EHP310	310	Heat pump	Vitreous enamel lined mild steel		N/A	N/A	N/A	N/A	Electric		Booster does not operate unless ambient air temp drops below 5°C.	5 years on cylinder
	GTS270	270	Indirect split system			up to 6	up to 3	Australis Series 2 or Titan Series 2	Low iron tempered	Gas		Drain back system, frost protected, tempering valve supplied.	
	GTD340	340	Direct split system			up to 6	up to 3			Electric		Not suitable for frost areas.	
Energy Conscious Design Limited ph:(09) 416 6997 info@ecosolar.co.nz www.ecosolar.co.nz	Ecosolar 2.3S		Retrofit collector, mains pressure thermosiphon and remote mounted cylinders available			2.3	1	Copper, matt black surface	Prismatic galss	-	$568	Thermosiphon or pumped full or kit set systems available, with / without cylinders	5 years
	Ecosolar 4.6S					4.6	2			-	$1,136		
	Ecosolar 2.3H					2.3	1	Copper, Sunselect selective absorber	Low Iron	-	$776		
	Ecosolar 2.8H					2.8	1			-	$876		
	Ecosolar 2.95H					2.95	1			-	$924		
	Ecosolar 4.6H					4.6	2			-	$1,552		
	Ecosolar 5.6H					5.6	2			-	$1,752		
	Ecosolar 5.9H					5.9	2			-	$1,848		
	Ecosolar Pumped kit	-	-	-	-	-	-	-	-	-	$500	Kit includes bronze pump and solar controller with digital display, 3 temperature sensors, heat counter	1 year
	Ecosolar Multi system pumped kit	-	-	-	-	-	-	-	-	-	$600	Kit includes bronze pump and solar controller with digital display, 3 temperature sensors, heat counter and datalogging facility. Can control up to 3 solar systems or cylinders fed from the same solar collectors.	
Genersys Solar Australia Pty Ltd ph:(07) 4771 5723 info@genersys.com.au www.genersys.com.au	1450 Vacuum Flat Plate collector	200lt upwards	Mains pressure. Closed circuit heat exchanger	Stainless steel	Glass wool/ polyurethane	1.698m² nett per panel	-	Vacuum design. Aluminum (AlMg) one piece construction, aluminum oxide highly selective surface	Safety solar ESG white glass 4mm	Gas condensing heat pump biomass	POA	High end domestic/commercial/ industrial use/Swimming pools. Ten panels connected in series.	20 year on collector 20 year on stainless tank
	1000-10 collector	200lt upwards	Mains pressure. Closed circuit heat exchanger	Stainless steel		1.74m² nett per panel	-	Aluminum (AlMg) one piece construction, aluminum oxide highly selective surface				Available as horizontal/landscape mounted panel, model 1000-10H. High end domestic/commercial use. Ten panels connected in series	

Make	Model	Capacity (litres)	Type	Tank material	Insulating material	Total collector area (m²)	Number of collectors	Collector material	Glass type	Boosting	RRP	Comments	Warranty
GreenLand Systems ph:(03) 9532 0351 info@greenlandsystems.com.au www.greenlandsystems.com.au	E-GL70-20-160	160	Vacuum tube (evacuated), mains pressure, split system, pump assisted. Dry heat interface (DHI).	Stainless steel	Inner: aluminium silicate fibre with black glass fibre cloth. Outer: high density polyurethane	3.6	20 x 70mm tubes	70mm or 100mm diameter vacuum tube (evacuated) with copper heat pipes and stainless steel framing	High impact borosilicate glass tubes	Electric	POA	Vacuum sealing (less than 0.001 Pa) of all active parts ensures life-long, peak performance - stagnation-free. Hail resistant and frost protected. Durable stainless-steel frame, easy installation. Excellent performance on overcast and rainy days. Commercial and industrial enquiries also welcome.	12 years on collectors, 10 years on tanks
	E-GL70-20-250	250				5.5	30 x 70mm tubes						
	E-GL70-30-315	315				7.3	40 x 70mm tubes						
	E-GL70-40-315	315				4.2	16 x 100mm tubes						
	E-GL100-16-250	250					16 x 100mm PT tubes						
	E-GL100-16PT-250	250					16 x 100mm tubes						
	E-GL100-16-315	315					16 x 100mm PT tubes						
	E-GL100-16PT-315	315					24 x 100mm tubes						
	E-GL100-24-315	315				6.4	24 x 100mm PT tubes						
	E-GL100-24PT-315	315											
	G-GL70-20-160	160	Vacuum tube (evacuated), mains pressure, split system, pump assisted. Dry heat interface (DHI).			3.6	20 x 70mm tubes			Gas (natural or LPG)			
	G-GL70-20-250	250				5.5	30 x 70mm tubes						
	G-GL70-30-315	315				7.3	40 x 70mm tubes						
	G-GL70-40-315	315				4.2	16 x 100mm tubes						
	G-GL100-16-250	250					16 x 100mm PT tubes						
	G-GL100-16PT-250	250					16 x 100mm tubes						
	G-GL100-16-315	315					16 x 100mm PT tubes						
	G-GL100-16PT-315	315					24 x 100mm tubes						
	G-GL100-24-315	315				6.4	24 x 100mm PT tubes						
	G-GL100-24PT-315	315											
Quantum Energy Technologies ph:1800 644 705 www.quantumenergy.com.au	150-08ACW-134	150	Heat pump	Steel with vitreous enamel lining	Polyester (no ozone depletion)	N/A	N/A	N/A	N/A	N/A	$2,998	Operates in temperatures of -10 °C up to +40 °C	5 years on water storage tank, 2 years on refrigeration and circuits
	270-11AC3-134	270									$3,410		
	340-11AC3-134	340									$3,713		
	340-17ACW-134	340									$4,263		
Rheem Australia Pty Ltd ph:(02) 9684 9100 www.rheem.com.au	Rheem failed to provide updated data for the guide. For previous data, please see the table in *ReNew 97*.												
Rinnai Solar ph:1300 555 545 www.rinnai.com.au	Prestige PC1801S20	180	Close coupled	Stainless steel	Polyurethane	2	1	-	Low iron	Instantaneous gas using Rinnai Gas Boost 20 or 26 continuous flow heater	POA	All systems use high performance selective surface panels. FTC (frost tolerant collectors) available on all systems	Varies from 5 to 10 years, ask your dealer
	Prestige PC3302S26	330				4	2						
	Prestige PS2502S20	250	Split system			4	2						
	Prestige PS3152S26	315				4	2						
	Prestige PS3153S26	315				6	3						
	Prestige PC1801E24	180	Close coupled			2	1			Electric			
	Prestige PC3302E36	330				4	2						
	Prestige 5S2802P	280	Gravity feed	Copper	Polystyrene	4	2			Electric and solid fuel			
	Prestige 5S3702P	370				4	2						
	Prestige 5S3703P	370				6	3						
	Prestige 5S2802P	280				4	2						
	Prestige 5S3702P	370				4	2						
	Prestige 175SC2P	280				4	2			Gas and solid fuel			
	Prestige 5MC3702P	370	Gravity and mains pressure			4	2			Electric and solid fuel			
	Sunmaster S1751S20	175	Split system	Glass lined mild steel	Polyurethane	2	1			Instantaneous gas using Rinnai Gas Boost 20 or 26 heater			
	Sunmaster S2152S20	215				4	2						
	Sunmaster S2152S26	215				4	2						
	Sunmaster RG270S202P	270				4	2						
	Sunmaster RG270S263P	270				6	3						
	Sunmaster S2002E36	200				4	2			Electric			
	Sunmaster S3152E36	315				4	2						
Solahart ph:(02) 9684 9100 www.solahart.com.au	151J Gas	150	Mains pressure close coupled. Closed circuit heat exchanger	Vitreous enamel lined mild steel	Polyurethane	2	1	Mild steel	Low iron	Gas	$3,900	Thermosiphon J series closed circuit systems shown. Also available is the thermosiphon KF closed circuit range with selective surface collectors and the thermosiphon L series open circuit range. Each thermosiphon range also available in the Free Heat series. Active split systems and heat pump systems also available	For single family domestic dwellings, thermosiphon Free Heat series is 10/5/5 (10 years supply tank and collectors, 5 years labour tank and collectors, 5 years components supply and labour), standard thermosiphon series is 5/5/5. For active and heat pump warranties, ask your dealer.
	181J Gas	180				2	1				$4,300		
	221J Gas	220				2	1				$4,400		
	302J Gas	300				4	2				$5,675		
	443J Gas	440				6	3				$7,600		
	151J	150				2	1			Electricity	$2,325		
	181J	180				2	1				$2,750		
	221J	220				2	1				$2,850		
	302J	300				4	2				$4,125		
	443J	440				6	3				$6,050		
Sola-Kleen ph:(08) 9271 5725 www.sola-kleen.com.au	Sola-Kleen failed to provide updated data for the guide. For previous data, please see the table in *ReNew 97*.												

Make	Model	Capacity (litres)	Type	Tank material	Insulating material	Total collector area (m^2)	Number of collectors	Collector material	Glass type	Boosting	RRP	Comments	Warranty
Solar Lord (Entrend Australia) ph:1300 133 782 www.solarlord.com.au	E270U15-O	270	Mains pressure, split system, open circuit, suitable for good quality water and minimum -7°C degrees	Vitreous enamel lined mild steel	Polyurethane	2100 x 15 U-tubes	1	AIN/AIN-SS/CU surface, Novel sputtering treatment (Sydney University patent), U copper tubes collector	Evacuated glass tube Borosilicate glass	Continuous electric	$3,286.80	Winner of HIA GreenSmart Award - Product of the Year 2007. Independent tests show much higher efficiency than flat panels. Best performance in winter and on overcast and rainy days.	10 years on gas instantaneous booster, 7 years on tank and collector and 2 years on parts
	E340U15-O	340					1				$3,605.80		
	E450U30-O	450				2100 x 30 U-tubes	2				$5,206.30		
	E450U45-O	450				2100 x 45 U-tubes	3				$6,358.00		
	G270U15-O	270				2100 x 15 U-tubes	1			Instantaneous gas	$4,166.80		
	G340U15-O	340					1				$4,485.80		
	G450U30-O	450				2100 x 30 U-tubes	2				$6,086.30		
	G450U45-O	450				2100 x 45 U-tubes	3				$7,238.00		
	E180H16-O	180	Mains pressure, split system, open circuit, suitable for areas that have hard to poor quality water and temperature go down to -9°C degrees			1800 x 16 heat pipes	1	AIN/AIN-SS/CU surface, Novel sputtering treatment (Sydney University patent), Heat pipe collector		Continuous electric	$2,527.80	Tested by International top Authorities, 40-50% more efficient than flat panels, easy and cost saving installation. Good performance in winter and on overcast and rainy days.	
	E270H24-O	270				1800 x 24 heat pipes	1				$3,396.80		
	E340H32-O	340				1800 x 32 heat pipes	2				$4,111.80		
	E450H40-O	450				1800 x 40 heat pipes	2				$4,881.80		
	E450H48-O	450				1800 x 48 heat pipes	2				$5,363.60		
	G180H16-O	180				1800 x 16 heat pipes	1			Instantaneous gas	$3,407.80		
	G270H24-O	270				1800 x 24 heat pipes	1				$4,276.80		
	G340H32-O	340				1800 x 32 heat pipes	2				$4,991.80		
	G450H40-O	450				1800 x 40 heat pipes	2				$5,761.80		
	G450H48-O	450				1800 x 48 heat pipes	2				$6,240.30		
Solar-Mio Albury Consolidated Industries ph:(02) 6040 6666 www.metaldynamics.com.au	C2/250	250	Gravity feed. Both thermosiphon and pump operated	Copper	Rockwool	4	2	Copper with CSIRO nickel black surface coating	Toughened low-iron cushion mounted prismatic glass	Electric with wood stove option	POA	Systems avaliable with squat panels for around $54 extra per panel	7-10 years
	C2/315	315				4	2						
	C3/315	315				6	3						
	C3/400	400				6	3						
	MP2/250	250	Mains pressure			4	2					Heat exchange coil to allow mains pressure operation. Solar and stove connection included.	
	MP2/315	315				4	2						
	MP3/315	315				6	3						
	MP3/400	400				6	3						
	PCE 250/2	250	Solar/electric - pump circulated electric boosted	Stainless steel	Injected foam	4	2			Electric	$3,248.00	Additional frost protection available for high frost areas	
	PCE 315/2	315				4	2				$3,357.00		
	17E 250/2	250	Solar/gas - pre-plumbed instantaneous gas heater with gas/solar valve			4	2			Gas	$4,747.80	Additional frost protection available for high frost areas	
	21E 250/2	250				4	2				$4,795.80		
	21E 315/2	315				4	2				$4,987.80		
	25E 315/2	315				4	2				$5,272.20		
	PLUS T1	NA	Retrofit - thermosiphon	NA	NA	2	1			NA	$964.00	Thermosiphon kit. Add $54.00 per collector if squat collector(s) required	
	PLUS T2					4	2				$1,569.00		
	PLUS T3					6	3				$2,185.00		
	PLUS T4					8	4				$2,772.00		
	PLUS PC1		Retrofit - pump and controller			2	1				$1,513.00	Includes pump and controller. Add $54.00 per collector if squat collector(s) required	
	PLUS PC2					4	2				$2,118.00		
	PLUS PC3					6	3				$2,732.00		
	PLUS PC4					8	4				$3,346.00		
	TOPPS 1		Retrofit - thermally operated photovoltaic pump system (totally solar)			2	1				$1,716.00	Add $54.00 per collector if squat collector(s) required	
	TOPPS 2					4	2				$2,318.00		
	TOPPS 3					6	3				$2,932.00		
	TOPPS 4					8	4				$3,546.00		
	Platinum PH 1/160	160	Platinum series mains pressure and gas preheated, pump assisted	Stainless steel	Injected foam	2	1			Gas option	$2,780.00	Avaliable as pre-heater for gas systems at a slightly reduced price. Add $54.00 per collector if squat collector(s) required	
	Platinum PH2/250	250				4	2				$3,483.00		
	Platinum PH3/315	315				6	3				$4,207.00		
SunPlus Solar ph:1300 653 872 sales@sunplussolar.com.au www.sunplussolar.com.au	CPCASE1	315	Split system	Vitreous enamel	Injected foam	3	3	Aluminium, copper and glass	Borosilicate glass	Off-peak electric boost	$4,298.44	Other models available	5 years
	CPCASE2	315				4	4				$5,179.24		
	CPCASE3	400				4	4				$5,494.30		
	CPCASE4	400				6	6				$7,255.91		
	CPCASG5	160				2	2			Gas boosted	$3,898.73	Rinnai gas boosting	
	CPCASG2	250				2	2				$4,183.03		
	CPCASG6	250				3	3				$5,063.83		
	CPCASG3	315				3	3				$5,146.44		
	CPCASG4	400				4	4				$6,242.30		
	CPCASGL1	400				4	4				POA	Baxi.Luna gas hot water and hydronic boosting	
	CPCASGL2	400				6	6						
	CPCBMGL1	315		Stainless steel		4	4						10 years
	CPCBMGL2	315				5	5						
	CPCBSG1	160				2	2				$5,475.51	Bosch gas boosting	
	CPCBSG2	250				2	2				$5,823.29		
	CPCBSG3	315				2	2				$5,807.18		
	CPCBSE2	160				3	3			Off-peakelectric boost	POA		
	CPCBSE3	250				4	4				POA		
	CPCBSE4	315				3	3				$5,743.83		

ReNew magazine's sustainable shed competition

In keeping with *ReNew* magazine's theme, we're looking for a shed that excels in sustainability. Are you building an electric car in your shed? Have you built a water-saving device? Is your shed solar powered? Does it have its own wind turbine? Or did you build your own wind turbine in your shed? Is your shed made from recycled materials?

How to enter

Send answers to the following questions, along with your name, telephone and email address to Shed Competition, *ReNew* Magazine, Level 1, 39 Little Collins St, Melbourne VIC 3000, or email to renew@ata.org.au. All entries must be accompanied by a photo of the shed, either emailed as a high resolution jpeg or posted to the address above.

1. What year did you first start work in this shed?

2. List the most interesting DIY projects you have undertaken in your shed and briefly describe their outcome.

3. Did you build your shed yourself? If yes, please describe the construction and materials used.

4. If you did not build your own shed, have you retrofitted your shed in any way? Please describe the additions/improvements you have made.

5. List your shed's sustainable features.

6. What's the most important thing you have learnt in your shed?

Guidelines

We'll be looking at the following criteria when judging the winning shed.

1. Sustainable shed construction. This can include a sustainable retrofit of the shed, for example the use of recycled materials.

2. Renewable energy to power the shed, including solar and wind power or other renewable methods.

3. Commitment to DIY projects in the shed, with an emphasis on these projects being sustainable. For example, projects that help to reduce greenhouse gas emissions or use sustainable best practice in their making.

4. The competition is open to Australian and New Zealand entries.

Prize details

The best three sheds will win a solar and lighting kit consisting of:
1 X 20W solar panel
1 X solar regulator kit to suit
3 X 4W LED light kits
1 X battery and fuse
Prize generously donated by Oatley Electronics **www.oatleyelectronics.com**

OATLEY ELECTRONICS
www.oatleyelectronics.com

Each winner will also receive a copy of *Makers, Breakers & Fixers: Inside Australia's Most Resourceful Sheds* by acclaimed shed researcher Mark Thomson. To find out more about shed dwelling go to Mark's website at the Institute of Backyard Studies: www.ibys.org.

The competition will be judged by Mark Thomson and *ReNew* editors Jacinta Cleary and Lance Turner.

Competition closes 30 January 2009

Winning shed featured in *ReNew 107* (out mid-March 2009)

For more information email renew@ata.org.au

High density greening

Living in an apartment can be environmentally challenging. Bojun Björkman-Chiswell explores sustainable options for high density living.

Brett Woodward's enthusiasm for reducing, reusing, recycling and retrofitting everything he possibly can in his Melbourne apartment is so infectious, you can't help but share his delight in living more sustainably.

The list of things he's tried is so long that it's hard to believe when he admits, "the couch with a remote is my preferred place of work." Even harder to believe is the response he got when, at no cost to his landlord, he wanted to install a rainwater tank.

"I was originally told you can't do that, as if Australia had a law. Then my landlord said, it's just a rule that the four people who own the apartments made up."

The Owners Corporation claimed the addition of a water tank would make the outside of the building ugly. "I was given every excuse just to get me off the phone," he laments.

Although Brett gave up on the rainwater tank, he didn't give up on devising his own water saving system.

Rectangular buckets, big enough to stand in, small enough to lift, with good lids, "so you're not slopping water down the hallway," now catch greywater from the shower to flush the toilet.

"It's not 100% a greywater system, but if I was waiting on the body corporate there'd be a lot more water down the drain!" says Brett.

However, rainwater tanks for apartments are not impossible, says greywater consultant Grant Harper.

Brett Woodward on his luscious balcony. The solar lights for Brett's apartment will be recharged here as well.

Water wise

Grant's design for a balcony rainwater tank collects rainwater from the roof of a two-storey terrace in a 220 litre streamline tank. The tank is attached to the balcony wall and supplies a small pond and balcony garden watering system.

The overflow diverts to the down pipe, which flows into the garden or drain below.

"If the Owners Corporation won't allow you to attach the tank to the internal balcony wall, you could make a frame or legs for the tank," says Grant.

"But if you're getting above a 200 to 300 litre tank you will need someone who knows about the apartment's structural aspects, so it's better to stick to a size of tank that people can do themselves."

Owners, builders and innovators

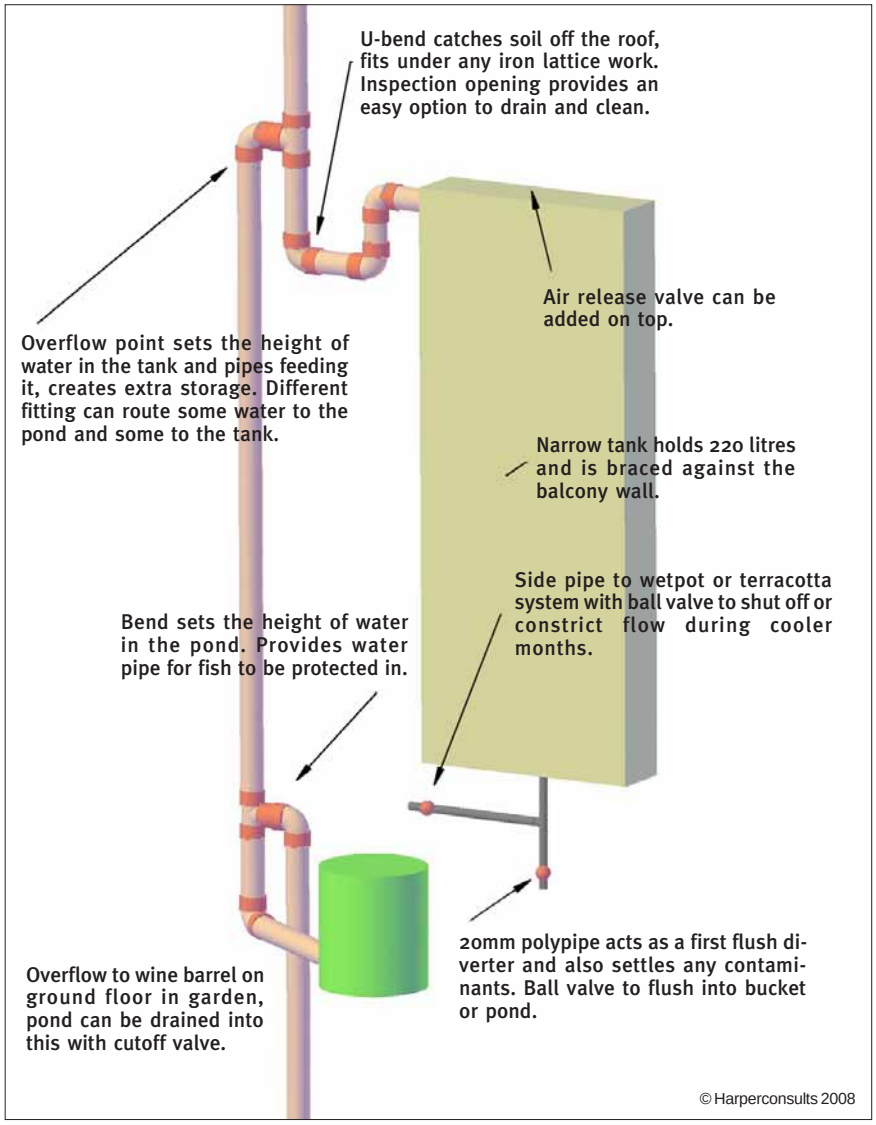
Brett's story of environmentally unfriendly Owners Corporations is by no means the exception.

In the lift of *Summit* high rise apartment block in Melbourne's CBD, a sign reads, "Residents are not permitted to air laundry, store bicycles or other unsightly items on balconies."

This rule not only ignores the fact that apartments are space limited, but has large ramifications for sustainability.

In the life-cycle of a T-shirt, tumble drying accounts for 53% of the overall carbon footprint.

Dorothy Le Claire, of Melbourne Inner City Management (MICM), which manages city apartments, has been participating in the council's Sustainable Living in the City (SLIC) pilot program. She is keen to point out that



Cecilia Macaulay

Left: a design for a balcony rainwater tank. Right: the rainwater tank can be fitted to a wall—great for apartment dwellers.

nobody is stopping residents from drying clothes indoors, recycling, using efficient lights or saving water.

Le Claire suggests focusing on balcony drying is missing the point. "We need to figure out how to make more energy efficient lifts, that would save much more greenhouse gases."

Indeed, Le Claire is right. With more apartment blocks in Australian cities, their building standards as as important as ever.

Professor Bill Randolph, from the Australian Housing and Urban Research Institute (AHURI) in NSW, says, due to a successful lobby by building developers to have higher environmental standards waived for apartments, over the next 20 years the majority of new dwellings in Melbourne, Sydney, Brisbane and Adelaide will be produced at lower environmental standards.

"People still think that mansions in the suburbs is where the problem lies, when actually there aren't that many mansions being built at the moment," says Randolph.

He says, despite the built environment producing one quarter of all greenhouse gas emissions, the impact that high density apartment blocks are having on our cities is not generally appreciated.

Verandah veggies

Everyone can grow at least one plant, says permaculture teacher and terraced house resident Cecilia Macaulay. "And if you make sure it's a rare plant, you might be the only person keeping a rare breed of capsicum alive," she says.

However, a major obstacle to balcony gardens is that plant pots tend to dry out quickly.

Cecilia turned to an ancient craft for a solution: wet pot irrigation.

A small 20 litre water tank supplies a series of porous gourds, buried inside each pot plant, which provide plants with a regular water supply and prevents evaporation or spills.

Balcony gardens have one major water advantage over backyards: there are no water restrictions for balcony gardens!

"You wouldn't want to be irresponsible and you want to be as clever as you can, so that's why I put in a rainwater tank," says Cecilia. It means you can give your miniature crops a little water when they need it.

For the high-rise or sunless balcony,

Cecilia recommends growing mushrooms and small herbs.

Small-scale solar

Having reduced his household energy consumption by 70%, Brett is now trying balcony solar.

Mick Harris from the Environment Shop says while there is nothing made specifically for apartments, it is easy enough to rig up balcony solar. You will, of course, need a sun-drenched balcony.

There are small inverters available that plug into a power point and connect to a couple of medium-sized solar panels, say two 60 watt panels, which can be put out on your balcony during the day.

There are also small solar lighting systems available, such as the Glowstar lantern and Sundaya lighting kits.

If you don't have room for a solar panel there are solar powered camping lamps that charge an internal battery. If left out in the sun during the day they light up your home at night, says Mick.

Lastly, the leftovers

Both Cecilia and Brett have balcony worm farms to deal with organic waste, which create a rich compost for their miniature food crops, "but make sure it's shaded," says Cecilia.

Cecilia's secret for an odourless worm farm is to keep the food scraps small and not add too much, so the worms get through it faster and the soil is aerated. "Make sure they've eaten everything before you feed them again," says Cecilia.

If you don't have any garden just use someone elses, Cecilia recommends. "There's so much unloved garden in the world, become friends with an old lady down the road (or the local community garden) and make a compost heap there."

And for hard waste, well of course, says Brett, "recycle everything!" ✻

Green apartment links

Efficient lights

LED down lights, (3 watt instead of 50 watt), plug directly into the original socket and also cast a softer light. Available from ATA webshop www.shop.ata.org.au

Small scale solar

SWEA www.swea.nl available from Laddertech Australia www.laddertech.com.au

Small solar lighting systems

www.environmentshop.com.au
www.rpc.com.au

Blogs and other sites

Cecilia Macaulay's blog:
www.balconyofdreams.blogspot.com
Grant Harper's website:
www.harperconsults.com

A wind-powered Futuna

Oliver Crowder jumped at the chance to test his skills in the tropics. He writes about his experience seeking wind turbine sites in Vanuatu.

The Vanuatu Renewable Energy and Power Association (or VANREPA), headed by David Stein, an American who has lived in Vanuatu for the last decade, received funding to provide wind-generated electricity for two remote islands in Vanuatu. The project aims to place about a dozen small turbines in several villages, for charging battery banks, powering community buildings and recharging household lanterns.

David asked the Alternative Technology Association to help evaluate the available wind resource and assist with site selection for the turbines. Nalini Blacker, a wind analyst from Garrad Hassan, volunteered her time to identify sites, adapting meteorological data to Futuna Island. However, this analysis contained a lot of assumptions and on-the-ground verification of terrain and local vegetation conditions was considered essential. David also wanted to discuss a number of system design and project implementation issues. It appeared a site visit was in order!

I am a renewable energy installer from Victoria, with experience in small off-grid wind turbine installations and liked the idea of a week working on a small tropical island. New Zealand engineering student Natalie, from Engineers Without Borders, was working with VANREPA and also joined us in Futuna.

Futuna, and nearby Aneityum, are the most remote islands in Vanuatu, way down in the southern island group. Futuna is home to a close-knit community of about 600 people living off abundant fish, cassava and coconuts. They don't have much in the way of technology: there are two phones connected to a satellite dish, no electricity

Photo: Oliver Crowder

Natalie (left) and members of the Futuna Renewable Energy Committee (FREC).

(except for a solar-powered freezer in the fishing co-op) and they mainly use kerosene lighting. Kerosene is expensive and scarce: the supply ship had not been back for six months. Locals supported the plans for wind energy.

Futuna sits right in the heart of the trade winds. According to NASA wind data for the area, the average wind speed is 6.8m/s and blows all year, varying little from east to southeast. We calculated that one 600 watt Ampair turbine at a good site could produce about 5kWh per day. VANREPA intends to install seven of these small turbines on masts around the island. These turbines are small, but very robust, as they are designed for yachts, which face similar conditions to these islands.

As our light plane passed the north side of the extinct volcano that is Futuna, I tried to imagine how we were going to get around on the ground. All I could see were cliffs and jungle. (I discovered that cliff tracks through the jungle is exactly how we were to travel.) The grassy runway is pretty much the only flat land on the island. There are no cars or bikes, as any kind of wheeled vehicle would be useless here. People walk everywhere and the locals think nothing of walking five kilometers across cliff faces, in the dark, to visit a friend.

The tracks (locals call them roads) although precarious, are very well maintained. Every Tuesday, islanders turn out to cut steps in cliffs and tend the borders of rocks and flowers. This has been going on for hundreds of years.

This is one example of the high level of community organisation on the island, and why Futuna was chosen for this project over nearby islands with more friendly topography. David has learnt through experience that community participation is integral to such a project's success. VANREPA had helped to set up a committee made up of representatives from the four villages, appointed by their chiefs. Committee members Nitu,

Sampson, Tamata and Lang went with us on our three days of wind site surveys.

The subjects of our study—topography and the weather—are the two most important influences on life here. The mountain is so obvious that it is actually easy to forget it is there (I had to insert references to it in my report, when, at the time, it was taken for granted.) It has a huge effect on the daily life of the islanders, as well as on the wind blowing over it.

As the trade winds blow over the mountain from the east, the smooth flow is disrupted, causing an area of generally lower wind and turbulence on the opposite coast. Herald Bay, on the northwest side of the island, is Futuna's largest village, but experiences turbulent, variable winds, so is not ideal for wind turbines. The primary school, potentially a large consumer of power, is located here. The school is one of the first priorities for VANREPA, however after our survey, it will probably be powered by solar.

Villages on the other side of the island are exposed to the prevailing southeasterlies. Residents have encouraged extensive rows of shea-oaks and coconut palms to act as windbreaks. Outside the windbreaks are sites ideally suited for wind turbines, with unobstructed wind access. The first turbine installation will probably be at an easily accessed site beside the runway.

While surveying the southern end of Futuna, island committee member Lang asked Natalie and I if we would like to see an old crane built by New Zealand Army Engineers that was a total failure. With New Zealand engineer-in-training Natalie in tow, I eagerly followed Lang down the track.

Years ago, these engineers donated materials and constructed a small crane cantilevered out from the cliff to haul supplies from boats 100 metres below. This was to avoid the most treacherous part of the path from the beach and make supplying villages in the area easier.

But the crane never worked. Lang explained why: it was too heavy, had too much friction, and, importantly, not enough people in the village to pull on the steel ropes. Sadly, in building the new crane, the army engineers destroyed a smaller working crane built by islanders.

While Natalie and I pondered, Sampson, the guitar-playing 23 year-old son-of-a-chief with long black curly hair to match his name, bluntly pointed out the moral of this story: 'When you put in these wind turbines, they better not fail like this crane,' he laughed. We had been warned.

In most technology-based aid projects, technical problems are not actually the difficult part—they can be solved. Communication problems are a bit trickier. Often, there is a gap in understanding between the well-meaning but pushy donors and the forbearing recipients. So it was somehow encouraging, and comforting, to be humbled like this. I felt like a contractor with a demanding customer, and I liked it.

A cliff seen from the boat on the West coast, Iasoah. The batteries and all the gear for the wind turbines might have to be carried up those steps!

It is not an easy task to install reliable wind turbines and stand-alone power systems in such a remote and rugged location, and keep them operational for years to come between maintenance visits. But with such a well-organised and capable community, and sharp people like Sampson and Lang to assist (and keep us in our place) it should be possible to get a better result than those poor engineers. ✻

Oliver Crowder has volunteered on ATA projects in East Timor and Vanuatu and operates renewable energy business Saltwater Solar in Victoria saltwatersolar.com.au

Solar and seafood in Timor

Driving along steep rocky paths into remote schools, Nick Stephenson joined a band of volunteers installing solar panels across East Timor.

Last October, as part of the Alternative Technology Association's International Projects Group, I boarded a discount Friday night flight to Darwin in readiness to fly to East Timor. Together with Callum Dougall and Brian Bailey, we were to undertake a number of solar installations in and around Maliana, the country's third largest city near the western-most border.

Our first afternoon was spent acclimatising near the beach devouring a large barbecued snapper we'd selected from the restaurant's chest freezer. Hoping that this was a sign of a relaxed pace for the week ahead, I remembered the frantic pace of last year's projects as we ate.

The next day we drove over to NGO Plan International's compound to pick up the gear we'd need for the week's projects. Our shopping list from the Alternative Technology Association storage container included 15 or so lead acid batteries (weighing over 20kgs each) 16 solar panels, two ladders, two toolboxes, an assortment of cabling, inverters, timber and lots of screws. After loading up the ute on that still, humid morning in the full Dili sun we were glad to be on the coastal road towards Maliana.

Heading west from Dili, we passed through Liquica before stopping further on in a town close to Atabae, where the shops were elevated to road level on both sides from the river delta. We ate a lunch of little grilled fish and rice wrapped in leaves, with the fish caught nearby in the ocean. Further on we turned inland just short of the West Timor border and into the hills of the Bobonaro region. We stopped briefly in Balibo to visit the memorial of both Australian and East Timorese nationals who died during the nation's occupied years.

Photos: Nick Stephenson

Antonio Soares prepares a solar panel for mounting in Nanutana.

Arriving late in the afternoon, we asked locals to help locate a good hotel and within minutes were escorted to an ochre coloured compound nearby. We parked, ate and then crashed out in readiness for the next day's work.

When introducing any new element into people's daily routine, as we did with the provision of solar power, there's invariably a transitional phase where ingrained habits test the capacity of the systems. Our first school visit and installation at Maliana Secondary School served as the textbook realisation of this concept.

Having met our liason Joao Vicente earlier at the biblioteca, we arrived after lunch on Monday and reviewed the job. Rambling L-shaped buildings faced a large quadrangle, the roofs of which were steeply pitched gables with no gutters. Three centralised meeting rooms and an entry hall were to be serviced by the new power supply after consulting with the head teachers. The only sign of an existing power supply were the two wires sticking out of the brick wall that served as the connection point for a fuel powered generator.

Splitting into teams, Brian took care of the battery/inverter and regulator set-up while Callum and I inspected the roof, its orientation and set about mounting the panels to the frames. Senor Joao kept us constantly appraised of the staff's wishes, serving as our interpreter and cultural liaison.

Late in the day we managed to lift the clunky frame onto the roof with me harnessed to a rope running up and over the ridge line for support. Callum was tethered to the same line and as we considered the most suitable fixing points,

Fixing the solar panels with the help of teachers in Nanutana.

Callum Dougall (left) and Nick Stephenson on the job in Maliana.

the first drops of rain decorated the roof. Four quick fixings later and we were off the roof abandoning work until at least the lightning had eased. We called it a day and returned to finish the install the following day.

Although we ate at the same (and to our enquiries only) restaurant each night, our diet changed sufficiently over the week, more as a result of our selection from the servery than any change in the menu. The Restaurant Maliana had a curtain-backed glass cabinet that could have been a bain-marie if it had any power, that showcased a selection of meals. Having worked out that the turnover of dishes was gradual, we typically dined on a variety of greens, tempeh and rice one evening alternated with spiced beef, fried chicken and rice the next.

On alternate nights there was cold beer, corresponding to the side of town that had power on the previous night in order to operate the fridge. These 'mains' generators were supplemented by domestic generators with fluctuating output that was evidenced by the dimming light and fan in our hotel room.

Over the following days we travelled first to Saburai and then to Nanutana primary schools, both some distance and elevation from Maliana. We had since met our local technician, Antoio Soares, who had recently returned from Dili where he had completed a renewables training course with Mike O'Connell and Chris Moss. With a penchant for Guns'n'Roses' music, Antonio is a local electrician who will be a useful contact in the region for ongoing projects and maintenance.

The road to Saburai passed within a kilometre of West Timor border checkpoints and traced a steep, rocky path to the remote school. Our arrival brought a flood of kids running out to the school yard, with the group mesmerised by our activities well into the afternoon. The systems were greeted with enthusiasm and Senor Joao was on call for a speech thanking all involved, both present and abroad.

Having packed up the small amount of remaining gear the next morning, the plan was to briefly call in on the installations then head back to Dili. Not so. We dropped in at Maliana Secondary School and the diagnosis was that the system 'doesn't work'. We checked the system and found that not only did it work, but it was charging well. The problem was somewhere in the building's wiring.

From our earlier analysis we had decided not to fiddle with the existing wiring and only provide an alternative plug to the generator. Having checked all the ceiling fan switches, then all the power points, it was clearly a short circuit somewhere in the ceiling. Callum and I had almost expired earlier in the hot box that was the ceiling so we decided to introduce a bypass cable from the new supply to the switchboard.

We checked the system and it still worked with either the new batteries or the generator.

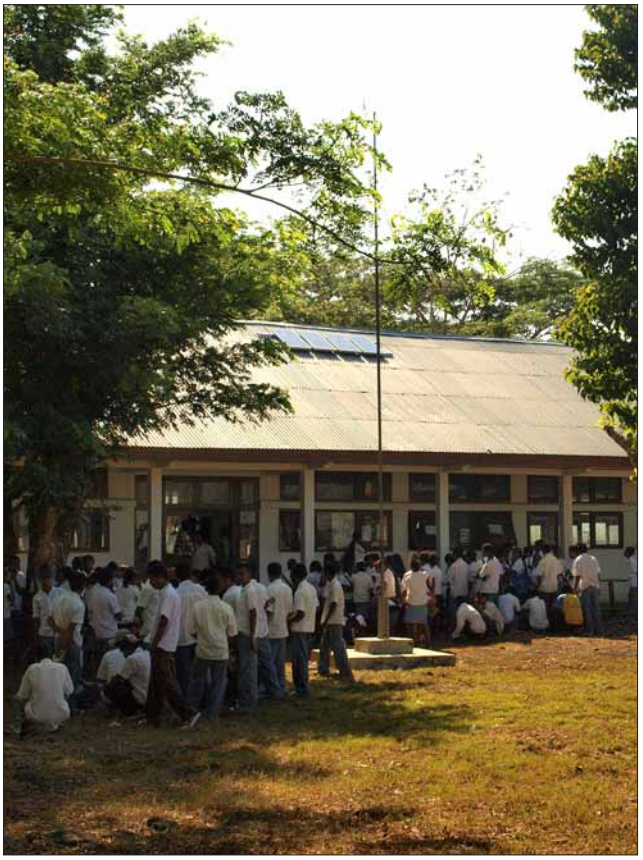
It was just after one o'clock. Bidding thanks and farewell to Senor Joao and Antonio, we jumped in the vehicle and headed for the coast. Our journey back was made remarkable only by a repeat of the fried fish and little rice balls for lunch and a crazy looking guy with a

chicken under his arm coercing a lift with us back to Dili. ✻

This project was possible due to the Friends of Maliana (Leichardt) and Sydney Secondary College.

IPG Volunteers

The Alternative Technology Association would like to thank the following volunteers for their work with the International Projects Group:
Alan Hutchinson, Peter Reichart, Sarah Hoyall, John Kemp, Mary Hutchinson, Michael O'Connell, Chris Moss, Mick Harris, David Hewitt, Bill Bennett, Oliver Crowder, Patrick Eijsvogel, Callum Dougall, Nick Stephenson, Brian Bailey, Duncan Macgregor, Shaun Curran, Peter Lewis, Patrick Innes, Sasha Gifford, Justin Stewart, Nalini Blacker, Alan McDowell, Wayne Bowers, Elvira Cadan, Meg Batchelor, Ruth McDonald, Bill Bland, Peter McDonald, Chris Halliwell, Katherine Miles and many others who have helped along the way.



School assembly after installation of solar panels at Maliana Secondary School.

ATA team delivers renewables

Solar and lighting installations continue in East Timor and wind power comes to Vanuatu, writes Anton Vikstrom.

It's been another year of growth and change for the Alternative Technology Association's International Projects Group. The group made its first foray into Vanuatu, partnering with the Vanuatu Renewable Energy and Power Association (VANREPA), and has continued with projects big and small in East Timor.

In Timor ATA volunteers installed 21 solar power systems in schools, clinics and community centres in 10 of Timor's 13 districts. This continues the strong commitment by the Australian volunteers.

Training and capacity building is an important part of the IPG's work and this year we reinforced this by conducting a targeted training course for 13 Timorese technicians. The one week course was run by ATA volunteers Michael O'Connell and Chris Moss, with participants training in solar power design installation and maintenance. These trained technicians went on to complete installations in East Timor, working alongside ATA volunteers in Malinana, Ainaro, Railako, Turaskai, Bacau and Los Palos. This training will be replicated and improved on until there are competent technicians in each district of East Timor. This technique has been shown to work, with previously trained technicians from the Suai Community centre installing a further 10 systems in health clinics throughout Covalima.

The Village Lighting Scheme has continued in Besilau, with two visits in the last year. In June, Peter and Sandra Cock from Moora Moora, councillors from Moreland and Hume councils (Friends of Aileu) and the ATA conducted a project review in Besilau. This review reconfigured the scope and approach of the project with small stand alone power systems being selected by the villagers for the villagers. In October the second phase of the project was implemented. Key elements included the formation of a committee of management, technician training and financial and bookkeeping training. Over one week ATA volunteers Mick Harris and David Hewitt worked with local technicians, training them in the fundamentals of solar power. At the end of the week these technicians where busy on village roofs and buildings installing solar power in all eligible households. Over 90 systems will be installed during this process.

The past year has been a time of consolidation as new approaches were imbedded into the group's processes. It also saw a number of milestones like the set up of our first workshop in Dili. Other highlights included participation at the second Australian-Timor Friendship Conference in Dili where the ATA spoke at a session on partnerships.

In 2009 the IPG aims to continue its current trajectory and consolidate its processes. This includes continued commitment to training and capacity building in East Timor. We also aim to develop partnerships and projects in other countries and in Australian Indigenous Communities. If you wish to find out more about the group's activities, a report documenting 2008 activities is on the ATA website www.ata.org.au ✻

Anton Vikstrom is manager of the International Projects Group.

The Alternative Technology Association International Projects Group would like to thank the following sponsors and supporters

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All quiet on the waterfront

Graham Daniels shows us around his electric boat.

Electric propulsion in cars is becoming a serious alternative, particularly in the form of hybrids. A recent push by Kevin Rudd to have Japanese hybrids built here in Australia attests to a paradigm shift.

But what of propulsion options on the water? Despite a long history of electric boating in Europe and the USA, the boating fraternities in Australia remain largely ignorant of the joys of this wonderful propulsion option. The boating magazines today are dominated by reviews, releases and advertisements for hydrocarbon fueled boats while electric propulsion generally appears only in the form of small electric trolling outboard units.

The germination of an idea

As the operator of a small custom boatbuilding business in Port Lincoln, South Australia, I secured a commission to build a seven-metre electric-powered launch in the late 1980s. The success of this vessel and its electric drive inspired me to design and tool up to produce a similar 7.3 metre fibreglass launch for the Australian boating public. I saw a market for such vessels in the numerous coastal canal waterways and ecologically sensitive lakes, rivers and reservoirs in Australia.

The Daniels 24 was the result. The design genre is a 'fantail launch', a hull form that has a long history of development, driven by the necessity for efficiency of form and function in an earlier era of wind and, later, steam power.

Its principal dimensions are 7.3 metres long, 2 metres wide, with a 0.6 metre draft. The first of these vessels was reviewed by Modern Boating magazine in 1994 and a small number of vessels were built and remain in use today.

The Daniels 24 weighs in at 1.3 tonnes and is readily trailerable. Solar panels can be fitted to the canopy to provide range augmentation. The vessel can be built under commercial survey to carry passengers in areas gazetted 'smooth water' by all state transport authorities.

The TESLA

The newest of these launches is the 'TESLA' which operates commercially as a tour launch through the six kilometers of waterway that constitute the Lincoln Cove Marina in Port Lincoln, South Australia. TESLA has a large cockpit with peripheral seating for 12 adults and has a canopy over the cockpit fitted with clear PVC curtains that can be rolled up in fine weather or zipped firmly down when the weather deteriorates.

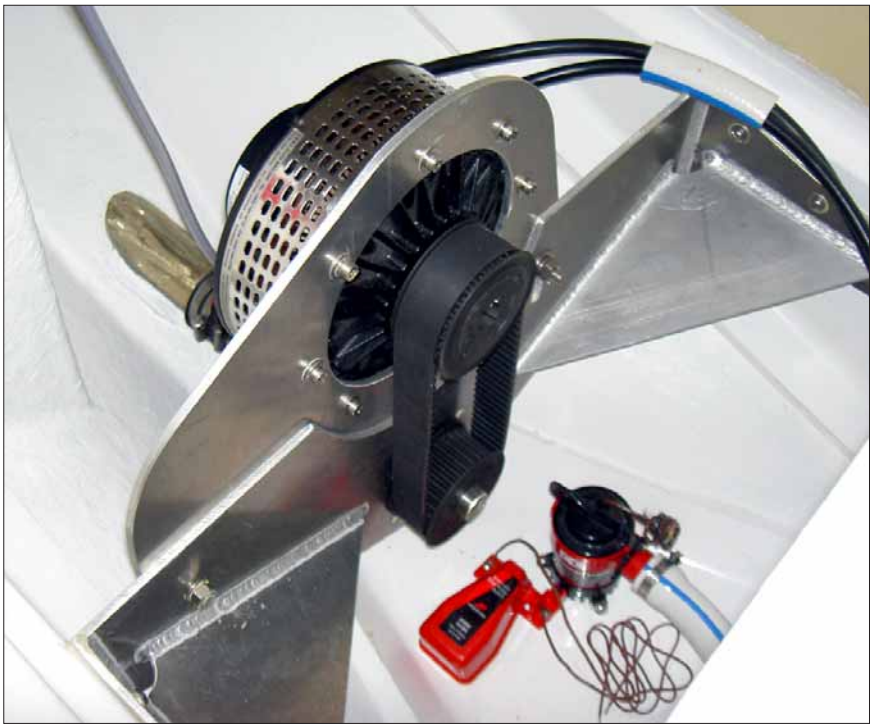
The Lincoln Cove waterway is a fas-

cinating mixture of residential canals adorned with magnificent waterfront homes as well as commercial basins housing Australia's biggest commercial fishing fleet. TESLA provides the ideal platform from which to view both as the electric propulsion is free of noise, vibration and fumes!

The large battery capacity gives an operating time of approximately ten hours at four knots (7.5km/h) and should the weather blow up there is more than enough power to push her through wind and waves with ease.

TESLA's battery provides a cruising range of about 80 kilometres for an energy cost of around $2! The ride is wonderfully quiet and vibration-free and its control is simplicity itself. A Curtis electronic controller provides very efficient energy delivery to the motor and a simple single-axis joystick provides completely smooth speed control in forward and reverse, with a central off position. The battery level is monitored by a Curtis gauge which is calibrated like a fuel gauge and gives a visual display in the form of a progression of illuminated LEDs, which change in colour from yellow to red as the level falls below 40% capacity remaining. The Curtis controller also has a low voltage protection feature which reduces the current available to the motor if the battery voltage falls dangerously low.

There's no fuel tank of course, just a bank of 18 batteries hidden away under a seat.



The high-efficiency electric motor is tiny compared to most boat motors.

TESLA is powered by a compact, lightweight and very efficient Lynch permanent magnet motor which develops 4.4kW (6hp) at 36 volts. The motor mounts above a conventional inboard shaft and drives to the shaft via a toothed belt. This lifts the motor away from the traditional bilge location where it might be subject to water damage and at the same time ensures ease of serviceability.

TESLA's battery bank consists of 18 two-volt traction cells. The batteries are recharged by an onboard fully automatic charger when connected to a shore power supply. The charger recharges the

Specifications at a glance

Dimensions:	7.3m long x 2m wide x 0.6m draft (24' x 6'6" x 2')
Weight:	1300kg
Motor:	LEM-170 Lynch permanent magnet 4.4kW (6hp), 36V
Batteries:	Exide TMPA-25 cells (18 x 2V = 36V, 384Ah)
Charger:	Exide 45 amp automatic
Controller:	Curtis pulse-width modulation controller
Capacity:	12 adults
Performance:	6.4kt (12 km/h) maximum, 2 hour runtime
	4-5kt cruising, 8-10 hour runtime

The controls of the boat couldn't be simpler—compare this to the average petrol or diesel boat!

battery bank in approximately ten hours and records charging history via a built-in processor.

During battery charging the battery enclosure is exhausted to the outside of the vessel via a ducted fan, thus removing any accumulation of hydrogen. As a further safety feature, the motor control circuit is isolated via a prohibition relay to prevent the vessel being driven away from the berth with the shore power still connected.

The battery bank is further fitted with a maintenance device which sits across the terminals and continually pulses at a frequency which breaks the sulphate molecular bond and so minimises the battery degradation resulting from the usual process of sulphation in lead acid batteries. TESLA has a 36 volt to 12 volt reducer to provide 12 volt power for lights and other ancillary equipment.

The end result

The TESLA is superb as a small tour vessel and she has carried over five thousand passengers and traveled a total distance of six thousand kilometres in this role over the past four years. When she is not carrying paying passengers she becomes a wonderful family fun boat for cruising quietly around Port Lincoln's magnificent harbour, nosing into beaches, gliding along with dolphins, picnicing, trolling, swimming and doing all those things that make boating a rewarding, relaxing experience.

The future

Several manufacturers now offer a range of small battery-powered vessels (see the box for details of several suppliers). Perhaps the Australian boating public will become receptive to this very viable propulsion option. As hydrocarbon fuels become prohibitively expensive, comments about D-cells and extension leads should be replaced by serious consideration of electric propulsion as a way to continue to enjoy boating, albeit at a more sedate and relaxing pace! ✻

For further information email Graham Daniels via grahamd@sa.chariot.net.au

Other electric boating options

As pollution, noise and fuel costs have become recognised as serious issues with current boating practices, more electric boating options have become available.

The most common electric boat motors are the small 'trolling' outboard motors, which are used as backup motors and for moving a boat slowly and quietly through the water. These are available from several manufacturers including Minn Kota, Torqeedo (see the product writeup in the Products section of this issue), MotorGuide, Omoto and Jarvis Walker (at right). All of these companies make a range of motors for moving boats up to six metres or more in length, and some of these motors are powerful enough to be the prime motive force for many vessels. Some trolling motors have battery packs built in, making them a complete stand-alone device without the need for external battery packs, but an inbuilt battery will have a limited range compared to a larger capacity external battery.

Outboards are not the only way to go electric boating. Several manufacturers make purpose-built electric boats. A good example is the range available from Solar Boat in Hunters Hill, NSW (www.solarboat.com.au). They have their own models, including commercial boats such as the 45 seat ferry below, as well as the Duffy range from California, which features boats up to 6.7m (22 feet) in length.

Ecoboats Australia of Kirribilli NSW (www.ecoboats.com.au) also sell the Duffy and Solar Boat range of vessels, as well as inboard and outboard drive systems. They also have an electric boat hire service.

Vorta Power Systems in WA (www.vortapowersystems.com) make a marine jet powered small boat (basically a large canoe style boat) that is ideal for quiet boating in rivers and other calm waters.

The Electric Boat Association of Australia aims to promote electric boating and to help both commercial operators and individuals in their electric boating needs. See www.electricboats.com.au for details.

Worldwide wind cooperatives

Last issue we looked at plans for Australia's first community-owned wind farm. Now Alicia Webb explores wind cooperatives around the world.

Islands with enough wind power to be carbon-neutral, cooperatives owned by cooperatives and football fields upon football fields of turbines owned by communities rather than corporations. Community-owned wind farms are popping up all over the world, providing electricity as well as an income for investors. What started as a way to keep nuclear energy at bay and reduce reliance on fossil fuels is now increasingly bringing communities together in the shared interest of investing in their financial future and energy security. In Australia there's a lot to learn from what's going on overseas, from bringing free beer to a community meeting to super-sizing wind farms US style.

In the last issue we wrote about Australia's first community-owned wind farm near Daylesford in Victoria, which is currently seeking investors. However, the community-owned model has been around for quite a while in those wind-loving countries in Northern Europe, particularly Denmark, Germany and the Netherlands. Other places such as Sweden, the UK and the US are in the early stages of adopting the community-owned model.

Samso Energy Academy

A wind turbine on Samsø in Denmark, surveyed by some of its owners.

The community-owned model

It all started in the late eighties. With increasing concerns about climate change and the government's decision to ban nuclear power following the Chernobyl disaster, Denmark decided to push renewable energy. To encourage investment in wind power, families were offered tax cuts for generating their own electricity. While this could have involved purchasing a turbine outright, more families purchased shares in wind turbine cooperatives, which in turn invested in community wind turbines. By 1996 there were around 2,100 cooperatives in the country.

By 2004 over 150,000 households were either members of wind power cooperatives or owned turbines. About 5,500 turbines had been installed, accounting for 75% of Denmark's wind turbines.

Some Danish wind farms are owned by a mix of community and private companies. The Middelgrunden offshore wind farm has 20 turbines and was the world's largest offshore farm at the time

it was built in 2000. Half is owned by the 10,000 investors in the Middelgrunden Wind Turbine Cooperative, and the other half by the municipal utility company.

Wind farms in Australia are typically privately owned, whereby investors build the turbines and sell the electricity, and landowners are paid rent over the project's life. The community-owned model typically involves smaller farms with fewer turbines and local residents are invited to buy shares and profit from the sale of the electricity.

It is widely believed that some of the antagonism towards wind farms arises from the perception that they are owned by large remote companies with no interest in the area. Studies have shown that some of that opposition can be diffused if the local community is offered a chance to participate in the financial success of the project.

For inspiration, here are some community wind farms from around the world.

Samsø Island

Samsø is a Danish island 15 kilometres off the Jutland Peninsula, most famous for being the largest carbon-neutral settlement on the planet. The island has a population of just over 4000 and is 114km^2 in area. The residents have used a combination of community-owned wind power, solar power and biomass fuel to offset all of their emissions including transport.

Samsø's transformation began in 1997 when the Danish Ministry of Environment and Energy sponsored a renewable-energy contest. To enter, a community had to submit a plan showing how it could wean itself off fossil fuels. An engineer who didn't actually live on Samsø won the competition.

However, the brief surge of interest that followed soon dissipated. Samsø was designated Denmark's 'renewable-energy island,' but this did not involve prize money or government assistance. One of the few people on the island who thought the project was worth pursuing was Søren Hermansen, a farmer who had lived there all his life. When some federal money was found for a single staff position he became the project's first employee.

For the first few years not much happened. 'There was this conservative hesitating, waiting for the neighbour to do the move,' Hermansen told the *New Yorker* last July. 'I know the community and I know this is what usually happens.'

He began attending local meetings on any issue and asking Samsingers to think about what it would be like to work together on something they could all be proud of. He even showed up a few times with free beer.

Hermansen was determined to use the strong social ties as a driver for change, and his plan worked out. As more people got involved, that encouraged others to do so and after a while, enough Samsingers were participating that participation became the norm.

Samsø's carbon-neutral status has mainly been achieved by using community-owned wind power. Eleven one-megawatt onshore wind turbines cater for the community's electricity needs. Ten additional 2.3MW offshore wind turbines were installed in 2003 to compensate for the island's transportation emissions—including ferries—and all other non-renewable energy consumption.

www.energiakademiet.dk/default_uk.asp

Westmill

Westmill is the first wind farm in the south-east of England and the first 100% community-owned scheme in the UK.

It took 15 years of planning, with work finally commencing in August 2007. The turbines were commissioned in March 2008 and over 600 members and guests attended the grand opening of Westmill wind farm in May. The

Samso Energy Academy

wind farm is on an old airfield and consists of five 49-metre-high turbines with 31-metre blades.

Power generated from the turbines is sold through a power purchase agreement to two separate electricity suppliers for a fixed term. The wind farm produces enough electricity for over 2500 average homes. According to Energy4All's Helen Jackson the wind farm has raised a total of £4.8million from member contributions.

Westmill Co-op is a member of the Energy4All family of cooperatives. Energy4All was formed in 2002 to assist communities in the UK to set up community-owned wind farms, offering industry experience plus administrative and financial services to cooperatives for an annual fee.

They realised that although community-owned wind farms were playing a huge part in renewable energy in Europe, the UK wasn't incorporating the model, preferring to build large privately owned wind farms. Energy4All began building wind farm cooperatives in 1996, starting with Baywind.

Energy4All is actually owned by the cooperatives it assists: Baywind Energy Cooperative, Westmill Wind Farm Cooperative, Boyndie Wind Farm Co-

operative, Fenland Green Power Co-operative, Isle of Skye Renewables Co-operative and Great Glen Energy Cooperative. As additional cooperatives are established they will take a share in the organisation.

www.westmill.coop

Dakota Wind Energy

Like the United Kingdom, the United States is trailing behind Denmark and Germany in the extent of their community wind farm implementation. Several smaller wind turbines have been put up by farmers and local utilities, but, in general, the commercial model is favoured. However, things are changing in a big way.

The United States is doing things on a larger scale. Rather than messing about with two or three turbines here or there, the new Dakota Wind Energy cooperative will be building a utility-scale wind farm with a capacity of 750MW, to be developed in phases over the next three to five years.

They now have over 162 square kilometres of land under option in connection with plans to develop South Dakota's largest community-based wind farm. This is over half of the 300 square kilometres they are aiming to secure for the massive development, around a sixth of the area of greater Melbourne!

The cooperative put up wind measurement masts last April and desktop studies show that the wind resource will be strong.

'The landowner interest in our project has been immense, especially with our recently announced intrastate public offering,' says Pete Karlsson, a local project specialist.

'Most landowners who have granted Dakota Wind Energy wind-related rights are choosing to become owners in the project company.'

Nine local South Dakota landowners have partnered together to form and capitalise on this project. The cooperative is being managed by a group called National Wind, who have participated in developing 15 wind energy projects and currently have over 3000MW in development in Minnesota, Iowa, North Dakota and South Dakota. ✻

www.dakotawindenergy.com

Own part of a wind farm!

Australia's first community-owned wind farm is still seeking public investment. The share offer for the Hepburn Community Wind Park has been extended into December. Go to www.hepburnwind.com.au

Home insulation buyers guide

In this update to the insulation buyers guide from issue 88 of *ReNew*, Lance Turner takes a look at what options are available to help improve the thermal performance of your home.

Insulation improves the comfort level inside your home by reducing heat flows into and out of the building. Reducing heatflows stabilises the temperature inside the house, regardless of the temperature outside. In winter, once the home has been heated to a comfortable level it will stay that way with less energy input than an uninsulated home would require.

The same applies to summer conditions. The insulated home will take longer to heat up and if an air-conditioner is used it will use less energy than one cooling an uninsulated house.

Photo: Maine Green Building Supply www.mainegreenbuilding.com

Insulation made from natural textile fibres, such as these batts made from recycled denim, are safe to handle without protective equipment, making them ideal for DIY installation. Now, if we could only get recycled denim insulation in Australia!

How does it work?

There are three ways in which heat transfers to or from a house: conduction, radiation and convection.

Conduction means the transfer of heat through a substance, in this case the walls and ceiling of the house. The type of insulation used to reduce conductive heat transfer is known as 'bulk fill' insulation.

This is the most common home insulation and may be in the form of fluffy 'batts' made of many materials, including polyester fibre, glass fibre and sheep's wool. Insulation may also be in the form of loose fill material, such as treated cellulose fibre (usually made from recycled paper), which is simply pumped into the roof or wall cavities. These materials are poor conductors of heat and so when they are installed properly, they reduce the rate of heat flow.

Radiation is a different form of heat transfer. All warm objects radiate heat in the form of infrared radiation. If this heat can be reflected back from where it has come using reflective foil insulation, then heat loss or gain through radiation can be greatly reduced. The main thing to remember with foil insulation is that it needs an air gap between the shiny side and the roof or wall cladding (assuming it has a shiny side facing that direction). If it is fixed such that the wall or roof materials are in contact with the shiny surface then it will not be effective unless it is a double-sided material which has a shiny suface facing into the cavity. In this instance it is not reflectance, but the low emissivity of the reflective material that prevents the heat transfer.

Foil's effectiveness can also decrease if it becomes dirty or dusty, so it needs to be installed with this in mind.

Many foils have only one reflective side and so will reflect heat away only from that side. Foil is often installed into walls on building sites with the reflective side facing inwards. In this instance, the foil will help keep heat in during winter with reflectance, and help keep it out in summer by not emitting it from the shiny side.

However, products with foil on both sides, such as the Concertina foil batts from Wren Industries, will have a greater insulating effect than those with foil on just one side, providing that the double-sided foil product is installed in a manner that makes good use of both sides.

Convection heat transfer is often the undoing of many insulation jobs. Circulating air can pass between poorly installed insulation and thus transfer heat into or out of the house.

An example of this is the way foil insulation is installed in many house walls. While it will resist radiant energy transfer, air can often circulate across both sides of the foil, as well as through the joins between the sheets. Air also flows through holes in the foil, such as where pipes and cables pass through it. This circulation greatly reduces the effectiveness of the insulation. However, if foil is used in conjunction with bulk fill (which will stop air currents flowing) the insulating properties are greatly increased, providing an air gap on the reflective side of the foil is maintained.

The problem with this is that most bricklayers are loath to include batts in the walls as they build them. As a result, most newer homes are poorly insulated and require vast quantities of energy to heat and cool to a comfortable level. Putting your foot down with the builder and ensuring that batts are included in the walls can make a huge difference to the natural livability of the home, not to mention energy bills.

One solution to this problem is foilboard, which is expanded polystyrene (EPS) sheet with foil bonded to one side of it. This allows the foil and bulk fill to be installed at the same time, thus reducing installation times.

Other insulation needs

This article only looks at the insulation materials suitable for the roof, ceiling, walls and floor (if the house structure allows). However, there is not much point insulating the opaque part of the structure if the transparent part (the windows) are plain glass with no protection. While we won't go into this subject in depth here, there are a number of products available for this purpose including double-glazed windows, double-glazing add-on materials such as the Clear Comfort film, glass with low-emissivity coatings and even foil products like the perforated foil-coated paper Renshade.

Permishield is a new insulation that is designed for use in walls.

Excluding draughts is also an important area to look at. There is no point spending money on insulation if air pours in under doors and around windows.

Simple solutions include installing foam tape around windows and doors, draught excluders across the bottom of external doors and even exhaust fan covers, such as the Draft Stoppa, inside the ceiling—you would be amazed how much of your precious hot air flows out through exhaust fans and vents during winter!

There are plenty of these simple solutions available at most hardware stores and there are too many to list here, so check them out at your local store.

R values

When looking for insulation you will regularly come across the term 'R value'. The R value of an insulation product is basically a measure of its ability to insulate, or resist heat transfer. The higher the R value, the greater the level of insulation, so a batt with an installed R value of 1.5 will let more heat through than an R2.6 batt.

Some insulations work better in summer than in winter and this will be reflected in their ratings. Foil products often have a better summer rating than a winter one. To improve the performance of foil insulations in winter they should generally be used in combination with bulk insulation, so foil is under the roofing and wall cladding material, with bulk insulation just above the ceiling and just behind the inner wall cladding.

Another term heard in relation to insulation is 'U value'. While R value is an indication of the thermal resistivity of a material, the U value is the inverse of that—how well the material transfers heat. With R values, the higher the number, the better, but with U values, the lower the number the better. It is important not to confuse the two!

We should also mention that there are different R value systems used in different parts of the world. For instance, the US uses a system where the numbers are much higher for a given insulative value, so be aware that some suppliers may list the American R value to make the product look a lot better than it really is.

Bulk fill insulation

As mentioned earlier, the two main types of insulation systems are bulk fill and reflective foils, though some products use features of both.

Bulk fill insulation is primarily used in ceilings, usually fitted directly on top of the ceiling between the roof joists. This needs to be done with care as even small holes can compromise the insulation's ability to reduce heat flow. Increasingly it is also used inside walls to improve winter performance.

Bulk fill insulation comes in many shapes, thicknesses and materials, all of which have their pros and cons. The most common materials are still min-

eral wool and glass fibre. Mineral wool, or rock wool, is composed of tiny fibres made from rock (such as basalt), or sometimes from furnace slag. Fibreglass, as its name suggests, is composed of very fine glass fibres clumped together to form a thick mat.

These mats are available in many thicknesses, with a range of insulation values (R values), usually as packets of pre-cut batts.

Batts are also available in other materials, including recycled and virgin polyester, sheep's wool, and even combinations of these two. These materials are also available as rolls, or 'blankets', that can be cut to shape as required.

Another type of bulk fill insulation becoming more popular is loose-fill. While arguably in a class of its own, it performs in the same manner as the batts and blankets, that is, as a barrier to conduction.

Loose-fill insulation is usually made from cellulose fibre from sources such as recycled phone books and newspapers. It is reduced to a fine, light and fluffy material that is treated with various fire retardant chemicals. It is usually 'blown in' to the space it is to insulate, and can completely fill the gap between the roof joists, as some settling does occur with this material over time. An interesting use of this material is to fill the gaps between wall spaces in existing homes, thus allowing older homes to have their walls insulated without removal of the cladding.

When first developed, there were reports of this material losing its fire retardant abilities due to leaching of the fire retarding chemicals when the insulation was subject to moisture. However, this problem has been overcome. Another problem sometimes experienced with loose-fill material is 'blowing around', where air currents in the roof cavity move the material from its original position. At least one company, Cool or Cosy, has overcome this problem with their Supa-Cel product.

Reflective foils

There are many different types of foils available, but most take the form of aluminium foil bonded to a backing sheet. This sheet is often paper treated to resist moisture and fire, and may be reinforced with glass or plastic fibre threads to improve strength.

Some foil insulation comes in the form of batts made from paper or thin card with foil on one or more surfaces. Silverbatts, for instance, have two to four layers of foiled paper separated by short perpendicular walls. They are supplied flat and are pulled open to form batts up to 60mm in thickness which are fitted between or on top of roof joists in a similar manner to bulk insulation.

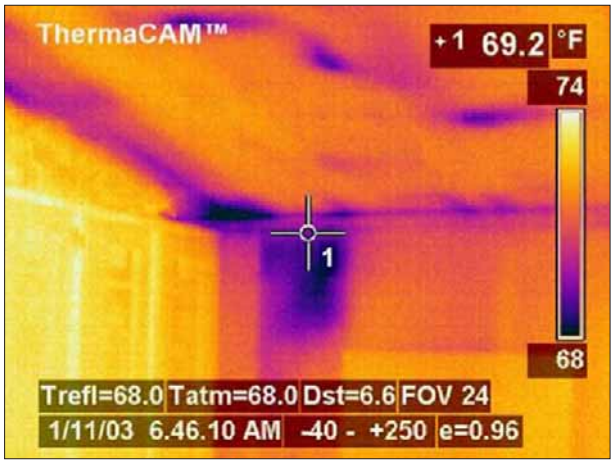
Another unusual type of foil insulation is the Retroshield and similar products produced by AIR-CELL. It consists of what is basically a heavy grade bubblewrap material, with foil on both sides. The reflective foil reduces radiant heat transfer while the stabilised air space in the bubbles resists conductive transfer. AIR-CELL also make closed-cell foam/foil laminations that work in a similar manner.

When used correctly, foil products can have a very high insulating value, especially in summer. When used in conjunction with correctly fitted bulk insulation, the combined insulation abilities can be very impressive.

Pros and cons

While the advantages of correctly fitted insulation are obvious—reduced energy bills and greenhouse gas emissions—there are other factors to consider before deciding on an insulation product.

Over the years there have been numerous claims of the dangers of glass and other mineral fibres, particularly as a possible cause of lung cancer and other diseases of the respiratory tract. There have been many studies conducted around the world, some of which seem to support these claims, and others which do not. That said, mineral and glass fibre are rated as class 2B, possibly carcinogenic materials, by the International Agency for Research and Cancer (IARC). However, most glass fibre materials used for domestic insulation are now said to be biosoluble, meaning they dissolve in the lungs over two to three weeks. Indeed, some of these materials are supposed to be safe without the use of breathing protection, although installers of these materials still seem to suffer from lung problems—known in the industry as 'the cough'.



Residential Energy Services Network www.natresnet.org

This thermograph shows how poorly installed insulation can affect the thermal performance of a room. Note the cold spots (dark areas) in the corner and on the ceiling where heat is escaping.

There is no doubt that glass and mineral fibres cause irritation of the skin, eyes and throat, as any fibreglass worker (or indeed, anyone who has walked around inside a fibreglass-filled roof space) can attest. Having worked with fibreglass for some years, I can say that the material is a serious irritant and breathing apparatus is the minimum requirement for handling this substance. I have handled the new bio-soluble materials and they still seem to be an irritant to me—I certainly would never install these materials without the use of breathing apparatus and gloves.

While you would expect that once installed, the glass fibre would not pose a hazard, this can only be said if it is completely sealed into the cavity into which it is installed.

Most homes are not sealed to this degree and have one or more openings between the ceiling and the roof cavity, for fittings such as exhaust fans, manholes, ducted heating and cooling vents, convection vents and the like. What this means is that many homes with glass or mineral fibre insulation may have some degree of contamination of the air inside the living spaces.

Virgin polyester, being made from petroleum, is a finite resource. Its production also involves the use of some toxic chemicals, so it certainly has its negative aspects.

Recycled polyester insulation uses far less energy in its manufacture and keeps a vast number of plastic drink bottles from ending up in landfill. The insulation in an average home contains around 1400 plastic drink bottles—that's a lot of landfill space saved! As far as safety is concerned, both polyesters can be handled without protective clothing, making them safe for do-it-yourself installations.

Another option is sheep's wool. This material obviously comes from a natural source, but, like all products derived from livestock, has its own associated problems. These include massive land degradation due to clearing for grazing, and movement of the animals themselves. There are also other issues, such as the inhumane treatment of animals during the production process, although the industry is slowly working on some of these problems.

Cellulose fibre insulation has the advantages of being a great use for old newspapers and phone books, although some of the fire retardant chemicals used in these materials are based on the element boron, of which reserves are limited on this planet. These chemicals can also be irritants to skin, eyes and lungs, so breathing apparatus may be a good idea if exposed to these materials for any length of time.

Another safety factor is fire retardance. It used to be that the best of the materials were the glass and mineral fibres. They will not combust and produce little smoke or fumes when subject to a fire. However, in some tests it seems the newer fire retardant cellulose fibre performs as well as or better than mineral fibres. Most of the other materials can be made to burn to some degree, though they all still conform to the relevant Australian Standards and are far less combustible than most other parts of your home.

It would seem that the foil materials are possibly the most environmentally sound products, due in part to the small amount of material required to achieve the end result. Virgin aluminium requires vast quantities of energy to process, but recycled aluminium, which is used in many US made insulations, consumes only around one twentieth of this energy.

So, all in all, there is no perfect insulation from an environmental point of view, but some are definitely worse than others, both in manufacture, installation and living with the product. My personal choice would be an aluminium foil product used in combination with either polyester or wool batts or blankets, as this combination is unlikely to cause any health problems for residents. ✻

Further insulation information

Insulation Council of Australia and New Zealand (ICANZ): www.icanz.org.au

The Your Home Technical Manual online: www.yourhome.gov.au/technical/index.html

Department of Energy (USA) insulation fact sheet: www.ornl.gov/sci/roofs+walls/insulation/ins_01.html

Aluminium Foil Insulation Association: www.afia.com.au

Australian Cellulose Insulation Manufacturers' Association: www.acima.asn.au

The Insulation Contractors Association of Australia: www.tica.org.au

Fibreglass Information Network homepage—information on the dangers of glass fibres: www.sustainableenterprises.com/fin/index.htm

Non-contact thermometers are ideal for measuring the temperature of surfaces from a distance. An hour or so taking measurements around your home on a hot or cold day can tell you where heat is flowing into or out of your home.

About the table

The table covers most of the commonly available forms of insulation products, though it does not cover every manufacturer or supplier—there are just too many to cover them all, and many of the products are virtually the same in both material and performance. Each entry in the table lists the manufacturer's or supplier's details and those of the products they sell, and includes insulation type and material, R ratings, what it is suitable for, how it is supplied and pricing information if supplied, as well as any comments we feel are relevant.

Company/Brand	Product	Material	Used for	R rating	Supplied as	Price per pack	Price per m²	Comments
AIR-CELL Insulation ph:1300 247 235 info@air-cell.com.au www.air-cell.com.au State distributors available	Retroshield	Aluminium foil/single layer polyethylene bubble wrap	Roofs, ceilings, walls and floors	1.5 to 3.3, depending on application	1350mm x 22.25 metre roll	Please contact nearest distributor	Please contact nearest distributor	Many other uses including shed, packaging, hydroponics and winery insulation.
	Glareshield							
	Insulaire							
	Insulbreak	Aluminium foil/closed cell, physically cross-linked foam	Walls and roofs	0.8 to 2.7, depending on application				Thermal break solution for steel-framed applications.
	Permishield	Aluminium foil/closed cell, physically cross-linked foam with breather holes	Walls					Vapour-permeable insulation for steel-framed cladded walls.
	Permifloor		Floors		1350mm x 33.33 metre roll			Water-permeable insulation for suspended framed floors.
Allsafe Energy Efficient Products Group ph:1300 2557233 info@all-safe.com.au www.all-safe.com.au	Wool Batts	70% Wool, 30% polyester	Walls and ceilings	1 to 4.5	7.5m² packs	Please contact nearest distributor	Please contact nearest distributor	Safe, clean and easy to install.
	Poly Batts	100% Polyester						User friendly, non irritant, non allergenic, odourless, non toxic, recycled and recyclable.
	Wool Blend Batts	50% Wool, 50% polyester						
	Roofing Blanket in Poly or wool Blend	Polyester or wool blend/silver foil	Under roof tiles	1.5 to 2	50mm and 75mm thickness			
	Aircell and Green bubble Cell	Foil air-celled insulation blanket	Walls and ceilings	2.5 to 3	20.25 or 30m² rolls			Comes with or without anti-glare.
	Energy Rated Batts	100% polyester	Ceilings and walls	2.2	7.5 or 9m² pack			Builders or trade sales only.
APS Versiclad 27 Helles Ave Moorebank NSW 2170 ph:(02) 9821 2199 info@apsversiclad.com.au www.apsversiclad.com	Ceilink 900	Stucco embossed white steel ceiling face. 51mm polystyrene insulation core, foil sarking	Under roof	2.28 average	Cut to order	Please contact nearest distributor	Depends on roof area	Free span 4 metres unsupported.
Autex P/L Melbourne ph:(03) 9457 6700 Sydney ph:(02) 9756 3122 Perth ph:(08) 9355 1911 sales@autex.com.au www.autex.com.au	Greenstuf	Polyester	Thermal insulation	1.5	Batts	Prices available on request	Prices available on request	User friendly, non irritant, non allergenic, odourless, non toxic, recycled and recyclable.
				2				
				2.5				
				3				
				3.5				
	Roofing Blankets - foiled or unfoiled			50mm thickness	1 roll per pack, 18m² pack coverage. 15 metres long by 1.2 metres wide			-
				75mm thickness				
				100mm thickness				
				50mm thickness				
				75mm thickness				
				100mm thickness				
	Autex Sound Blankets (ASB)	Polyester	Acoustic insulation	ASB 2 - 50mm	2 rolls per pack, to cover 10m²			This is acoustic insulation with reasonable thermal properties. 16.5m x 610mm.
				ASB 3 - 65mm				
				ASB 4 - 75mm				
				ASB 5 - 85mm				
	Autex Absorption Batts/or Blanket	Polyester: white/black		AAB 14	50mm, 75mm, 100mm			This is acoustic insulation with reasonable thermal properties. Cut to size to suit project. Items per pack and coverage dependent on thickness and weight.
				AAB 20				
				AAB 32				
				AAB 48				
Battmans Insulating Services ph:(03) 9775 0460	Battmans failed to supply updated information for the guide.							
CSR Bradford Insulation Freecall:1800 023 380 binccconsumer@csr.com.au www.bradfordinsulation.com.au	Gold	Glasswool batts	Walls, floors and ceilings	1.5, 2, 2.5, 3, 3.5, 4.1, 5.0, 6.0	Batts	Call 1800 023 380 for your nearest distributor	Call 1800 023 380 for your nearest distributor	At least 80% recycled glass.
	SoundScreen	Rockwool batts		1.6, 2, 2.5, 3				Up of 31% recycled waste, increasing to up to 46% within the next few months.
	EnviroSeal	Aluminium foil with poly or paper/yarn backing	Wall wrap or roof sark	See comments	1350mm x 20m and 60m long rolls			
	Anticon	Glasswool blanket with aluminium foil facing	Under roof and walls	1.5, 2, 2.5, 3.0	R1.5 and R2 in 18m² roll. R2.5 in 12m² roll			May need to be used with other insulation to achieve desired R rating.
Cool or Cosy Natural Insulation ph:13 33 34 www.coolorcosy.com.au	Supa Cell Home Insulation	100 % Recycled Cellulose	Thermal/acoustic insulation. Ceilings, walls and floors	3.6 at 140 mm	Loose fill blown in	NA	Call 13 33 34	Sealant applied to prevent dust movement. Environmentally friendly thermal/acoustic insulation and moisture barrier to suit most residential and commercial structures.
Enviro Acoustics Freecall: 1800 800 569 ph:(02) 9605 1333 envirospray@gmail.com www.envirospray300.com.au	Envirospray 300	100% Recycled Cellulose	Reverberation control, spray applied thermal barriers, high transmission loss barriers, rain noise attenuation and condensation control	1.3 per 50 mm as stand alone product	On-site sprayed system in any thickness up to 1500mm	NA	From $25 to $800 per square metre depending on thickness, access, substrate, quantity and design / certification requirement	Excellent for rain noise attenuation on metal roofs, as retrofit absorbers and in achieving ultra high transmission barriers up to Rw85 (noise transmission loss rating).
	Thermospray 800							
	Enviropanel FR				Prefabricated or onsite sprayed panel with plasterboard backing	NA		
Enviroflex ph:(03) 97533811 enviro@enviroflex.com.au www.enviroflex.com.au	Cellulose fibre	Loose fill	Ceilings	2.5 to 3.5	Loose fill blown in	NA	$4-$6 depending on rating	Flexicoat sealer available.
	Polyester batts	60% recycled polyester	Walls, floors and ceilings	1.5 to 4.0	1170mm x 430mm to 580mm centres	Prices available on request	$4-$9 depending on rating	Can be made to size. Can supply only or also install.

Company/Brand	Product	Material	Used for	R rating	Supplied as	Price per pack	Price per m²	Comments
Higgins Insulation Freecall:1300 130 233. sales@higginsinsulation.com.au www.higginsinsulation.com.au	Insulation Batts	Wool or Polyester	Thermal insulation	1.5	11.2m² pack coverage	Prices available on request	Prices available on request	-
				2	9.0m² pack coverage			
				2.5				
				3				
				3.5	6.8m² pack coverage			
	Roofing Blanket - foiled or unfoiled			50mm thickness	1 roll per pack, 18 square metre pack coverage			15m x 1.2m unit size.
				60mm thickness				
				75mm thickness				
		EcoBlanket-just released. Made from natural jute fibre		50mm thickness	1 roll per pack, 18square metre pack coverage			15m x 1.2m unit size.
				60mm thickness				
				75mm thickness				
	Sound Blankets		Acoustic insulation	HSB 2 - 50mm	2 rolls per pack to cover 18.3m² or 3 rolls per pack to cover 20.3m²			15 metres long by 450mm or 610mm wide.
				HSB 3 - 65mm				
				HSB 4 - 75mm				
				HSB 5 - 85mm				
	High Density Pads/Blankets	Polyester: white/black		PACB 20kg	3 x 85mm			430 or 580, 8 batts/pack.
				PACB 32kg	3 x 50mm			430 or 580, 8 batts/pack.
				HBL 14	50mm, 75mm, 100mm			Cut to size to suit project. Items per pack and coverage dependent on thickness and weight.
				HBL 20				
				HBL 32				
				HBL 48	50mm, 75mm			
	Ceiling Panel Overlays	Polyester: white/black		60mm thickness	15 batts/pack to cover 10.8m²			1200mm x 600mm.
				75mm thickness	12 batts/pack to cover 8.64m²			
Pilon Plastics ph:(02) 9525 9880 info@pilon.com.au www.pilon.com.au	Thermobreak (commercial applications)	FR grade, closed-cell crosslinked polyolefin foam with reinforced aluminium foil	Roofs, ceilings, walls and pipe insulation	0.2 to 4	1-1.5 metre wide to 50 metre long rolls and in preformed tube for pipe insulation	Prices available on request	Prices available on request	Environmentally friendly–made from polyethylene without the use of CFCs or HCFCs.
	Thermobreak 2S (home applications)	Double foil faced insulation						
Pink Batts - Fletcher Insulation Freecall: 1300 300 249 info@pinkbatts.com.au www.pinkbats.com.au	Pink Batts Wall Insulation	Glasswool	Walls	R1.5, R2.0, R2.0 High Density, R2.5, R2.5 High Density	Packs of 1160 x 430, 1160 x 580	Prices available on request	Prices available on request	Made from approx. 70% recycled glass. The only glasswool insulation in Australia with Good Environment Choice Ecolabel Certification, CodeMark & AS/NZS 489.1.
	Pink Batts Ceiling Insulation			R2.5, R3.3, R3.8, R4.0, R5.0 & R6.0				
	Silencer Acoustic Insulation			R1.3, R1.7 & R2.1 in 50mm, 70mm & 90mm				
	Sonobatts Premium Acoustic Insulation			R1.5, R2.1, R2.7 and R3.0 in 50mm, 70mm, 90mm and 100mm	Packs of 1160 x 430, 1160 x 581			
Polyair ph: 1300 767 776 sales@martini.net.au www.reflective insulation.com.au State Distributors available	ONE	Aluminium foil (single sided)/single layer polyethylene small bubble	Roofs, ceilngs, walls and floors. Thermal and acoustic insulation	1.0 to 4.25 depending on application	1200mm x 30m or 60m roll	Please contact nearest distributor	Please contact nearest distributor	Many other uses including acoustic, shed, industrial, commercial, food and winery insulation.
	SUPER	Aluminium foil (double sided)/single layer polyethylene bubble						
	ULTRA	Multiple aluminium foil layers (4)/double layer polyethylene large bubble						
	SOUND	Aluminium foil (double sided)/single or double layer polyethylene large bubble						
Green Insulation Pty Ltd Ph: 1300 308 164 info@greeninsulation.com.au www.greeninsulation.com.au	Reflecta Shield Reflecta Cell Reflecta Guard Foil Tape	Aluminium scrimed foil/double layer polyethelene bubble inner layer.	Roofs, ceilings, walls, floors and garage doors etc.	1.5 to 3.2 This will depend on the product and application	In rolls of 1500mm wide x 20 metres long	Please contact your nearest Green Insulation distributor	Please contact your nearest Green Insulation distributor	Our product comes with a unique polymer coating applied to the top aluminium foil layer to prevent oxidisation and corrosion.
Silverbatts Insulation Systems ph:(02) 9317 4455 info@silverbatts.com www.silverbatts.com.au	Silverbatts	Multi-layer reflective foil	Roofs, ceilings and walls	2 to 6	1200mm x 450mm or 1200mm x 600mm	Prices available on request	Prices available on request	Approved by Asthma Foundation.
	Silversark Extra Tough	Extra heavy duty sarking and premium wall wrap foil/woven polypropylene with antioxidant for tear resistance	Roofs and walls	1 to 1.3	1350mm x 60 metre long roll or 1500mm x 60 metre long roll			Suitable for installation under tile and steel roofs.
	SilverWrap Tough	Medium duty wall wrap foil/woven polypropylene with antioxidant for tear resistance	Perimeter walls		1350mm x 60 metre long roll or 1500mm x 60 metre long roll			Resistant to wind.
	SilverFloor	Extra heavy duty floor insualtion; woven polypropylene centre with double-sided foil laminate	Timber floors	3	500mm x 60 metre long rol			Designed to be installed from above before the floor is laid down.
	Pleated foil wall batts	Foil/kraft paper	Perimeter walls	2 to 4 depending on cavity space and building material	1200mm x 450mm flat pack			May be used in any building type including brick veneer and weatherboard.
Thermowool Ph:(03) 9336 2111 john.skylightshop@bigpond.com www.skylightshop.com.au	Thermowool batts	70% wool, 30% polyester blend	Walls and ceilings	1.5, 2, 2.5, 3, 3.5	Batts 1160mm long by 430mm or 580mm wide	$43.90 to $52	$5.10 to $12.10	May contain industrial recycled wool up to 50%.
Wren Industries Freecall: 1800 066 002 ph:(03) 9532 5855 info@concertinafoilbatts.com www.concertinafoilbatts.com	Concertina Foil Batts	Expandable aluminium foil/kraft paper/aluminium foil laminate	Walls	R2.6 with foil wrap	1200mm or 1350mm long by 450mm or 600mm wide. Pack of 25 batts	$81.67 to $122.52	$6.05	Reflects 97% radiant heat. Can be used with bulk insulation in ceilings to reduce radiation.
			Floors	3.1				
			Ceilings	Adds approx 1.0 on top of bulk				
	Renshade	Perforated aluminium foil/kraft paper/aluminium foil laminate	Windows	Unspecified	1350mm wide x 10m long rolls	$178.20	$13.20	Velcro to inside of glass or as Holland blinds. Stops approx. 85% radiation while maintaining view.
			Skylights					
			Transparent roofing					

Better batteries—where are they?

With all the media reports of new battery technology lately, you could be forgiven for thinking that the lead-acid battery has been made redundant. Lance Turner looks at the state of play in batteries.

The lead-acid battery has been the mainstay of the energy storage industry for over 100 years. They are cheap, relatively robust and can handle hundreds to several thousand charge-discharge cycles if treated correctly. However, they do have a number of problems that make them less than perfect.

Firstly, being predominantly lead, they are extremely heavy. While this isn't too much of an issue for stationary applications, for mobile applications, the lighter the battery, the better. Of all the rechargeable battery technologies, lead-acid has one of the lowest energy storage densities available. This means that, per unit of energy stored, they are heavier than most other battery types. Typical energy densities can be seen in Figure 1.

Another problem with lead-acid batteries is that they suffer from greatly reduced cycle life when they are cycled deeply. While most battery technologies have a direct relationship between number of cycles and depth of discharge (DOD) per cycle, the effect of deep discharges on lead-acid batteries is quite marked. For example, a battery that may be rated for 3000 cycles at 10% DOD may only be rated for 300 cycles at 80% DOD. If you were to use this battery in an electric vehicle or other situation that requires deep discharges, then the battery isn't going to last very long.

Lead-acid advances

However, a number of companies have decided that there's life in lead-acid technology yet. The general trend has been to develop new designs of batteries that not only have longer lifecycles, but also have better energy densities than current designs.

The method for achieving this is similar with most of these designs, and usually involves replacing one of the electrodes (usually the negative electrode) with a carbon foam matrix impregnated with active material. Distributing the active material inside a carbon matrix allows more complete use of the material (giving greater energy density) and provides more internal structural strength, which reduces plate degradation and increases lifespans.

A typical example of this is the Oasis battery from Firefly Energy (a division of heavy machinery company Caterpillar). For example, the 100Ah version has a rated life of 800 cycles to 80% DOD and 700 cycles to a full 100% DOD. Compare this to a regular sealed lead-acid battery, which has a typical life of 100 to 300 cycles at 100% DOD. According to the battery datasheet, after over 1000 cycles the battery still retains over 90% of rated capacity. This makes the Oasis battery a realistic proposition for deep discharge uses such as powering electric vehicles.

Energy density is also improved over conventional lead-acid batteries. For instance, the same battery has a density of around 28 watt-hours per kilogram at a C/3 discharge rate. At that discharge rate, a high quality conventional gel cell for electric vehicles is typically rated at 24 watt-hours per kilogram and is unlikely to retain that rating for more than a few dozen cycles.

The Oasis will be on the market early 2009 and is aimed at the trucking market to reduce the need for engine idling, but it is expected to be offered more widely in the near future. Firefly Energy state that they see a considerable market for electric vehicles. There is no Australian distributor yet.

Locally, the CSIRO has been working on what they call their UltraBattery, which is, as they describe it, a combined lead-acid battery and supercapacitor. The idea is that for lower continuous currents the lead-acid cells provide the current, but for short-term high peak requirements the supercapacitor pro-

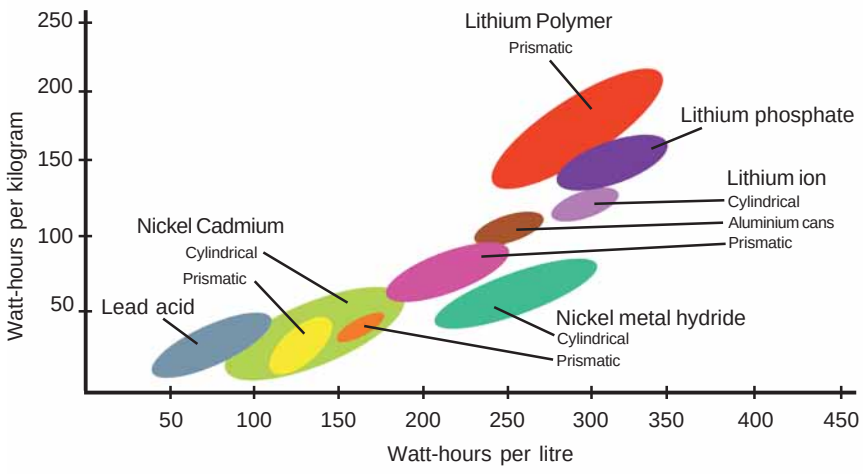


Figure 1. Energy densities for various battery chemistries. Not all chemistries are shown.

vides most of the current. This greatly reduces stress on the battery plates, greatly increasing their lifespan.

CSIRO state that cycle life will be around four times that of conventional lead-acid batteries, with rated power (i.e. instantaneous output) around 50% higher. However, they make no claims about improved energy density.

The UltraBattery is aimed at the hybrid and plug-in hybrid electric vehicle market, with the aim of replacing the more expensive nickel-metal-hydride and lithium batteries that make hybrids so expensive. Of course, they would also be attractive for pure electric vehicles and would greatly extend battery bank life of renewable energy systems.

As is typical with many Australian inventions, the UltraBattery won't be manufactured here, at least for now. Instead, Japanese firm Furukawa Battery Company has started modifying a plant to make the UltraBattery by the middle of next year. In the US, battery manufacturer East Penn in Pennsylvania will also manufacture it. So it seems that once again, a device developed here will be made elsewhere and Australians will have to pay through the nose for our own technology.

Lithium cells

Anyone who owns a laptop or mobile phone has used lithium battery technology. The most common form is lithium ion, which are generally manufactured in the form of small cylindrical or flat (called prismatic) cells. This technology has been the subject of numerous battery recalls due to batteries overheating and catching fire. However, technology has improved considerably in recent years and the batteries are safer than previous versions.

Their main advantages are their high energy density. Densities of over 90 watt-hours per kilogram are typical, making them three to four times as energy dense as lead-acid batteries. For applications such as mobile electronics and electric vehicles, the lighter the battery the better, and this aspect alone makes lithium batteries very attractive to manufacturers.

However, their propensity to overheat when cycled rapidly or when damaged makes them unsuitable for commercial electric vehicles. But there is another lithium technology that is set to become the major player in the EV sector.

Lithium phosphate is not only a great deal safer than regular lithium ion but also has improved energy and power densities. There are several suppliers of these cells, including Lifebatt (who have an office here in Australia), A123, whose cells are used in the Tesla Roadster EV, and Valence Technologies in the USA, who make 12 and 18 volt batteries in sizes up to 138Ah. All of these suppliers make small cylindrical cells up to 10Ah or so in capacity. Dozens or hundreds of cells are assembled together into larger batteries, which often include inbuilt battery management systems for battery monitoring and protection.

There are also larger format lithium phosphate cells available, such as those from Thundersky in China. Initially there were some problems with the Thundersky cells but they seem to be improving and they have become popular for home-built and commercial electric vehicle conversions. They are rated at 2000 cycles at 80% DOD, which is much better than standard lead-acid batteries.

The main drawback with lithium phosphate cells is the initial cost, although, with their long cycle life (the Lifebatt cells for instance have been tested to over 7000 deep cycles), the overall lifetime cost of these batteries is quite reasonable.

As with all lithium technologies, lithium phosphate cells must be accurately monitored during both charging and discharging to prevent them from being damaged. This means it is very important to include some form of battery management system in any battery bank that uses these cells. Some brands include the BMS in the battery pack itself so you don't have to worry about it, but the large format cells like the Thunderskys need external management systems fitted.

As mentioned earlier, one of the biggest selling points of lithium phosphate batteries is their much better safety compared to other lithium ion technologies. They are much less likely to cause fires, especially when punctured or crushed, as might happen in a vehicle accident. Indeed, the worst that happens is they vent a bit of gas. There is a great demonstration of this on the Valence website at www.valence.com/technology/battery_safety/battery_safety_video

Image credit – Advanced Lead-Acid Battery Consortium

Energy Transformed Flagship Director, Dr John Wright, with the Honda Insight fitted with the CSIRO UltraBattery, which clocked up 160,000 kilometres in a test this year.

Lithium polymer

Another interesting lithium technology is the lithium polymer cell. These are now widely used for high performance electric remote control models, as they can provide high output currents and have very high energy densities.

The main drawbacks with lithium polymer are their cost, although this is coming down steadily, and their susceptibility to excessive discharge. Indeed, if they are discharged below a certain point the cells can be permanently damaged. This problem has prevented them from being more widely used. While their excellent energy density and power density would make them ideal for electric vehicles, the potential cost of accidentally overdischarging a pack prevents them from being used in this application, at least, so far. They can also be prone to bursting into flame if physically damaged.

Zinc chemistry

Silver-zinc batteries are another interesting technology. The main developer of these seems to be Zpower, who have redesigned this battery chemistry using a composite polymer-zinc anode to produce batteries that they claim have energy densities well above lithium ion.

They are designed to be fully recyclable and are said to be non-toxic and non-flammable. The safety aspect alone gives these batteries a considerable edge over lithium technologies. What the company doesn't state is their cycle life. Previous zinc chemistry cells have had life cycles of only a couple of hundred cycles at best, but the design of the Zpower cells means they are far more mechanically stable, so their cycle life should be considerably improved.

Other battery technologies

There are several other battery technologies that should be mentioned, although none of them are readily available for domestic use. This is due to price, them not yet being in production, or issues with the technologies. These chemistries include sodium sulphur and carbon fluoride, such as the CFX rechargeables from CFX Battery Inc.

Ultracapacitors

Supercapacitors are capacitors with ratings in the Farads to a few tens of Farads. Ultracapacitors have ratings in the hundreds or even thousands of Farads. However, because most ultracaps are rated at around 2.5 volts per capacitor, the energy stored by a single capacitor is still quite small. Even the best ultracaps have energy densities of less than 10 watt-hours per kilogram.

The trick is to make capacitors that work at much higher voltages, but because the dimensions between charge carrying surfaces inside ultracaps are so small, the dielectric (insulator) between surfaces generally breaks down when subject to voltages higher than a few volts. Up until now, this has prevented high voltage ultracapacitors from being manufactured, but EEStor in the US claim to be able to manufacture materials based on barium titanate that allow them to produce ultracapacitors that can handle voltages into the thousands of volts. As the energy stored in a capacitor increases with the square of the voltage, then a capacitor running at this sort of voltage will store a great deal of energy.

Indeed, EEStor claim they can manufacture an energy storage unit with a capacity of 52kWh weighing just 190kg. This equates to an energy density of over 270Wh/kg! What's more, they are estimating prices to be around half that of equivalent lead-acid batteries when they are in full-scale production.

All this is based on the specifications of their barium titanate material and they are yet to produce any commercially available ultracapacitors, but there is a great deal of interest in their product. At least two electric vehicle manufacturers plan to use the EEStor units in their vehicles, as does defense contractor Lockheed Martin. If this company can produce what they say they can, they will make many other battery technologies obsolete.

The Oasis battery from Firefly Energy. It looks like a regular lead-acid battery and will be a drop-in replacement in many systems.

In the future

With the sudden popularity of electric vehicles, there has been a recent explosion of battery technology research and development. There are some very interesting possibilities being explored, one of which is a new design of lithium cell where the lithium is embedded in silicon nanowires. Developed by Stanford University, batteries made using this technology could theoretically gain a tenfold increase in capacity over current lithium ion batteries. Imagine an EV with a range of over 1500km on a single charge!

We will continue to monitor the state of play in battery research, so keep an eye out for more battery technology articles in *ReNew*. ✻

More information

- **en.wikipedia.org/wiki/Rechargeable_battery**
- **www.fireflyenergy.com**
- **www.lifebatt.com.au**
- **www.ev-power.com.au**
- **www.a123systems.com**
- **www.thunder-sky.com**
- **www.valence.com**
- **www.cfxbattery.com**
- **www.zpowerbattery.com**
- **www.axionpower.com**
- **www.ultracapacitors.org**
- **www.csiro.au/science/UltraBattery.html**

Simple greywater irrigation

Paul Young waters his orchard with this simple, low cost greywater irrigation system, perfect for keeping trees going during summer.

Like many people concerned with water use and reducing the impact of my excessive capitalist wasteful bourgeois lifestyle, I decided to put my greywater to better use. It's easier than putting my greymatter to better use and arguably a more valuable resource.

I had a few ideas I wanted to stick to, as well as keeping it within reason regarding council approval. It's best to read up on your own council greywater regulations. I based my system on the 'what they don't know...' legal principle.

Keeping it simple

The main guidelines I followed were:

No storage. Stored greywater will build up bacteria and also requires space. Up to 24 hours storage is acceptable, but I opted for no greywater storage at my house.

Shower/bath/sink/laundry only. My kitchen water goes down the normal wastewater system, meaning no grease traps to worry about.

Minimal maintenance. Small holes clog up so it had to be robust. Greywater contains hairs, soaps, grease, dirt and who knows what else that falls off my kids.

Subsurface irrigation. I wanted the water delivered under the mulch and into the soil.

Cheap, very cheap. That means no pumps or commercial kits.

The main reason for setting up this system was so that I could water my 16 tree orchard. My sloping block made this much easier, although it would work on a flat block. If it's uphill—forget it.

The system is very simple. Water flows from the various sources in the

1. This odd looking contraption guarantees things work smoothly. It's an overflow pipe and diverter valve. Details on how it works can be seen at right.

2. The diversion valve. When I have too much rain and the trees don't need watering, I turn the valve and the greywater goes back into the sewer. I used 25mm corrugated greywater pipe to get to the trees.

3. Overflow pipe. If the greywater can't escape fast enough, for example when the kids let the water out of the bath whilst I am having a shower, it will fill 1.5 metres of vertical pipe on the right, then overflow into the kitchen drain pipe on the left, flowing to the sewer. The air-valve is to stop airlock/siphon issues.

Greywater tips

- Don't store untreated greywater for more than 24 hours
- Don't use water from the kitchen sink or dishwasher as it is often contaminated
- Choose low salt, low phosphorous and biodegradeable detergents and cleaners
- Avoid spraying or hosing greywater

4. The first tree also has a 1.3 metre overflow pipe. If there is a blockage lower further down the pipe, or too much flow, it simply comes out here. This is below the level of the house. Make sure yours is too.

5. This is a one inch (25mm) poly and one inch poly pipe Y piece. I used the cheapest low density irrigation poly I could get. Hose clamps were not needed.

6. One inch poly, one inch poly T, and an end stop using a cable tie.

The trees that benefit from the greywater system.

house via a diverter and overflow set-up, into one inch (25mm) polypipe. This leads straight into the orchard, where the water is distributed to the trees by pipes branching off the main pipe, which are fitted into water spikes.

The system is explained in the photos, just start at photo one and work your way through, you'll get the idea.

The only maintenance required is for the spike to be washed out and replaced every six months or so. There's no filters, no pumps, no smell, no cleaning, no worries. The ends of the pipe don't appear to collect rubbish and the system is pretty foolproof and self regulating. The system has easily obtainable parts that should last for a long time and are dirt cheap to replace.

I had the luxury of a high-set house and a sloping block, giving me plenty of fall and water flow, It gives me cheap year round irrigation. Your results may vary, depending on the nature of your land. ✻

To visit Paul's website and blog go to www.neuralfibre.com/paul/tree-hugging

7. The magic ingredient. The one inch poly fits perfectly into these water spikes. They are 99 cents from Bunnings and designed for use with soft drink bottles. They deliver a perfect amount of water. I tried enlarging the holes, which was a bad move; the factory size is perfect.

To find out more about greywater and some of the more complex treatment systems available see the greywater buyers guide in *ReNew 102*. Every issue of *ReNew* is available for download from the ATA website. Downloads are free for ATA members, or range in price from $2 to $5 for non-members. Articles can be searched for in the online library at www.ata.org.au/library

The national picture

Emissions trading is still on the agenda, however, opportunities to reinvigorate the economy with sustainable measures are being lost, writes Alan Pears.

It's certainly a relief to hear that the federal government plans to continue implementation of its emissions trading scheme, known as the Carbon Pollution Reduction Scheme (oh dear, the spin doctors have to meddle with everything nowadays, it seems), despite the global economic meltdown. They're right to do this. It's obvious that delay will just undermine investment decisions by continuing uncertainty. We would miss out on the chance to capture business growth opportunities if we fail to send positive signals to emerging low, zero and negative carbon businesses. And the more we delay, the more likely it is that businesses with opportunities to cost-effectively cut emissions will delay action in the hope of gaining a 'compensation' bonanza. I think many will be surprised to see how many remarkably financially attractive actions are taken by businesses as soon as the scheme starts. I hope researchers are getting good baseline data now, so that they will be able to report back on the unexpected good news.

The economic meltdown has also seriously challenged the ascendency of market economists. It's obvious now that markets need some controls, and that they do have limits in their ability to drive rational and efficient outcomes. The economic crisis is also likely to apply even stronger pressure to the government to 'compensate' affected trade-exposed industries and coal power stations. This reinforces the argument that emissions trading is only part of the solution and that a comprehensive package of measures including incentives, research, development and demonstration (RD&D), regulation, information and recognition of voluntary action will be needed.

The government's efforts to reinvigorate the economy make sense, but there are worrying signs that the opportunities to use this investment to position us for a successful low emission future are being lost. I just don't understand why the first home buyer incentives were not linked to investment in sustainable features, and limited to smaller homes. Can anyone really argue that a new home bigger than say 200 square metres is a community asset? I see it as a liability that locks us into ongoing energy and resource waste and traps the buyer into higher debt and higher living costs. So why are we subsidising them?

Cost of climate response

There's lots of talk about the cost of responding to climate change. But most of it is unduly negative. The reality is that we are already benefiting from abatement actions—often without realising it. Any household that buys a new family fridge will be saving around $150 a year on running costs compared with old fridges. Someone who lives in an insulated house is healthier and is saving money. And we have had to invest less money in energy infrastructure to supply them. In industry, variable speed drives and efficient motors, more efficient air compressors, 'smart' control systems and many other modern features save emissions, energy and money, while improving productivity. But we take these savings for granted, and focus on the negatives that flood the media.

Sure, we could (and should) have done a lot better. But we should be acknowledging these savings because they support further investment.

I also find that many people see emissions trading from a one-sided perspective. They see $20 a tonne of CO_2 as a cost. That's not right. This money flows to the government (if permits are auctioned or sold) and increases its revenue—just like increasing taxes. All that money therefore either reduces the need for government to raise other taxes, or allows it to do more to help us.

Much of the small cost of climate response shown by the economic modelling is actually due to modelling assumptions. They assume that we are pretty efficient in the way we allocate money now and that we use energy and resources quite efficiently. So shifting from present spending patterns to more sustainable ones, according to modellers, reduces overall economic efficiency and shows up as a cost to the economy, which is not a very big one, though. If a smart country can't find more productive ways of investing its

money than building capital-intensive power stations and freeways and oversized houses, I will be very surprised.

The modelling for the Garnaut Review shows some interesting things. First, it shows a loss of growth in economic output of around 0.1% each year until mid-century, when it shifts to become a benefit. But Garnaut went to great lengths to point out that this modelling included only one of four kinds of costs due to unabated climate change. That is, three of the categories of benefits from doing something about climate change could not be modelled. So it's likely that the overall outcome will be a net benefit from the early days of action.

The interesting thing about the more recently released Treasury modelling is that the 'cost' of achieving a 25% emission cut by 2020 is not much higher than the cost of much more modest cuts. Looking at Figure 6.9 (p.144) in the Garnaut Review suggests that under the no-cuts scenario, GNP per person grows by 67% by 2050, while the low cut scenario (5 to 10% cut) limits GNP growth to 57% and the supposedly devastating 25% cut scenario drives growth of 53%, a 4% reduction in growth over 40 years. This compares with a cumulative reduction in GNP growth of 10% for the initial 5-10% cuts. We would get a lot more bang for our buck by going for stronger cuts. Oh, and we might help save humanity.

National energy efficiency scheme

We now have three states—NSW (NEET), Victoria (VEET) and South Australia (REES)—with energy efficiency obligations on energy retailers, and other states contemplating similar schemes. All are different. Earlier this year there was a senate inquiry into developing a national energy efficiency scheme, promoted by former Senator Lynne Allison. The inquiry decided to ignore national coordination. In my evidence to the inquiry I warned that the government had the opportunity to lead now, or try to sort out the mess in a couple of years. The excuse I got from Canberra is that they are too busy with emissions trading. This is a re-run of the story with energy market reform: we were promised they would get to energy efficiency after they sorted out the core issues of the market. After 17 years we're still waiting. The problem is that key policy makers just don't seem to get it: energy efficiency *is* a core part of any effective energy or emissions policy, not an optional add-on.

US election results

The world can expect to see significant shifts in US policy on climate change and energy efficiency, based on the incoming president's published policies. These seem to have been influenced by Al Gore's recent call for the US to shift to 100% renewable electricity in ten years. At the same time, major shift was inevitable; Senator McCain was also a strong advocate of climate change response.

Perhaps a more subtle outcome of this election relates to how Senator Obama raised funds. He used his community organising background and the internet to raise a lot of money from small donors. So he may well be the first US president for a long time who does not owe a debt to big business. This will of course lead to massive public relations campaigns to try to keep him in line. But it just may leave him free to act more independently. Another example of how distributed systems support democracy? ✻

www.motherearthnews.com

Mother Earth News magazine is touted as the original guide to living wisely. While we're not sure how accurate that statement is, there is no doubt their website has a great deal of useful information.

From solar power, green homes and organic gardening, right through to DIY projects, making apple cider and even making eco-friendly coffins, this site could keep you busy for many hours with the ideas and projects it contains.

Mother Earth News is an American publication, so you have to allow for the imperial units and measures in the articles, as well as references specific to the northern hemisphere. However, these are minor issues that are easily worked around and it can make for interesting reading (I got sidetracked reading about skunks!)

The main issue I had with this site is that it regularly pops up adverts for the printed version of the magazine. While you can easily close these, it might be best to turn on your pop-up blocker for this site.

climate.jpl.nasa.gov

We all know the climate is changing (well, some people still deny it, but let's leave them to their ignorance), but just how much has it changed in the last century or so?

The Global Climate Change website, put together by the people at NASA, lets you take a look at how rising sea levels and melting ice will affect coastlines around the world. Unfortunately, the only part of Australia shown is the top bit of the Northern Territory.

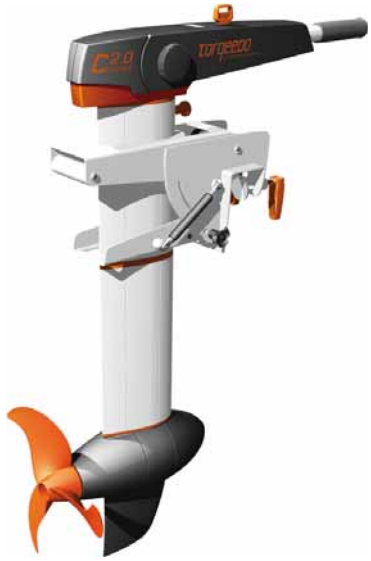
The really scary map is the average global temperature. You can scroll from 1890 through to present day and see just how much the temperature has risen globally.

There's a lot more on the site, including videos on global warming, a climate blog, plus some concise explanations of what global warming actually is, what causes it, and what you can do to help.

If you are a space nut, there is a list of NASA vehicles (i.e. satellites) that are used to monitor the state of the planet's atmosphere and global temperatures. You can read about each satellite, what it does and how it does it.

Probably the best page is the Key Indicators page, where there are several graphs and diagrams that clearly show the rapid changes that are happening to our planet. Send this page to any climate change deniers you know; the evidence here is clear and anyone denying climate change after looking at this page is beyond help.

Boating without the smell, hassle and fire danger



If you use outboard motors then you have no doubt discovered that they can be a real pain. Having to handle flammable fuels on board a boat can be a real hazard, as the numerous boat fires each year show. There is a much better way to enjoy a day on the water.

Electric outboards have traditionally been used only as trolling motors—for moving the boat silently while fishing, or for just puttering along. The Torqeedo range of electric outboards goes one step further, with models up to an equivalent of a 5-6hp petrol outboard.

The Torqeedo range even includes outboards with an inbuilt lithium battery that can give over 10 nautical miles range at low speeds—ideal as an emergency backup or for low speed river use.

RRP: From $2450 for the Travel 801 to $3800 for the Cruise 2.

For more information contact Torqeedo Australia, 246 Duke Rd, Doonan QLD 4562, mob:0410 538 334, email: Claude@torqeedoaustralia.com, www.torqeedoaustralia.com and www.torqeedo.com

Take the kids with you!

Taking the little ones with you when you're cycling can be difficult. The options are limited to bike trailers, rear seats or a carry harness, if the child is small enough. None of these solutions are ideal—the first two mean the child is behind you and you can't see them, while harnesses can upset the balance of the rider.

The WeeRide bike seat aims to solve this problem by allowing the child to ride in front of you where you can see them. The seat mounts to the bike in front of the rider and includes features such as a full harness, padded seat, foot rests and a padded pedestal for the child to lean against—and fall asleep against! The mounting system allows the seat to be easily removed when not needed and the mounting kit is available separately so that the seat can be swapped between bikes.

The WeeRide is suitable for children one year or older (they must be able to hold their head upright with a helmet on) and the maximum load is 18kg.

RRP: $169.95 for the standard WeeRide, $199.95 for the WeeRide Ltd, plus $15 postage inside Australia.

Available from WeeRide Australia, 119/103 Beach St, Port Melbourne VIC 3207, ph:(03) 9015 7251, www.weeride.com.au

Don't use hardwoods, use ModWood!

There's no doubt that hardwood boards look great, but the environmental damage from harvesting trees from forests just can't be justified.

ModWood Technologies has recently released the Natural Grain Collection of hardwood timber replacement boards. ModWood is a composite material made from plastic from recycled milk bottles and reclaimed pine sawdust. It has many advantages over hardwoods including being termite and rot resistant, requires no painting or finishes and is not affected by water.

The new range consists of three new colours and both smooth and brushed finishes. The new colours resemble the timber species that have inspired their names such as Black Bean (dark mocca), Jarrah (red/brown) and Silver Gum (silver/grey).

Natural Grain Collection timber composite boards feature a side groove, which can be used with KlevaKlip system to create a deck with a concealed fixing system. The boards are available in 88mm and 137mm board widths.

ModWood Technologies Pty Ltd, 5 Jesica Rd, Campbellfield VIC 3061, ph:(03) 9357 8866, email: info@modwood.com.au, www.modwood.com.au

Wind-up electronic toys for the little ones

Electronic toys all need batteries, and most people still buy the single-use type. Wouldn't it be great if electronic toys were powered by the almost limitless energy of the child?

Ecotronic Toys make a range of toys aimed at younger children that are designed to do just that. They are powered by inbuilt dynamos that are activated by a crank handle or by shaking the toy for a few seconds. As most electronic toys don't require much power, a few seconds of cranking can give several minutes of play.

The range includes Mr Robot Head, Eco Duck, Eco Phone, Eco Radios, a penguin-shaped torch and the Eco Rocket. More toys are planned for the future.

In keeping with the environmentally friendly aspect, these toys are packaged in Gekopak, a biodegradable packaging that's easy to open, has no dangerous ties and wires and contains nothing but recycled paper.

Available from Ecotronic Toys, The Coach House, 21 Broadway, Chilton Polden, Bridgwater, Somerset TA7 9DR, UK, email info@ecotronictoys.com, www.ecotronictoys.com

First hybrid cars, now hybrid PCs!

Many electronics manufacturers, especially computer manufacturers, are rapidly reducing the environmental impact of their products. Dell has been one of the leaders, and their latest PC is touted as being the most eco-friendly Dell PC ever.

The Studio Hybrid is designed to use just 30% of the energy of a regular desktop PC and its power supply is 87% efficient. It is 20% of the size of a regular desktop and is made from 95% recyclable materials. It also has greatly reduced printed documentation and even comes with a system recycling kit.

The Studio Hybrid is available in a range of colours and even a natural bamboo finish. Specs include up to 4GB RAM, up to 320GB hard drive, a slot-load optical drive (Blu-ray optional), USB, firewire, analogue and digital video ports and gigabit network.

RRP: $899 (although you can buy it online from the Dell USA website for US$499).

For more information, contact your local Dell dealer or go to www.dell.com.au and go to the desktops section.

Making water from thin air

Water is rapidly becoming a scarce commodity, but what if you could just extract it from the air? Well, you can—if you have an air-conditioner it does it all the time.

The Aqua V air-to-water purifier from Envirosource works much like an air-conditioner, except that it is designed purely to condense water from the air. It produces the water and can then provide it cooled or heated (or neither). Because it is optimised to do nothing but produce water, the energy used is surprisingly low. The manufacturer rates it at just 63 watt-hours per litre, or 1.26kWh per day for 20 litres production. They don't specify what ambient temperature or relative humidity that is at, however, but if you have an abundance of renewably-generated electricity and a lack of potable water, the Aqua V may be the solution.

The Aqua V also includes a six-stage filtration system, including UV sterilisation, a sediment filter, pre-carbon filter, UF filter and a post-carbon filter.

Available from Envirosource International, 4 Hossack Ave, Coburg VIC 3058, ph:(03) 9350 6585, email: info@envirosource.com.au, www.envirosource.com.au

Tiny grid-connect inverter

The Envirotech SSI-200W is rated at 200 watts nominal and 250 watts maximum output and is also switchable between 115 and 220 volts (the 220 volt range is between 190 and 250 volts). Input is rated at 14 to 28 volts DC, so it is a 12 volt nominal device, meaning you can start with as little as a single solar panel.

It has all the usual safety features of a grid-interactive inverter, including anti-islanding (it turns off if the grid fails) and reverse polarity protection. Other features include unlimited stacking, so you can expand your system without limit, LED indicators, compact design and RoHS compliance. It doesn't have Australian approval.

RRP: Buyerisland.net sells them for US$259.95

Available from www.buyerisland.net and the Hi-iQ Telecom eBay store at http://stores.ebay.com.au/Hi-iQ-Telecom-Ltd

Maximum power point tracking for smaller systems

Maximum power point trackers are great. They make sure you get the most energy out of your solar panels, increasing the output by 10% or more over non-MPPT solar regulators.

The SunSaver MPPT is a maximum power point tracking regulator designed for smaller solar power systems up to 400 watts or so. It can be used on nominal 12 or 24 volt systems and can use solar arrays of up to a nominal 36 volts, allowing the use of lighter cabling without increased energy loss. Maximum open circuit PV voltage is 75 volts.

The SunSaver MPPT can charge the battery at up to 15 amps and features a load disconnect that can also handle up to 15 amps. Other features include overload, short circuit and over voltage protection, reverse polarity, lightning and surge protection. The controller is suitable for gel, AGM and flooded cell batteries and uses four-stage, temperature-compensated charging. Remote metering is available as an option and the controller comes with a five-year warranty.

Available from Morningstar stockists Australia wide. See www.morningstarcorp.com for more information.

Solar tracking without electricity

Solar trackers usually require an electronic tracking controller and electric actuator to do the tracking, but the Portasol Tracker system is motorless and uses no electricity.

Instead it uses a hydraulic system powered by the sun, which heats a fluid to create the pressure to drive the tracker. It is ideal for installations where there is no spare energy available to run a tracking motor and controller.

At sunset, the liquid cools and contracts, allowing gravity and a small spring to return the array to the morning position. The tracker will funtion in cold weather and in conditions of as much as 70% overcast.

There are several versions of the Portasol Tracker and they are rated by the panel area they can carry. There are one, two, four and eight square metre models, and single and two axis systems.

Price is from $685 for the 1m² poletop unit through to $3570 for the 8m² model, plus GST and freight.

Available from Portasol Trackers, ph:(07) 4698 2881, email: info@portasoltrackers.com.au, www.portasoltrackers.com.au

The ultimate hand dryer?

Dyson are known for their innovative design, and their new hand dryer, the Airblade, is no exception. It is designed to dry hands in just 10 seconds, using only 25% of the energy of a conventional dryer.

You place your hands into the slot and a high velocity blast of unheated air (moving at over 600km/h) literally wipes the water from your hands. The Airblade features a HEPA filter to remove virtually all bacteria from the air before it hits your hands, thus improving hygiene. It also has a very low standby power consumption of just one watt.

The Airblade comes with a five-year/350,000 uses (whichever comes first) guarantee covering parts and a one-year guarantee for on-site labour. The only issue with this device is its size. At 640 x 305 x 250mm, it is not a small dryer and so may not fit in every toilet or bathroom.

RRP: $1644.50 inc GST.

For more information contact Dyson on ph:1800 239 766 or go to www.dysonairblade.com.au

Dual input grid-interactive inverters

Are you planning on adding to your grid-interactive solar array at a future date, or maybe you have two strings of solar panels with different voltages but don't want to buy two inverters?

The Aurora Power One grid-interactive inverters are available in 2000 and 3600 watt sizes, in both indoor and outdoor models. What makes them unusual is that the 3600 watt models have two separate maximum power point tracking (MPPT) inputs, so you can connect two completely different energy sources without having to try and match them. The only requirement is that they be able to share a common negative.

The inverters feature a MPPT voltage range of 90 to 580 volts, making them capable of using solar arrays in many different configurations. The inverters feature all of the usual safety features and are designed to last 25 years and to be able to deliver maximum rated power under all typical conditions.

Available from Solar Inverters, 30 Osprey Drive Urunga NSW 2455, ph:(02) 6655 3930, email: sales@solarinverters.com.au, www.solarinverters.com.au

Pipe the sun indoors

Skylights are great, but many rooms have too much roof space above them to use conventional skylights.

The Solatube Brighten Up series is designed to allow you to bring sunlight into any room of the house. It is designed to provide controllable, consistent and comfortable daylighting for residential, retail or commercial applications. The system combines Solatube's LightTracker Reflector and Raybender 3000 systems to capture light through a UV filtering dome and redirect it indoors.

Installation is simple and requires no structural changes—a single daylighting device can be installed in approximately one hour, as much of the units are factory preassembled.

The Brighten Up series features adjustable tubing with angle adaptors, allowing it to be installed around obstructions while still retaining good lighting performance.

There's also a selection of trim styles, diffusers and effect lenses, allowing the system to be customised to match the aesthetics of any environment. Optional lighting and ventilation add-ons include a daylight dimmer to provide control over light levels.

For further information contact Solatube on ph:13 16 19 or www.solatube.com.au

Now or Never: A Sustainable Future for Australia?

Quarterly Essay by Tim Flannery $16.95 Black Inc. Can be purchased from www.quarterlyessay.com

When Tim Flannery gave his lecture to accompany the launch of his Quarterly Essay at Sydney's Seymour Centre, he told a large crowd that there was no time to delay.

His talk focused on the perilous state of the planet due to climate change, its 'Gaia' nature, what humans have done to destroy it, and what we might do to mend our ways in the future.

In the essay Tim Flannery makes a compelling argument for humankind to enter a new stage of evolution, where we not only walk as humans but also think of humankind when we take actions.

He quotes Carl Sagan and James Lovelock to support his case and writes, "The most credible estimates indicate that we are already exceeding Earth's capacity to support our species (termed its biocapacity) by around 25 per cent. With global food security at an all time low, and greenhouse gases so choking our atmosphere as to threaten a global climate catastrophe, the signs of what may come are all around us."

He then goes on to be more philsophical than he has in the past when he asks, "What is our purpose as a species? And how does Earth work?"

Here he cites James Lovelock and his invention of the 'Gaia' principal which conceives Earth as a self-regulating evolving system. "Gaia is about the giving, taking, and reprocessing of life. The challenge now is to assist Gaia remain true to its essential purpose," writes Flannery.

What is interesting in this chapter is how much he may also be describing how Indigenous Australians see 'country', and humans' relation to it in "caring for country".

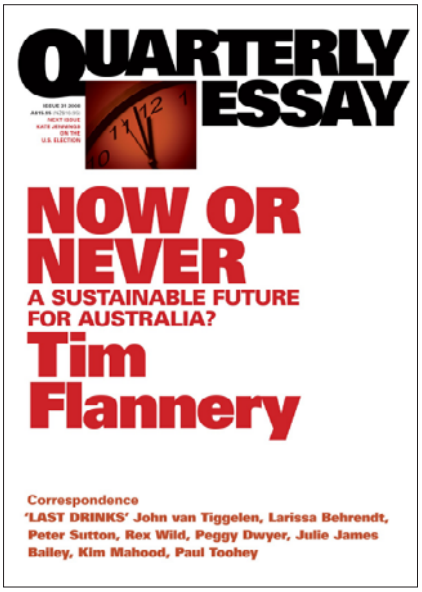
The challenge for Flannery and for humankind is huge, especially when he considers that there are now 6.6 billion of us, and what this is doing to the earth's crust, the movement of Earth's plates, the oceans and greenhouse emissions.

The author himself has caused some controversy over his answers to climate change. Again in this essay he doesn't venture sufficiently into renewables (though he powers his own house by solar panels).

Instead he argues that 'clean coal research' should be financed by companies not governments. "Why you might ask are the coal companies waiting for government agencies, such as the US Department of Energy to foot the bill for clean coal?" He cites their enormous profits, but perhaps their reluctance is because they know the technology is flawed and not a solution after all.

"Globally renewable energy will have to take a significiant portion of conventional coal's market share," argues Flannery. He then goes on to highlight geothermal heat energy's potential, solar collector arrays to power small cities, wind farms, electric cars and the need to preserve forests for carbon sinks (particularly in countries like Papua New Guinea).

Flannery also advocates a return to mixed farming methods such as permaculture, "to liberate us from the great human feedlot that imprisons most of us, which is the root cause of our wasteful attitude to water, energy and food".



His essay returns to the theme of Gaia and Australia's huge carbon footprint. He looks forward to Copenhagen in 2009 when the world will try to forge a post-Kyoto agreement and says that "if we fail, all of our species' great triumphs, all of our efforts, will have been for nought."

Like all Flannery's books, this essay is an inspiring read and if the long lines of questioners at his Sydney talk is evidence, destined to influence people and governments, no matter how inadequately.

Reviewed by Margaret Smith

Plug-in hybrid conversions

I'm trying to find out if you can buy an electric vehicle conversion kit (to plug-in) for a Toyota Prius? I have seen information about these on-line for America but suspect that unless approved by Australian/Victorian motor vehicle registry it might be a headache to get one registered for road use.

Zoe Pilven
Zoe.Pilven@solarsystems.com.au

There are some nice conversion kits in the US, if you go to http://calcars.org/howtoget.html you will see links to several suppliers. The only Australian converter I know of is www.greenauto.com.au but the Products section of their site has nothing in it so you would have to check with them to make sure it is currently available.

I would do some research on this, find out exactly what has to be done to convert the vehicle. I expect there is more to it than just adding a parallel battery pack, some reprogramming of the Prius's control system may be required as well. You should also contact the Australian Electric Vehicle Association as some of their members may have looked into this previously. Their website is at www.aeva.asn.au

Lance Turner

Battery bank life

In August 2001 we received our 24 BP Solar batteries (48 volts of model 2P1110) as part of our RRPGP system. We knew we had only a five year warranty but were led to believe that they should last easily 10 to 15 years or more if looked after properly. And that, we did! We did everything that was expected of us, checking the acid, equalising, checking the voltage, the specific gravity, etc. Within four years we noticed a problem with one of the cells and in March 2006, before the end of the warranty, we did get a new cell as a replacement.

Now the problem is much worse but we are out of warranty. We have two more dead batteries, six that are hardly better and a few more that could qualify as acceptable. Only half of them are good for their age. This is what we cannot understand. Why are some good, some bad and some downright ugly? There seems only one way to answer this question—no quality control! This would mean that the batteries we received were not all the same quality. Could it be because some were older than others? Not the same batch? Who knows? One thing's for sure, we did not get value for money!

At $500 for one battery, it's a pretty expensive exercise. I guess the question now is, what next? We will have to renew those batteries sooner rather than later, but at what cost again? And how long will they last? How will we know if these new batteries are all the same top quality they should be?

Lucky the weather is a bit wild at the moment so we have enough wind for our turbine and enough sun for our solar panels for our genny not to start every day. Still, one day without wind and sun and it will start of its own accord when I use the dishwasher. Any suggestions?

Evelyne Wagnon
jcewag@esat.net.au

Your battery bank should have lasted a lot longer than that. The main determinator of battery life is cycle depth, i.e. how far it is discharged each day. Generally, a system should be designed so that the battery is not discharged more than 10% per cycle (i.e. each day). However, this is something most owners, and many installers, still don't seem to understand. In order to win installations, installers will sometimes reduce the size of a battery bank in order to reduce the cost of a quote. This puts more stress on the bank and will reduce its lifespan. Being the heart of the system, the battery bank should be the last thing to be compromised on.

I don't know the history of your installation so don't know how much of the above applies to your system, but it would be worth doing the energy consumption calculations to see just how deeply your batteries are cycled each day.

There are other issues that can affect battery life, including rough handling, excessive heating during summer (they should never be exposed to temperatures above 38 degrees) and poor installation of the batteries, such as placing them on concrete floors which causes electrolyte stratification. Also, they should only be equalised once a month or so and only for an hour or two—over equalisation can damage them quickly.

I have big issues with battery companies providing replacement cells for banks that are several years old. The new cell will always have a higher capacity than the older cells, so will take longer to charge and therefore have a lower voltage across it, meaning that the older cells will be equalised more aggressively, hence speeding up their demise.

It does sound like the cells in your bank had considerable variance in capacity and I have to agree that there seems to be a quality control issue here. It could be that you got a mixed batch. Some variability in production is normal so banks are often assembled from cells from the same batch if possible.

It is difficult for a battery manufacturer to be held accountable for a bank that is several years old, they have no way of knowing how the batteries have been treated unless you have kept a detailed log of the charge/discharge cycles.

Personally, I would be looking at replacing the bank with sealed batteries, there are a lot more options in these nowadays, but they can be more expensive than flooded cells. But you don't have the hassle of constant maintenance and needing to equalise them. You are probably looking at a replacement cost of $15,000 to $25,000.

There are other battery options becoming

Write to us!

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

available, some people are looking at using lithium batteries for their systems. While they are extremely expensive to start with, they generally have very long lifetimes, typically many thousands of deep cycles, so you can use a much smaller capacity bank. For a decent size renewable energy system, you could be looking at $40,000-$50,000 though.

You should check out the most recent battery buyers guide from ReNew 98, it is a couple of years old but should give you a good idea of what's around.

Lance Turner

EV energy consumption

Electric cars are the flavour of the month, however I have never seen a 'fuel consumption' figure. If the electric car travels 150kms, how much power is required to recharge the batteries, including losses?

We have about $100,000 dollars invested in a solar and wind generating system to supply our house and shed, do we have to double this to cater for two more electric vehicles?

As both of our vehicles will see out 10 years on current distance travelled, at current fuel cost of $5000pa it would seem more logical to buy an ISO and fill it with 26,000 litres of diesel, which would cost about $52,000 and last us 10 years. Rather than spend $60,000 on two plastic cars and another $100,000 in a system to charge them.

It appears to me that it would just be swapping petrol or diesel for coal or diesel. It's also very hard to cart an extra 20 litres of electricity in the back of the ute.

Daryl Fanning
lyrad@austarnet.com.au

The average figures I've seen are between 150 and 300 watt-hours per mile (around 100 to 200Wh per km) but it varies depending on many factors, just like with an internal combustion vehicle. Typical total energy storage is between 15 and 40kWh and range varies from 60 to 300km, depending on the vehicle, battery type and other factors. That figure is the energy needed to be taken from the batteries to drive the vehicle, but there is extra expenditure of up to 20% for the battery charging losses and another 10-20% or so for losses in the charger itself. The better quality the components, the lower the losses.

So, for you, it may not be practical financially to have electric vehicles, as the energy generation equipment would indeed be considerable.

As far as emissions are concerned, even when powering an EV from coal-fired electricity, studies have shown that total emissions are considerably less than compared to internal combustion(IC) vehicles. The main reason is that pollution control is much easier to do at a few power stations than millions of cars. What's more, the emission figures specified by car manufacturers are almost never met in real life as the testing procedures usually don't reflect real world driving. Most drivers tend to have the habit of 'flat on the accelerator, flat on the brake' mentality, which massively increases fuel usage and emissions. When vehicles are under heavy acceleration, emission control virtually goes out the window. However, with an EV, the only result is an increase in energy needed to recharge the more discharged battery pack, there is no change in the ability of the energy source to control emissions.

And this is assuming that you are buying coal fired power for your EV. People who buy an EV are more likely to be charging it with at least some percentage of GreenPower. For many people, financial considerations are further down the list, with emissions being the main priority.

So in your case it would probably be far cheaper to buy a large tank and fill it with diesel, and indeed this may be the only viable option until EVs become more readily available and prices drop. But the environmental issues of going the diesel route are considerable. While diesel engines are more efficient than petrol ones, they produce far more particulates—even a latest model common rail high efficiency diesel will blow visible smoke when under heavy load. Also, diesel contains a host of nasties and is one of the most carcinogenic fuels available. Modern petrol hybrids are better than diesels in most emission outputs and would probably be the preferred option.

Personally, if it were me and I had the cash to do it, I would go the EV route. With a modern lithium battery pack you will have good range and a battery that will last at least 10 years.

Lance Turner

Sinewave inverter buyers guide addendum

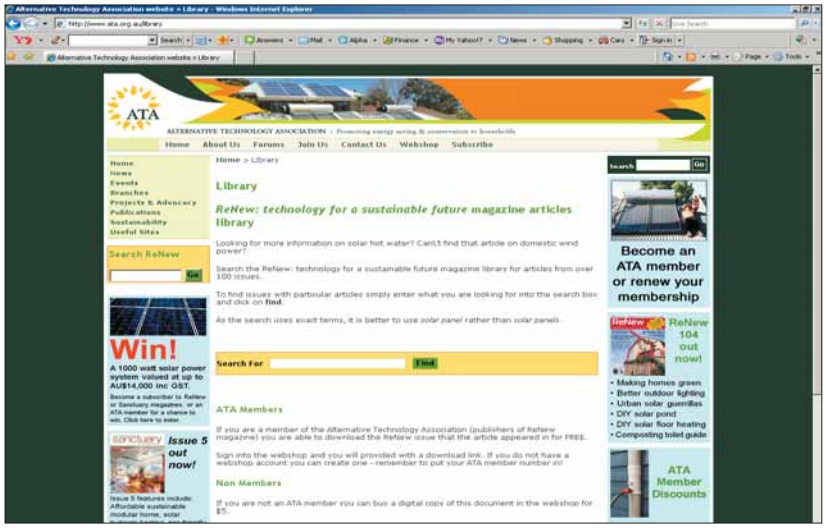
In *ReNew 105* we inadvertantly excluded the Sinergex range of inverters, available from Bainbridge Technologies, from the sinewave inverter buyers guide.

Manufacturer/ supplier (country made)	Model	Input voltage available	Operating voltage range	Power output (Watts)			Efficiency (at % of full load)	Power factor range	Idle power (watts)	Standby power (watts)	Auto start	Minimum start load	Indicators	Size (mm) W x H x D	Weight (kg)	RRP $	Warranty
				Cont.	1/2 hr	Surge											
Sinergex Bainbridge Technologies ph:(07) 3821 3333 info@baintech.com.au www.baintech.com.au	PureSine 150/12	12	10.5-15	150	-	250	72	-	<2.6	-	Yes	-	LEDs	200x132x72	2	$299	2 years
	PureSine 150/24	24	21-31	150		250	80		<3.8	-						$329	
	PureSine 300/12	12	10.5-15	300		450	72		<2.7	-				237x155x72	3.5	$389	
	PureSine 300/24	24	21-31	300		450	80		<3.7	-						$419	
	PureSine 700/12	12	10.5-15	700		1400	91		<14.4	<3				295x180x72	2.7	$799	
	PureSine 700/24	24	21-31	700		1400	93		<14.4	<3.6						$829	
	PureSine1000/12	12	10.5-15	1000		2000	91		<15	<3				383x182x88	4	$959	
	PureSine1000/24	24	21-31	1000		2000	94		<15.6	<3.6						$1,029	
	PureSine 1500/12	12	10.5-15	1500		3000	90		<16.8	<3.4				415x191x88	4.8	$1,299	
	PureSine 1500/24	24	21-31	1500		3000	93		<16.8	<3.6						$1,329	
	PureSine2000/12	12	10.5-15	2000		4000	91		<33.6	<6				422x208x160	9	$1,899	
	PureSine2000/24	24	21-31	2000		4000	94		<36	<6						$1,929	
	PureSine3000/12	12	10.5-15	3000		6000	90		<33.6	<6.6				452x208x166	9.8	$2,799	
	PureSine3000/24	24	21-31	3000		6000	93		<36	<8.4						$2,829	

Practical solutions for sustainable living

Support the organisation that publishes ReNew.

Search and download all the back issues of **ReNew** magazine for FREE! New feature for ATA members



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.

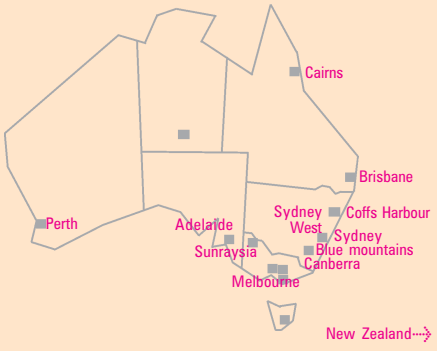
To become an ATA member or supporter go to the ATA website: www.ata.org.au or call (03) 9639 1500. Alternatively, fill out the order form on page 100.

Member discounts

Advanced Eco Technologies 10% • Australian Correspondence Schools 5-15% • BP Architects free Green House Plans book • CC Architects 10% • Dr Bob Rich 10% • Earth Basics 10% • Ecolibria 5-10% • Ecological Design Solutions 10% • EcoSouth $250 off power systems • Endless solar $200 off • Global Export Solutions $100 off • Going Solar 10% • Golden Cypress Timber Sales 5% • Livos 10% • Metcalf Building Consultants 10% • Natural Paint 10% • Outback Energy Supply 10% • Sandford Electronics & Solar 10% • Smartflo 10% • Solar Lord 5% • Solar Tasmania 10% • Sustainable Building Resources 3% • Sustainable Impact 5% plus 5% donation to ATA • The Environment Shop 10% • The Owner Builder magazine 3 free back issues (pre-selected) plus free CD

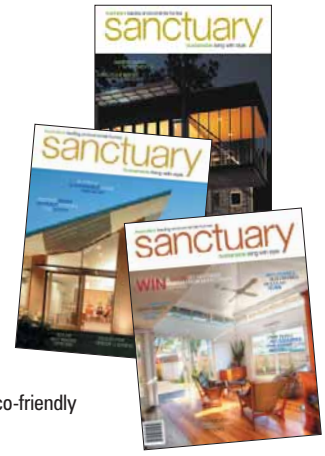
NB: the ATA website has full details of member discounters outlets.

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 5

Affordable sustainable modular home, solar hydronic heating, tank bling: accessories for clean water, eco-friendly flooring options, healthy green paints for your home, plus beautiful sustainable homes from across Australia.

Issue 4

Stylish sustainable home for less than $250,000, rainwater gardens, sustainable landscaping, the low-down on downlights, sustainable living rebates, plus 12 beautiful sustainable homes from across Australia.

Issue 3

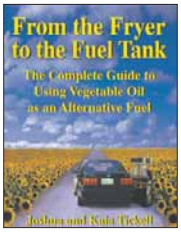
Buying a sustainable home checklist, design your home for green cleaning, keeping warm without costing the earth, plus 12 top eco-friendly homes from across Australia.

Issue 2

More beautiful sustainable homes form across the country. Features include water saving apartments, sustainable kit homes, eco-friendly flooring options, terraced wall garden greywater system and the latest savvy, sustainable products.

Issue 1

Sanctuary brings together 15 of Australia's leading sustainable architects and building designers. With their cutting-edge ideas, these homes are an inspiration to anyone wanting a modern home designed for style, comfort, health and with the environment in mind.



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*

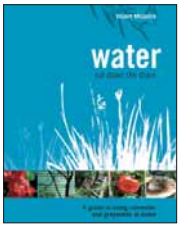
Solar That Really Works!

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

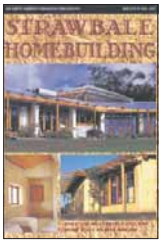
A comprehensive guide to sustainable water use around the home. Consult this book before you install rainwater tanks or a greywater system, or even if you just want to reduce your daily water use. *Item code: WNDD*

Your Home Technical Manual

Price: $49.50 (sorry, no member discount on this item) plus $8 postage

Gives you the information you need to design and build a more comfortable home that is less expensive to run while being more environmentally friendly.

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

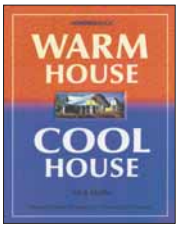


Strawbale Homebuilding

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



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*

Waterwise House & Garden

Price: $29.95 plus $8 postage

This practical guide shows you how to conserve water in your home and garden. The book details water saving using options including rainwater tanks, greywater recycling, and creating a water-efficient garden. Included is a list of native and exotic plants that are drought tolerant. *Item code: WWHG*

ATA Booklets series: Wind Power

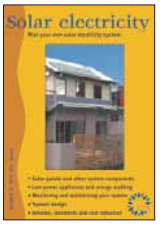
Price: $10 each plus $2.50 postage

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.

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: 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.

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

Professional Wind Speed/Direction Data Logger Kit

Price: $660

This wind monitoring kit provides a low-cost alternative to a professional weather station.

This kit is designed to provide an affordable and easy-to-use solution for wind site evaluation and wind generator performance. The Wind Data Logger records wind speed, gust, and direction, as well as the time and date, temperature (optional), battery voltage, and other important parameters.

The logger records directly to a secure digital card to provide convenient data downloads. Includes a 1GB SD card which will store months of data at 60 second logging intervals. This means fewer trips to retrieve data from the logger. A new file is created and saved to the card for each day the logger is in use.

Then just copy the data to your computer and use your favourite spreadsheet program to view, graph, and analyze your wind data. See the ATA's webshop at shop.ata.org.au for full details. Assembly is required. *Item code: WINDLOGGERKIT*

Low-cost 3 watt MR16 LED bulb

Price $32

Limited stock!

This bulb can be plugged into almost any 50mm halogen downlight socket that uses an MR16 halogen lamp. It uses a single Cree X-Lamp XR-E power LED (the most efficient power LED available) as the light source to generate over 150 lumens (neutral white) or 115 lumens (warm white). This unit comes with a diffuse cover for a more even beam spread.

The LED is driven by an inbuilt switchmode power supply and beam angle is around 45 degrees, suitable for task lighting or highlighting. The body is made of aluminium for good heat dissipation. Power consumption is around 3.5 watts at 12 volts. The bulb will run from any power source of around 12 volts, either AC or DC, so can be plugged straight into most halogen sockets without changing the transformer. *Item code: LEDHAL_1x3WMR16. Please specify warm or cool white when ordering.*

Note: may not work with some electronic halogen transformers as the LED bulb is not a large enough load for the transformer to operate. Light output is eqivalent to around an 18 watt halogen.

LED Replacement Bulb: cool white and warm white

Price: $34.95

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 and warm white, in 38 and 60 degree beam angles. *Item code: LEDHAL_5WMR16_XXYYCLR where XX is CW (cool white) or WW (warm white) and 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.

Low-cost energy meter Mark 2!

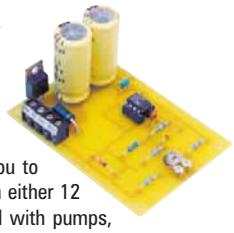
Price: $69.95

Our new Power Usage Meter is an Australian-approved version of the Killawatt EZ, a very popular meter in the US, and is far better than the last one we had available. The meter will display total kilowatt-hours, voltage, watts, current, frequency, volt-amps, power factor, elapsed time, utility rate (energy cost per kilowatt-hour) and accumulated energy cost. It will also project costs, in dollars and cents, for an hour, day, week, month or year. The unit has memory backup so you can move it from place to place without losing the settings and recorded information.

Rated accuracy is ±2%, but we ran one in series with one of our very accurate Power-Mate meters and it generally tracked the Power-Mate within around 1%. **However, this meter is not very accurate below 10 watts due to the resolution of the internal circuitry.** *Item code: POWERUSAGEMETER*

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.

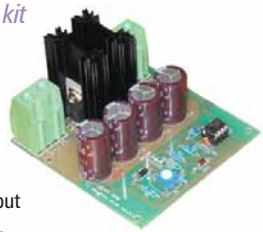
Note: not suitable for battery charging use!

Item code: MAXIMISER_6AMP_KIT

Giant LED Sale!

We are having a sale of all our Luxeon and superflux LEDs. To grab a LED bargain, see our webshop at http://shop.ata.org.au. Note that LEDs are available as webshop purchases only!

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.

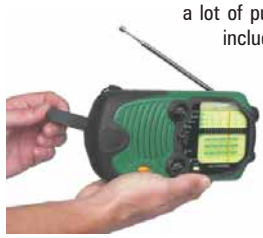
Maximum current: 12 amps.

Item code: MAXIMISER_12AMP_KIT

Dynamo multiband radio

Price: $49.95

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

30 amp speed controller kit

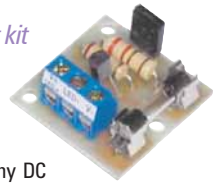
Price: $49.95

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

Constant current circuit kit



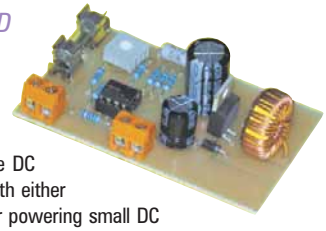
Price: $9.50

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)

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

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

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State P/C

Phone: (BH) (AH) Fax:

Email: Mobile:

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❒ Other pubs ❒ Other.....

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❒ Individual rest of world membership $85

❒ Schools and universities $120

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❒ Australia $30; ❒ NZ & PNG $39; ❒ Rest of world $46

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Sanctuary subscription (Australia only)

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❒ 24 months (8 issues) $70

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Item or code	Qty	Price $
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Please accept my donation Donations are tax deductible. ❒ Send me a tax deductible receipt.		$
Total (NB. All prices in $AUD. Prices subject to change)		$

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106/09

ATA branches round up

The Alternative Technology Association's branches have been out and about at festivals and running in torch relays, writes Cat O'Donovan.

Sunraysia, Victoria

Clive Williams and several members of the Sunraysia ATA branch were at the October Sustainability Expo in Mildura. Local members were on hand to answer questions and sign up new ATA members.

Running alongside the exhibition was the Mildura Climate Torch Relay. Over 100 people took turns carrying the National Climate Torch from Merbein to Mildura. The relay, which ended in Canberra on October 12, encourages communities to unite in looking towards a more sustainable future.

The Mildura Climate Torch Relay.

Adelaide, South Australia

The Adelaide branch invited Peter Oag from Cosy Wrap Insulation to speak about different ways to insulate a house. The talk covered the types of ceiling and wall insulation on the market and installation techniques.

Also discussed were Peter's own trials on what works best. He trialled adding more insulation batts on top of old ones as well as complete removal and replacement. He also discussed how to insulate exposed-beam ceilings.

Continuing the home improvements theme, the branch has also hosted discussions on solar air heating and buried pipe cooling, as well as water management in South Australia.

The branch has been invited to participate in the Premier's Climate Change Council Stakeholders' Reference Group. Not bad work at all.

Warkworth, New Zealand

This new branch sounds like a hub of activity. Members are interested in retrofitting at home for better energy efficiency, alternative energy generation, transport power, energy storage and tools. Potential projects include tool making, an eletric vehicle conversion and a DIY wind turbine.

Projects at the branch's base (an organic farm) may provide further stimulus including participation in micro hydro, methane digestors and cob wall garden structures. ✻

Classifieds/ Suppliers Directory

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

Carpenter/builder: Metamorphic solutions Alterations to buildings to achieve thermal comfort and efficiency using ethically sound materials. Servicing eastern Melbourne, Dandenong Ranges and the Yarra valley. Call Aron on 0402 435 372.

Position Wanted: 3rd year electrical apprentice seeking employment with electrical contractor - working in the renewable sector. For C.V. please contact Marcus Ph. 0439328365 or email marcusgreenpower@hotmail.com

Saltwater Solar designs, supplies and installs solar and wind systems on the Surf Coast, Melbourne, and Central Victoria. Residential grid-connect and stand alone systems, yacht battery charge systems. Free quotes, no nonsense, good workmanship. Phone Oliver on 0408 576 730, www.saltwatersolar.com.au

Solar system. Sell as package. 2 batteries (L16 Trogan). Sound condition. All other equipment in good condition. 2 BP 480H modules and 1 Solarex 60 module, Inverter (LD450 Selectronic), Charger (Stanbury Scarf Lord), Controller (Plasmatronic PL20), Circuit breakers. $3500 Negotiable. Ph. 0427 461 459

Waeco HDC220 Fridge/ Freezer. 12 or 24 volts. 18 months old, good condition. 214 litre incl 46 litre freezer. New $1999 sell for $1000. Mid North Coast NSW. Ph 0448 393 071

Home exterior/ interior

ARCHITECT:BP ARCHITECTS: Innovative Award Winning Sustainable Homes; architecturally designed for comfortable, energy efficient, low allergy, Healthy Living.
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